Walney Extension Offshore Wind Farm



Application Documents

Habitats Regulations Assessment Report

Document Reference:
7.0
APFP: 5(2)(g)
Date: June 2013

DONG energy

TABLE OF CONTENTS

1.0 Introduction 8
1.1 Walney Extension Offshore Wind Farm 8
1.2 Purpose of this report 9
1.3 Policy background 9

2.0 Project Components 11
2.1 Project description 11
2.2 Project timescale 11
2.3 Offshore project components 12
2.4 Construction 16
2.5 Operation and maintenance 29
2.6 Repowering 30
2.7 Decommissioning 30
2.8 Design Envelope 32

3.0 The Habitats Regulations Assessment 33
3.1 Introduction 33
3.2 Protection under European and domestic law and policy 33
3.3 Procedure and process 33
3.4 Study area and relevant European Sites 36

4.0 Baseline Environment in the Project Study Area 69
4.1 Introduction 69
4.2 Metocean and coastal processes 69
4.3 Subtidal benthic ecology 71
4.4 Intertidal benthic ecology 72
4.5 Migratory fish ecology 73
4.6 Marine mammals 76
4.7 Intertidal Ornithology 79
4.8 Offshore Ornithology 83
4.9 Terrestrial ecology 94

5.0 Habitats Regulations Assessment: Initial screening for likely significant effect 98
5.1 Introduction 98
5.2 Identification of potentially affected sites 98
5.3 Identification of possible effect on European Sites 98
5.4. Bat interest features 99
5.5 Diadromous fish features 100
5.6 Annex I Habitats 100
5.7 Marine Mammals 105
5.8 Intertidal Ornithology 109
5.9 Offshore Ornithology 113
5.10 Offshore Ornithology 114
5.11 Initial screening summary 126

6.0 Assessment of likely significant effect 128
6.1 Introduction 128
6.2 Whooper Swan and Pink-footed Goose 142
6.3 Collision risk to migratory bird populations 144
6.4 Assesment of impact on SPA breeding birds present outside the breeding season 147

7.0 Assessment of adverse effect from the Project alone 152
7.1 Introduction 152
7.2 Approach to assessment of potential adverse effects 152
7.3 Assessment of potential effect on the integrity of Morecambe Bay SPA and Ramsar 153
7.4 Assessment of potential effect on the integrity of Morecambe Bay SAC 167
7.5 Assessment of the potential effects on Liverpool Bay SPA 168
7.6 Assessment of potential effects on the Ribble and Alt Estuaries SPA and Ramsar 171
7.7 Assessment of potential effects on the Bowland Fells SPA 173
7.8 Assessment of potential effects on the Aberdaron Coast and Bardsey Island SPA 174
7.9 Assessment of potential effects on the Skokholm and Skomer SPA 178
7.10 Assessment of potential effects on the Copeland Islands SPA 181

8.0 Assessment of the effect of the Project in-combination with other plans and projects 185
8.1 Introduction 185
8.2 Screening for in-combination effects on the Annex I habitat features of the Shell Flat and Lune Deep SAC 186
8.3 Screening for in-combination effects on the intertidal habitat features of Morecambe Bay SAC 186
8.4 Screening for in-combination effects on wader and wildfowl interest features of Morecambe Bay SPA and Ramsar. 187
8.5 Screening for in-combination effects on Whooper Swan and Pink-footed Goose 187
8.6 Screening for in-combination effects on seabird features 193
8.9 Assessment of in-combination effects 206
8.10 Conclusion 209

9.0 Consideration of mitigation and proposed monitoring 211
9.1 Mitigation 211
9.2 Monitoring measures 214

10.0 Consultation on the HRA 215
10.1 Introduction 215
10.2 Summary of response 216

11.0 Summary and conclusions 261

12.0 Charts 273

13.0 Annexe 274

Supporting Documents

Document 7.0 – Habitats Regulations Assesment Report

Document Reference:
7.0

Pursuant to:
APFP 5(2)(g)

Prepared by:
Allen Risby
(Environmental Manager, DONG Energy)

Accepted by:
Sally Holroyd
(Consents Project Manager, DONG Energy)

Approved by:
Cliff Pullen
(Project Development Manager, DONG Energy)

Date:
June 2013

Status:
Final

Walney Extension Offshore Wind Farm
c/o DONG Energy Walney Extension (UK) Ltd.

33 Grosvenor Place
Belgravia
London
SW1X 7HY
United Kingdom
Tel: 020 7811 5200

Website: www.walneyextension.co.uk
Email: walneyextension@dongenergy.co.uk

Walney Extension Offshore Wind Farm
DONG Energy Walney Extension (UK) Ltd.



EXECUTIVE SUMMARY

This is the Habitats Regulations Asseessment Report for the Walney Extension offshore wind farm ("the Project"). This Report addresses the requirement contained in regulation 5(2)(g) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, which requires an applicant for development consent to provide a report identifying any European Site to which regulation 61 of the Conservation (Natural Habitats, &c.) Regulations 2010 (as amended) applies, or any Ramsar site, which may be affected by the proposed development, together with sufficient information that will enable the Competent Authority to make an appropriate assessment of the implications for the site if required by regulation 61(1). The offshore wind farm component of the proposed development is not located within a European or Ramsar site but the Offshore Cable Corridor crosses the Liverpool Bay SPA site and the Morecambe Bay SAC, SPA and Ramsar sites to make landfall on the Lancastrian coast, south of Heysham. The Project is not directly connected with or necessary to the management of these sites or any of the European or Ramsar sites considered in this assessment.

The Project is adjacent to the existing Walney I and II offshore wind farms and is located in English waters mainly beyond the 12 nautical mile limit approximately 19 km west south-west of the Isle of Walney coastline (Cumbria) occupying an area of 149 km^2 with a proposed maximum capacity of up to 750 MW generated from up to 207 wind turbines.

This assessment - and the environmental impact assessment – uses the "Design Envelope" approach to consider a range of maximum adverse project scenarios for each of the main receptor groups (marine mammals, migratory fish, Habitats Directive Annex I habitats, and passage / wintering / breeding birds) considered to be potentially impacted by the proposed project.

The study areas used in this assessment are receptor-specific; ranging from the area of the Project site and Offshore Cable Corridor plus one tidal excursion for Annex I habitats to the extent of the Irish Sea zone for marine mammals, and the mean maximum foraging range for colonial seabirds found on the Project site and a surrounding 4 km buffer.

Fifty designated sites (SAC, cSAC, SPA, Ramsar, pSPA) were initially screened as sites for which there was a potential for a likely significant effect as a result of the construction, operation, or decommissioning of the Project. The initial assessment (documented in Chapter 5 of this Report) concludes "no significant effect" on SAC sites designated for bat features, SAC sites designated for diadromous fish, and the Drigg Coast SAC Annex I habitat features. Similarly the Project offshore wind farm site is considered to be too distant to have a likely significant effect on any SAC site designated for marine mammals (of which there are a number around the Irish Sea coast). A number of Statutory Nature Conservation Bodies (SNCBs) agree with these conclusions. Construction works associated with the installation of the offshore power cable across the intertidal zone are considered not likely to have a significant effect on the breeding bird interest features of the Morecambe Bay SPA and Ramsar site.

Extensive use is made of bird survey data – including, where relevant, data from consented and constructed wind farm schemes in the vicinity of the Project site - to identify

mean peak bird densities on the site and a surrounding 4 km buffer area. The potential for bird mortality (as a result of collision with operational turbine blades) has been modelled, and for breeding birds (Lesser Black-backed Gull, hering gull, and gannet), this mortality has been assigned to SPA breeding colonies to assess the potential impact on the viability of the colony from both the Project alone and in-combination with other offshore wind farms within foraging range of the colony. Similarly for breeding Manx shearwater the potential for displacement from foraging and resting areas because of the presence of the offshore wind farm has been assessed (for both the Project alone and in-combination with other offshore wind farms) and the implications assessed for the breeding colonies (two in Wales and one in Northern Ireland) considered to be in foraging range for this seabird. The potential impact on other bird features - including migratory geese and swans and wintering birds using the extensive mudflats of Morecambe Bay and breeding seabirds present outside of the breeding season - has also been considered.

Following the consideration of likely significant effect, the assessment identifies the potential for an adverse effect on the integrity of the following European sites and features from the Project either alone or in-combination with other plans and projects:

- Wintering population of wildfowl and waders in Morecambe Bay SPA and Ramsar sites;
- Wintering populations of red-throated diver and common scoter in Liverpool Bay SPA;
- Breeding populations of Herring Gull and Lesser Black-backed Gull from Morecambe Bay SPA and Ramsar.
- Breeding population of Lesser Black-backed Gull from the Ribble and Alt Estuaries SPA and Ramsar;
- Breeding population of Lesser Black-backed Gull from the Bowland Fells SPA;
- Mudflat and sandflat habitats of the Morecambe Bay SAC; and
- Breeding Manx shearwater populations of the Copeland Islands SPA, Aberdaron Coast and Bardsey Island SPA, and Skokholm and Skomer SPA.

For each of these sites and features, further assessment was undertaken and it was concluded that the Project, either alone or in-combination with other plans and projects, will not have an adverse effect on site integrity. Where this conclusion relies on the delivery of mitigation measures - such as not undertaking intertidal construction works during the wintering bird season - these will be implemented through restrictions imposed on the proposed development by the deemed Marine Licence. This Licence will also require that monitoring measures are put in place in order to verify assumptions, validate key predictions, and confirm the successful delivery of mitigation measures.

SNCBs and interested parties have commented extensively on a draft version of this Habitats Regulations Assessment Report. Those comments, together with informal comments from the *Planning Inspectorate, have been used to develop this final version of the HRA Report for the Project.*





1.0 INTRODUCTION

1.1 Walney Extension Offshore Wind Farm

1.1.1 In July 2009 The Crown Estate ("TCE") issued an invitation to tender for a leasing round for the extension of existing Round 1 and Round 2 wind farm site areas in the UK. This offer was open to applicants with Round 1 and 2 projects which were either consented or had submitted consents for determination.

1.1.2 The aim of extending these lease areas was to take advantage of the potential for accelerated delivery of extensions, such that construction could be underway before development commenced on Round 3 offshore wind farm projects, delivering increased renewable energy capacity. The emphasis of this leasing round was on the timely delivery of additional offshore wind capacity.

1.1.3 DONG Energy ("the Applicant") sought an agreement for lease for an extension to the existing Walney I and Walney II Offshore Wind Farms, to be known as the Walney Extension Offshore Wind Farm ("the Project"). The Applicant was awarded such an agreement for lease which was finalised with TCE in November 2010. Following the lease agreement, the Applicant commenced the statutory consenting process for the Project under the Planning Act 2008, requiring preparation of an application for a Development Consent Order ("DCO"), including an Environmental Impact Assessment ("EIA") and full consultation. This Project is a Nationally Significant Infrastructure Project and the application is subject to an examination by the Planning Inspectorate.



1.2 Purpose of this report

1.2.1 The purpose of this Habitats Regulations Assessment Report ("HRA Report" or "the Report") is to document the assessment process that has been undertaken in respect of the Project, for the purposes of the Habitats Regulations1. The Report provides the information necessary to allow the Secretary of State (as the Competent Authority) to determine whether there will be an adverse effect on any Natura 2000 sites as a result of the Project. The Report should be read in conjunction with the HRA Screening and Scoping Report (included as Annex 5 to this report) and relevant chapters of the Environmental Statement ("ES") prepared in support of the Project application. Two sets of "Habitats Regulations" apply to this proposed development, the Conservation of Habitats and Species Regulations 2010 (as amended) for development out to the 12 nm limit ("the Habitats Regulations 2010"), and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) from 12 nm to the Continental Shelf ("the Offshore Habitats Regulations"). They are referred to collectively as "the Habitats Regulations"

1.2.2 It is to be noted that the general approach taken for the purposes of this Report has been subject to general agreement by SNCB"s including Natural England, JNCC, Scottish Natural Heritage, and Natural Resources Wales. See Section 10 following, for details of consultation responses. Full copies of consultation responses are held at Annex 7.

1.3 Policy background

1.3.1 The Energy Policy for Europe, published by the European Commission on 10th January 2007, established a target for 20% of energy consumption in Europe to come from renewable energy sources by 2020. This policy aim is secured by the EU Renewable Energy Directive (2009/28/EC), under which targets have been agreed by member states. Under this legislation, the UK is required to produce 15% of all its energy from renewable sources by 2020. Due to the relatively inflexible nature of energy in the transport sector this means that approximately 30–35% of electricity in the UK would need to come from renewable sources (DECC, 2011).

1.3.2 UK energy requirements have traditionally been met by fossil fuels and nuclear energy. However, the UK government has set ambitious targets for renewable energy, including offshore wind. These targets are intended to help the UK to meet its international climate change obligations, but also deliver increased security of energy supply. The Energy Act 2008 makes provision for new offshore renewable installations. The development of offshore wind farms is expected to be the largest contributor to the renewable energy targets.

1.3.3 UK policy on energy and climate change is set out in two white papers, published in 2007 and 2009. The delivery plan for these overarching policies is set out in more detail in documents such as the 2009 UK Renewable Energy Strategy ("RES") and National Policy Statements ("NPS") published under the Planning Act 2008.

1.3.4 The RES confirmed the UK"s commitment to source 15% of its energy from renewable sources by 2020. Scenarios published in the RES suggest that more than 30% of UK electricity (117 TWh) could be generated from renewables, compared with around 5.5% at present. While biomass, hydroelectricity and wave and tidal generation are all considered to have an important role to play, the RES anticipates that most of this new capacity will be generated from wind farms (onshore and offshore). In the "lead scenario" for 2020 set out in the strategy it is estimated that offshore wind will be the largest single contributor to renewable electricity generation.

1.3.5 There are 12 NPSs, detailing Government policy on different types of infrastructure development, including:

- Overarching NPS for Energy (EN-1);
- NPS for Renewable Energy Infrastructure (EN-3) ; and
- NPS for Electricity Networks Infrastructure (EN-5).

1.3.6 EN-1 sets out the policy for the delivery of major energy infrastructure and reflects the UK Low Carbon Transition Plan. The document notes that large scale deployment of renewables will help the UK tackle climate change, reducing the UK»s emissions of carbon dioxide by over 750 million tonnes by 2030.

1.3.7 The need for offshore wind farm development is clearly stated within EN-3 and in EN-1 where it is stated that: "offshore wind farms are expected to make up a significant proportion of the UK's renewable energy generating capacity up to 2020 and towards 2050". EN-5 contains policy relevant to the onshore elements of offshore windfarm development, such as substations.

1.3.8 Under the Planning Act 2008 ("the 2008 Act") certain types of development, including offshore renewable energy projects over 100 MW, are considered to be Nationally Significant Infrastructure Projects ("NSIP"). Under Section 104 of the 2008 Act, applications must be determined in accordance with any relevant NPSs.



2.0 PROJECT COMPONENTS

2.1 Project description

2.1.1 The Project is an extension to the Walney Offshore Wind Farms (Walney I and Walney II, "the Walney I and II Offshore Wind Farms"). The Project Site (which refers to the Agreement for Lease site, within which the turbine array will be located) is located north west of the Existing Walney I and II Offshore Wind Farms, around 19 km west south west of the Isle of Walney coast in Cumbria (Chart 2.1, presented in Chapter 14). It is 26 km south west from the Millom coast, 35 km north west from the Fleetwood and Blackpool coast, and 31 km south east from the Isle of Man. The total area of the Project Site is approximately 149 km^2, which is twice the area of the site of the Existing Walney I and II Offshore Wind Farms (73 km^2). The majority of the Project Site lies beyond the 12 nm limit (126 km^2 out of the 149 km^2).

2.1.2 2.1.2 The Project description is extensive. Full details of the Project description can be found in Chapter 4 of the Environmental Statement (ES), "Project Description". An outline of of the offshore and onshore project components and the construction process, and details of the Design Envelope employed for the purposes of the HRA are, however, set out at Sections 2.3 – 2.5 below.

2.1.3 The Project Site will have a maximum generating capacity of 750 MW, comprising up to 207 turbines. As set out in Chapter 4, the final layout of the turbines will only be determined following consent and is dependent on the final selection of turbine type and the detailed final Project design and procurement process. However, the separation distance between adjacent turbines will not be less than a minimum of 737 m in any direction.

2.1.4 Walney I and Walney II offshore wind farms are each rated at 183.6 MW; other offshore wind farms in the area include West of Duddon Sands, Barrow and Ormonde. Chart 2.2 shows the location of the Project in relation to the coastline, the 12 nm limit and the adjacent offshore wind farm sites. Chart 2.3 shows the location of the Project site and the adjacent Natura 2000 and Ramsar sites.

2.2 Project timescale

2.2.1 The DCO application will be submitted in Q2 2013. The precise timetable for the construction programme and construction sequence are not known at this stage and will be confirmed once the design detail is finalised and the construction contractor appointed. An indicative construction schedule is shown in Figure 2.1.

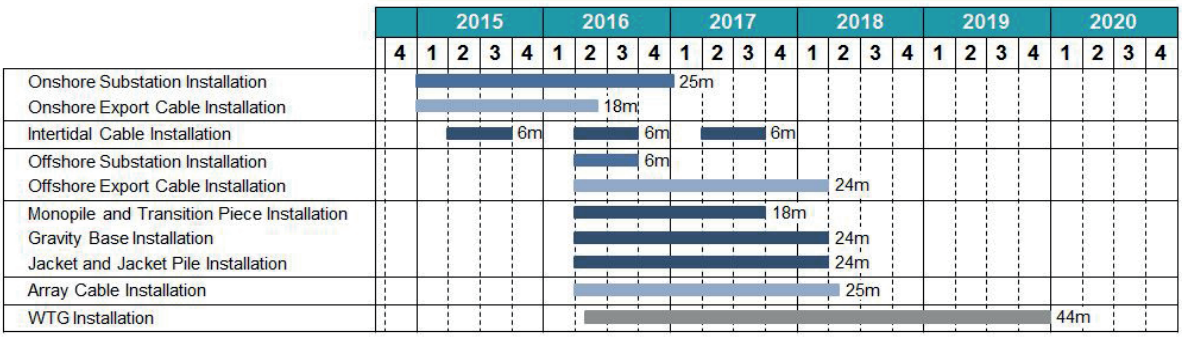


Figure 2.1 Project indicative construction schedule

2.3 Offshore project components

2.3.1 The range of options being considered for the main offshore components of the Project are summarised below:

- Up to 207 foundations for wind turbine generators and (if required) transition pieces, ancillary equipment and (where necessary) associated scour protection;
- Up to 207 wind turbines and towers;
- Up to 12 foundations for electrical offshore substation infrastrucuture;
- Electrical infrastructure, including up to 3 offshore substations; and
- Buried subsea cables (inter-array and export power cables) together with armouring (if required).

FOUNDATION TYPE

2.3.2 Up to 207 foundations will be required for the Project. Currently, the following foundation concepts are being considered:

- Single steel monopile;
- Gravity base foundation (GBF);
- Piled steel jacket; and
- Steel jacket on suction caissons.

2.3.3 Due to the range of water depths (21 m – 55 m LAT), and the high tidal range present at the site, it is likely that more than one foundation type will be utilised. The deeper water areas may suit a jacket foundation solution whereas the shallower parts are likely to suit gravity base structures or monopiles.



2.3.4 The maximum dimensions of the Project wind turbine foundations are presented in Table 2.1.

Table 2.1: Wind turbine foundation parameters

Foundation type	Sub-type	Parameter	Value
Single Steel Monopile		Maximum diameter	9.0 m
		Maximum diameter of transition piece	9.0 m
		Maximimum seabed area take per monopile	3,800 m^2 (combined total area of scour protection and monopile)
		Maximum seabed volume take (spoil) per foundation	2,900 m^3 (based on an indicative embedment depth of 45 m and assuming that spoil volume is equal to internal volume of each monopile). Maximum amount of spoil would only arise in the event of drilling.
Gravity Base		Maximum diameter at seabed	40 m
		Depth of tower/conical interface (for vessel draft clearance)	At least 6 m below LAT
		Maximum shaft diameter	12 m
		Maximum projected area of side view of foundation below LAT	1,350 m^2
		Maximum volume of spoil per foundation	8,500 m^3 (based on maximum 3 m leveling depth)
Steel Jacket	Piled	Maximum number of legs	4
		Maximum leg separation distance at seabed (centre-centre)	40 m (adjacent legs)
		Maximum leg separation distance at LAT (centre-centre)	20 m (adjacent legs)
		Maximum leg diameter	3 m
		Maximum pile diameter	3 m
		Maximum volume of spoil per foundation	2,000 m^3 (based on drilling four jacket piles each with a maximum embedment depth of 70 m and assuming that spoil volume is equal to internal volume of each pile)
	Suction Caissons	Maximum caisson diameter	10 m
		Maximum embedment depth	15 m
		Maximum height of caisson above seabed	5 m
		Maximum volume of spoil per foundation	1,300 m^3 (based on excavating 4 m of seabed below caisson)

TURBINE TYPES

2.3.5 The Project offshore wind farm capacity will be up to 750 MW. The wind turbine generator (WTG) options being considered for the Project range from a capacity of 3.6 MW to 8.0 MW. It is possible that more than one turbine type may be selected. The minimum and maximum dimensions are those associated with the smallest turbine (a 3.6 MW turbine) and largest turbine (an 8 MW turbine) respectively. These dimensions are set out in Table 2.2.

Table 2.2: Wind turbine design envelope parameters

Parameter	Minimum	Maximum
Number of turbines	-	207
Rotor Diameter (m)	120	200
Blade tip height (m)	142	222
Air draft above MHWS (m)	22	44.5
Nacelle (hub) height (m)	82	122
Separation (m)	737	N/A

INTER-ARRAY CABLING

2.3.6 A network of cables will connect the arrays of wind turbines and the offshore substations. The cables will be organised in "strings" of wind turbines. These inter-array and intra-array cables are collectively called "inter-array cables". Two voltage levels are being considered for the Project, 33 kV and 66 kV. The cables are made from cross-linked polyethylene (XLPE) and carry alternating current (AC). The exact specification of the inter-array cables will depend on the chosen wind turbine capacity and the outcome of electrical design studies. Details of the design envelope for cable design and installation are shown in Table 2.3

Table 2.3: Inter-array cable design envelope parameters

Design parameter	Value
Maximum total length of inter-array cables (m)	270,000
Target burial depth	Generally 0 - 3 metres (maximum 10 m, potential for surface laying with protection in some circumstances)
Maximum width of cable trench (m)	3 (from ploughing)
Maximum width of seabed affected per cable (m)	7 (excluding additional protection, see below)
Inter-array cable rock protection	
Maximum distance of cabling which may require rock protection	27,000 m (10% of inter-array cable length)
Average volume of rock protection per metre length of inter-array cable requiring protection	15 m^3(per metre of cable length)
Maximum volume of cable protection (rock placement)	**Crossings:** Volume: 64,328 m^3 **Surface-Laid Cables:** Volume: 27,000 m^3

2.3.7 The inter-array cables may be buried by ploughing, trenching, jetting, cutting and/or a combination of trenching and jetting (vertical injection), or, where the cable cannot be adequately buried, protected with flexible concrete mattresses, or buried beneath stones (rock-placement).

OFFSHORE SUBSTATION

2.3.8 The power generated by the wind turbines is collected by the inter-array cables and transmitted to the offshore substations, where the voltage is stepped-up from medium voltage (MV) to the chosen high voltage (HV) level for export to shore. A typical offshore substation can be divided in two main parts:

- The foundation structure and substructure (linking the foundations to the topside above sea level); and
- The topside which is typically a box-shaped structure placed on top of the substructure and contains the electrical equipment such as the transformers, HV and MV switchgear etc.

2.3.9 It is anticipated that up to a maximum of three offshore substations will be required at the Project Site, though currently, the most likely scenario is two offshore substations. The substations will be located within the Project Site and their final location will be determined once geotechnical surveys are completed and the turbine layout is finalised. The substations" export voltage will be AC and between 132 kV and 220 kV depending on the outcome of detailed electrical design works.



OFFSHORE EXPORT CABLES

2.3.10 The export cables connect the offshore wind farm substations to the onshore grid. The export cable system consists of a maximum of five subsea (offshore) cable systems, which are connected to onshore cables at a transition joint bay inland, close to the cable landfall.

2.3.11 The offshore export cables will be buried in the seabed to minimise the risk of damage. The target burial depth is a balance between providing adequate protection and heat build-up; the deeper the cable is buried, the hotter it will be. A burial depth of 0 m to 3 m will be adequate for the Project. The use of rock dumping or other protective measures may be necessary where it is not possible to bury the cable due to seabed conditions. Where cable or pipeline crossings are required then crossing structures will be constructed in accordance with relevant industry guidelines and as agreed with the owners and operators of the relevant infrastructure and The Crown Estate.

2.3.12 The exact export cable route has not been finalised though it will be located within the Offshore Cable Corridor (see Chart 2.1). The use of a cable corridor provides the flexibility to finalise the cable route within the corridor at a later stage once a detailed review of the installation and burial feasibility has been undertaken. The Offshore Offshore Cable Corridor options that were considered for the Project are illustrated and described further in Environmental Statement Chapter 5 – "Site Selection and Consideration of Alternatives". Details of the design envelope for the offshore export cable are shown in Table 2.4.

Table 2.4: Maximum offshore export cable design envelope parameters

Export cable envelope	Value
Maximum number of cable systems	5
Maximum length of cables	96 km per cable (5 cable systems = 480 km)
Cable specification	132 - 400 kV AC Diameter - up to 300 mm
Maximum cable corridor width	Total cable corridor width of up to 1,100 m. Up to 275 metres separation for each cable system (based on maximum 5 cable systems)
Maximum width of seabed affected per cable	7 m
Target Burial depth	The cable will be buried between 0 m - 3 m. Sections of the cables may be surface laid and protected by rock armouring or mattressing.
Maximum amount of rock placement required	Crossings: Volume: 125,955m^3 Footprint area: 144,548m^2 Surface-Laid cables: Volume: 129,600 m^3 Footprint area: 168,000 m^2

2.4 Construction

INSTALLATION SEQUENCE

2.4.1 Wind turbines accommodate a tower, nacelle and rotor, supported and fixed to the seabed by means of a foundation. A transition piece (TP) may be used, which acts as the interface between the turbine and the foundation. The structures may be installed in sequence, commencing with the foundation. The TP (where required) is then installed, followed by the tower, nacelle and rotor blades. Details of the construction techniques for each component are described later in this chapter.

2.4.2 Alternatively, sections of the structure, or even an entire wind turbine and foundation, may be prefabricated at a suitable coastal facility prior to being transferred to the offshore site. Currently, it is more common for the tower to be lifted and installed in two sections. However, for the Project it is anticipated that the tower will be assembled and completed onshore at the preassembly area allowing it to be lifted and installed on the foundation as one unit.

2.4.3 The substation topside and substructure will be fabricated near to the sea at a suitable fabrication yard. The most common fabrication scenario for a typical offshore substation, based on a four-legged jacket substructure, is that both topside and jacket are fabricated together at the same yard. However, the use of a concrete GBF substructure may require fabrication to be carried out at a separate site.

2.4.4 The offshore construction of the wind farm can be divided into the following main work phases (with overlap between phases):

- Site preparation for offshore substation foundation installation;

- Installation of offshore substation foundation, substructure and topside;
- Installation of the offshore export cables;
- Site preparation for turbine foundation installation;
- Installation of inter-array cables;
- Installation of wind turbines (on previously installed foundations); and
- Commissioning of wind turbines.

2.4.5 A number of different vessels will be involved in each of the construction phases. The exact number and type of vessels used will be defined at a later stage, but will be no greater than 163 and are likely to include foundation installation vessels and/or jack up vessels, wind turbine installation vessels and/or jack up vessels, cable laying vessels (for export and inter-array cables), crew vessels, transfer vessels, service vessels, anchor handling vessels, tugs etc. Offshore work will be coordinated and overseen by a Marine Coordinator located at the onshore construction site office. Details about the construction activities are provided in the sections below.

2.4.6 The Applicant is currently considering ports suitable for the construction base for the offshore elements of the Project. A wide area across the Irish Sea is being considered, including ports such as Workington, Barrow-in-Furness, Holyhead and Belfast. Other ports in the area may also be suitable and the final selection of construction port will be dependent on the findings of further technical studies and commercial negotiations.

MONOPILE FOUNDATION

2.4.7 Monopile foundations typically consist of a steel tubular section and a TP which includes boat landing features such as ladders, J-tubes (through which cables connect to the seabed) and ancillary components. The TP is usually painted yellow and marked according to relevant Maritime and Coastguard Agency (MCA) and Trinity House regulations. The envelope of parameters for the single steel monopiles considered for the Walney Extension project are outlined in Table 2.1.

Seabed preparation

2.4.8 Monopile foundations usually require minimal seabed preparation. However, certain obstructions may need to be removed at the installation locations if they prevent piling. Depending on the obstruction, this can either be achieved by using a grab located on the installation vessel, or by using a separate vessel such as a workboat with a crane, a multicat or an anchor handling boat. Any preparation that does occur will likely comprise of debris removal or seabed levelling (most likely by dredging).

Transport of the foundation

2.4.9 A number of methods could be used to transport the monopiles to site, including the following:

- By sealing both ends and floating out to the installation vessel;
- By transport barge towed by tugs;
- By self-propelled transport vessel; or
- Directly by the installation vessel.

Installation methodology

2.4.10 The installation vessel(s) will either be self-propelled jack-up vessels, jack-up barges (towed by tugs), or large Heavy-Lift Vessels (HLV). Once at site, the monopiles are upended and placed in a gripper attached to the installation vessel. The gripper holds the monopile in position whilst it is lowered to the seabed during installation. Once the monopile is on the seabed and secure, the crane is released and the hammer or drill, is installed on top of the monopile.

2.4.11 Pile driving and drilling parameters for the installation of monopiles are listed in Table 2.5.

Table 2.5: Design envelope parameters for pile driving and drilling monopole foundations

Installation details	Value
Piling	
Maximum hammer energy	2,500 kJ
Maximum number of strikes per minute (indicative)	35
Maximum number of simultaneous piling events (locations)	2
Maximum number of piling vessels	2
Maximum separation between piling vessels	7 km
Maximum number of monopiles installed in a 24 hour period	4
Maximum piling duration per pile (hours)	8
Drilling	
Drill rate	0.2 – 0.5 m per hour (excluding weather or mechanical downtime)
Hours of continuous drilling per 24 hr period	24
Total installation time (piling or drilling)	
Maximum total installation duration	18 months (based on 207 positions)

Transport of the drilled material

2.4.12 Drilled material (spoil) will be disposed of at the seabed near the drilling position using flexible pipes. The spoil is unpolluted from the operation (no polluting additives are used in the drilling operation although an inert "drilling mud", typically bentonite, may be injected if required) and displaced by pumping air through the bottom of the drill. Bentonite is an inert material consisting of a mixture of water (saltwater in the case of offshore foundation installation) and natural clays. Alternatively, the discharged soil will be pumped to the surface, removed, and stored on the drilling vessel or on a holding barge before transfer to a licensed disposal area. The maximum volume of material discharged is equal to the internal volume of each monopile below sea floor level, as outlined in Table 2.1.

Installation of monopile transition piece

2.4.13 The transition piece (TP) is placed on the monopile and levelled before being grouted together with the monopile using a high strength grout material. Further to this process ancillary structures (J-tubes, boat landing facilities etc.) will be mounted on the TP.

GRAVITY BASE FOUNDATION

2.4.14 GBF are constructed using reinforced concrete and are usually conical in shape. The foundation uses its own mass and that of a suitable ballast to resist overturning. As such it does not require piling or drilling to remain in place. A TP is also not required; the turbine tower is bolted directly to a flange connection cast into the concrete structure. Usually scour protection is necessary to prevent the foundation being undermined. The amount of ballast material and material for scour protection will depend on the final design of the foundation.

2.4.15 The dimensions of a gravity based foundation depend on the wind turbine size and site conditions. Due to the variation across

the offshore Project Site, the anticipated size of the foundation is likely to vary across the Site. The foundation may be equipped with a concrete or steel skirt designed to embrace the embedment of the foundation and reduce undermining. An envelope of parameters for concrete GBF at the Project site are detailed in Table 2.6 below.

Table 2.6: Concrete gravity foundation design envelope parameters

Gravity Base	Value
Maximum diameter at seabed	40 m
Maximum material weights and volumes per GBF	Concrete: 5000 m^3 Steel reinforcement: 1,000 tonnes Ballast: 6,000 m^3 Gravel: 2,200 m^3 Grout: 2,250 m^3
Depth of tower/conical interface (for vessel draft clearance)	At least 6 m below LAT
Maximum conical cross-sectional area (side view below LAT)	1,350 m^2
Maximum shaft diameter	12 m
Diameter of maximum extent of seabed levelling/preparation (excluding scour protection)	60 m
Maximum area of seabed area take per GBF	13,700 m^2 Combined total area of scour protection and GBF.
Maximum volume of spoil per GBF	8,500 m^3 (based on maximum 3 m levelling depth)

Seabed preparation

2.4.16 GBF generally require the seabed to be prepared prior to the installation of the foundation. The extent of the seabed preparation depends on the seabed conditions at each location. The work usually consists of seabed levelling, laying a gravel bed base layer and/or removal of loose sediment. Any sediment removal or dredging will be undertaken by specially equipped vessels.

Transport of the dredged material

2.4.17 Any loose, soft or otherwise compressible sediment present at the surface may need to be removed by dredging. This can be achieved using industry standard Trailer Suction Hopper Dredgers (TSHDs). The dredged material will be recovered to the surface, and stored on the dredging vessel or on a holding barge before transfer to a licensed disposal area.

Transport of the foundation to site

2.4.18 The GBFs will be transported individually to Site from the storage/manufacturing site using a number of different methods and vessel types:

- Floating the GBF out using tugs;
- By submersible barge (used during construction);
- Floating and supported by a catamaran type pontoon or other specially designed vessel; or
- By Heavy-Lift Vessel or sheerleg barge.

2.4.19 It is likely that any transportation vessels used will be operating concurrently on site along with dredging and rock installation vessels.

Installation methodology

2.4.20 Once at the Site, the foundations will be lowered and sunk in a controlled manner onto the pre-prepared base layer. Once in place, the ballast material (usually mixed with water) will be pumped into the foundation using a vessel specially equipped with a filling tower. Installation of a maximum of two foundations at a time could potentially take place. An overview of the GBF installation details is outlined in Table 2.7 below.

Table 2.7: GBF installation details

Installation details	Value
Type and number of installation vessels used	Up to a maximum of 3 primary installation vessels. These will either be Sheerleg barges, submersible pontoons, Heavy-Lift Vessels, or purpose designed vessels. Up to a maximum of 12 vessels may be used for seabed preparation. This will include up to 2 dedicated dredging vessel (most likely a Trailer Suction Hopper Dredger, up to 2 primary gravel bed vessels and up to 8 additional miscellaneous dredging support vessels)
Type and number of support vessels used	Up to a maximum of 18 support vessels. This will include 6 tug boats, up to 6 crew boats and up to 6 guard boats.
Maximum preparation duration for one GBF	72 hours for dredging 72 hours for bed preparation material (excluding weather downtime and technical breakdowns)
Maximum installation duration for one GBF	48 hours (excluding weather downtime and breakdown)
Maximum number of GBF installed over 24 hours	2
Maximum installation duration	24 months (based on 207 GBF positions)



JACKET FOUNDATION

2.4.21 Steel jacket foundations are formed with a steel lattice construction (comprising tubular steel members and welded joints) fixed to the seabed by either piles or suction caissons installed below each leg of the jacket. Typically the hollow steel piles are driven, drilled or vibrated into the seabed sub-strata relying on the frictional and end bearing properties of the seabed for support. The suction caissons are typically hollow steel cylinders which are fitted in a vertical position underneath the legs of the jacket structure. They do not require a hammer or drill for installation. Unlike monopiles, there is no separate transition piece, the transition piece and ancillary structure is fabricated as an integrated part of the jacket structure and is not installed separately offshore. Jacket foundations become more cost effective at deep water sites where the water depth is between 35 – 60 m, hence it"s suitability at the deeper parts of the Project site. A description of the envelope parameters for steel jacket foundations can be found in Table 2.8.

Table 2.8: Steel jacket design envelope parameters

Jacket foundation	Value
Maximum number of legs	4
Maximum height to the top of the integral transition piece above LAT	40 m
Maximum separation distance between adjacent legs at seabed level (centre-centre)	40 m
Maximum separation distance between adjacent legs at LAT (centre-centre)	20 m
Maximum leg diameter	3 m
Maximum material weights and volumes	1,200 tonnes (steel) 300 m^3 (grout - for a jacket founded on piles) 1,500 m^3 (grout - for a jacket founded on suction caissons)
Jacket foundation piles	
Maximum pile diameter	3 metres
Maximum embedment depth	70 metres
Number of piles per leg	1
Maximum seabed area take per jacket	4,000 m^2 (combined maximum area of mud mats and scour protection)
Maximum volume of spoil per foundation	2,000 m^3 (based on drilling four jacket piles each with a maximum embedment depth of 70 m and assuming that spoil volume is equal to internal volume of each pile)
Jacket suction caissons	
Maximum caisson diameter	10 m
Maximum embedded depth	15 m

Table 2.8: Steel jacket design envelope parameters

Jacket foundation	Value
Number of caissons per leg	1
Maximum height of caisson above seabed	5 m
Maximum seabed area take per jacket	6,800 m² (combined maximum area of suction caissons and scour protection)
Maximum volume of spoil per jacket	1,300 m³ (based on excavating 4 m of seabed below caisson)

Seabed preparation

2.4.22 As with monopile foundations, jacket foundations usually require minimal seabed preparation. Any preparation that does occur will likely comprise of debris removal or seabed levelling (most likely by dredging).

Transport of the foundation

2.4.23 The jacket foundations and piles will be pre-fabricated onshore, the jackets with TPs attached will either be transported to the wind farm site by transport barge, self-propelled transport vessel or directly using the installation vessels. This will most likely be directly from the manufacturer, although a pre-assembly harbour near the wind farm site may be utilised.

Installation methodology

2.4.24 The jacket can be fixed to the seabed in one of two ways:

- Pre-piling – whereby the jacket is lowered onto pre-installed piles with the use of a seabed template to guide the piles; and
- Post-piling – whereby the piles are driven after the jacket has been lowered and placed onto a prepared seabed.

2.4.25 The piles are typically driven into the seabed by a hydraulic hammer. Piling could take up to eight hours per pile, with up to four piles per foundation, but on average the duration is estimated to be lower. Installations of up to two jackets at a time could take place. Driving of the piles is not anticipated to result in a significant sediment spoil unless drilling is required. Details of the installation of steel jacket foundations and piles are outlined in Table 2.9.



Table 2.9: Jacket foundation and piling installation details

Installation Details	Requirement	Value
Jacket Foundation		
Type and number of installation vessels used	Description	Up to 2 primary installation vessels (self-propelled jack-up vessels, jack-up barges (towed by tugs), sheerleg barges or Heavy-Lift Vessels).
Type and number of support vessels used	Description	Up to 10 support vessels, including up to: 6 tug boats, 2 crew vessels and 2 guard boats.
Type and numbers of transportation vessels used	Description	Up to 8 transport barges supported by up to 4 tugs. Alternatively the primary installation vessels will also transport the foundations.
Number of jackets installed over 24 hours	Max	6
Maximum total installation duration	Max	24 months (based on 207 piled jacket positions)
Jacket Foundation Piles		
Type and number of installation vessels used	Description	Up to 2 piling vessels
Type and number of support vessels used	Description	Up to 12 support vessels including up to: 4 tug boats, 2 dredging support vessels, 4 drilling vessels and 2 crew vessels.
Type and numbers of transportation vessels used	Description	Up to 10 transport barges supported by up to 6 tugs. Alternatively the primary installation vessels will also transport the foundations.
Maximum piling duration per jacket pile	Max	8 hours
Maximum number of jacket piles installed in 24 hours	Max	8
Number of simultaneous piling events	Max	4 (2 piling vessels each with 2 hammers)
Maximum total piling duration	Max	18 months (based on 207 piled jacket positions)
Maximum hammer energy	Max	2000 kJ
Piling separation distance (if more than one piling vessel used)	Max	7000 m
Number of simultaneous drilling events	Max	4
Hours of continuous drilling per 24 hour period	Max	24 (accounting for multiple drilling vessels)
Drilling rate	Indicative	0.2 – 0.5 m per hour (excluding weather and breakdowns)

INSTALLATION OF SCOUR PROTECTION

2.4.26 Scour protection is designed to prevent foundation structures being undermined by sediment processes and seabed erosion. The shape of the foundation structure is an important parameter influencing the depth of the scour hole formation. In general, a scour hole with a depth of one to two times the width of the whole structure can be expected to develop under the normal action of waves and currents.

2.4.27 Scour around foundations is typically mitigated by the use of scour protection measures. Several types of scour protection exist, including mattress protection, sand bags, stone bags and artificial seaweeds. However, the placement of large quantities of crushed rock around the base of the foundation structure is the most frequently used solution ("rock placement") and this is the anticipated method for the Project. Crushed rock for scour protection can be sourced from a variety of licensed locations, either in the UK or elsewhere in Europe.

2.4.28 The preferred scour protection solution is most likely to comprise of a rock armour layer resting on a filter layer. The filter layer can either be installed before the foundation is installed ("pre-installed") or afterwards ("post-installed")". Alternatively, by using heavier rock material with a wider gradation, it is possible to avoid using a filter layer and pre-install a single layer of scour protection.

2.4.29 Table 2.10 provides information on the amount of scour protection required for the different foundation types being considered for the project.

Table 2.10: Scour protection details

Design parameter	Monopile	GBF	Piled jacket	Jacket with suction caissons
Maximum diameter of rocks used	0.65 m	0.65 m	0.65 m	0.65 m
Maximum height of scour protection above original seabed	2.0 m	2.0 m	2.0 m	2.0 m
Maximum extent of scour protection (from edge of foundation)	30 m	46 m	13.5 m (around each leg)	16 m
Maximum diameter of scour protection (including foundation)	69 m	132 m	30 m (around each leg)	82 m x 82 m (square)
Maximum scour protection volume per position	6,200 m^3	22,500 m^3	3,700 m^3	11,000 m^3
Maximum number of primary installation vessels and support vessels	4			

Table 2.10: Scour protection details

Design parameter	Monopile	GBF	Piled jacket	Jacket with suction caissons
Possible installation vessels	DP fallpipe vessel Side stone casting vessel Shuttle vessel Vessel with grab			

TURBINE INSTALLATION

2.4.30 Turbine installation will follow on from the installation of the chosen foundation and transition solution, and will preferably take place after commissioning of the associated inter-array cabling. The choice of either monopiles, jackets of GBF foundations will not materially affect the turbine installation process. A detailed installation programme will be developed at a later stage, after a contract has been formed with the chosen turbine supplier.

2.4.31 The WTG components will be fabricated and pre-assembled at the manufacturing site and the turbine blades, nacelle hub and tower loaded onto cargo vessels or coasters and transported to the pre-assembly harbour located near to the installation site. Each cargo vessel/coaster can carry up to five complete turbines.

2.4.32 The most realistic installation set-up for the project involves using one or more self-propelled jack-up vessels to transport a number of turbine sub-assemblies from the pre-assembly harbour to site before installing them on top of the foundations. The number of turbines per installation vessel will depend on the turbine type and the type of vessel used although it is likely to be between three and twelve.

INSTALLATION OF SUBSTATIONS

2.4.33 Foundations would be installed in a similar manner to that described in respect of wind turbines above, however with a four legged jacket suction caissons a floating crane/jack-up barge would be used. A GBF substructure would probably be floated out to Site and, if feasible, the topside will be installed onto the GBF substructure at the fabrication yard allowing the entire structure to be transported and installed on Site as one unit. The general process is as follows:

- The substation topside and foundation are pre-fabricated onshore;
- Seabed preparation occurs at the substation site;
- Foundation and substation topside transported to site by barge;
- Foundation installed;
- Substation topside installed on foundation;
- Subsea cables brought into substation via J-tubes; and
- Scour protection installed if required.

2.4.34 The offshore topside will be fitted out with the requisite transformers, switchgear, protection etc. prior to load out.

OFFSHORE CABLE INSTALLATION

2.4.35 The installation of the inter-array cables may be carried out in one operation where the cable is laid and buried from the same vessel simultaneously. However, it is more likely be split into two main operations; cable installation (laying and pull-in) and cable burial. The exact specifications of the inter array cables will depend on the chosen wind

turbine capacity and the outcome of electrical design studies. The target burial depth is a trade-off between providing adequate protection and avoiding excessive heat build-up; deeper burial impedes the cooling of the cable and increases the risk of hotspot development. For the majority of the Project, a burial depth of 0 - 3 metres is anticipated to be adequate as the seabed conditions are relatively good (for burial) and not subject to large movements. However, for the purpose of the maximum adverse scenario and subsequent impact assessment a burial depth of 3 m has been assumed. Deeper burial is expected in the central part of the Site due to the presence of a large sand wave (orientated north-south). In order to achieve risk free inter-array cable burial, it may be necessary to bury cables to below the level of the surrounding seabed to ensure they remain covered, should the san waves migrate.

2.4.36 The inter-array cables may be buried by ploughing, trenching, and/or jetting. Where the cable cannot be fully buried to a suitable depth rock-armouring or mattressing may be used.

2.4.37 The preferred cable burial methods for the project will be decided upon following detailed evaluation of geophysical and geotechnical survey data in collaboration with the cable installation contractor. This decision can occur only after consent has been granted and the methodology will be agreed with relevant stakeholders prior to commencement of development.

2.4.38 The following general definitions have been used for trenching, jetting, ploughing and rock-cutting:

- Trenching: any method or technology that cuts an open trench in the seabed for cable installation, for example using a vessel-mounted back-hoe.
- Jetting: any method or technology that is used to jet/pump water at a high power into the seabed at a targeted area to temporarily fluidise the sediment, allowing the cable to sink to a suitable burial depth under the cables own weight. This is usually carried out after cables are laid on the seabed, but could also be carried out before the cables are laid ("pre-lay").
- Ploughing: any method used whereby a tool, usually a sledge, is used to cut a furrow into the seabed allowing the cable to fall into the space created before passing over the cable to shift sediment back on top.
- Cutting: any method used to carve a space in hard rock/sediment where other burial techniques fail, to allow cable to be laid. This usually involves a device with rotating teeth that is manoeuvred along the sea floor.

2.4.39 Further detail on cable burial methods is provided in Section 4.7 of the Project Description chapter of the Environmental Statement (ES Chapter 4 - "Project Description").

2.4.40 The installation methods described for the inter-array cables are valid for the burial of the subsea export cables. However, the larger size of the export cables necessitates the use of larger vessels for installation. It is also anticipated that simultaneous ploughing, pre-trenching (by plough), or a combination of the two will be the primary burial method due to the long lengths involved.

2.4.41 Chart 2.4 shows the location of the existing or planned cables or pipelines which either the inter-array or export cables may need to cross. Crossing and proximity agreements will need to be made with the owners of these assets.

INTERTIDAL CABLE INSTALLATION

2.4.42 A typical capacity for an installation vessel is 2,000 - 4,500 tonnes, equating to approximately 20 - 50 km of cable installed

in a single campaign. The laying vessel will be accompanied by a spread of support vessels e.g. crew boats, anchor handling vessels, supply vessels, diver vessels or if required more specialised vessels such as rock placement and dredging vessels. In the shallowest area of the intertidal zone, where the tugs cannot safely operate, additional anchors may need to be installed temporarily from the land side. Typically, this is carried out by using heavy plant/diggers (accessing the beach via Potts Corner (Middleton Sands), as described at Section 4.9.3 of the Environmental Statement Chapter 4 "Project Description").

2.4.43 The anticipated procedure for the installation of the export cables across the intertidal zone is described in detail in Section 4.9.3 of the Environmental Statement Chapter 4, "Project Description".

CABLE INSTALLATION AT THE LANDFALL

2.4.44 This section describes the installation of the cable ducts through a process known as Horizontal Directional Drilling ("HDD"). This process is described in detail in Section 4.9.7 of Environmental Statement Chapter 4 "Project Description". The Project intends to use this technique in the intertidal zone to route the export power cable underneath the Middleton Sands saltmarsh and the sea defences thereby avoiding the need to open trench through these features.

2.4.45 An illustration of cable installation using HDD is shown at Figure 2.2. The drill enters the ground at an "entry point" and exits the ground at an "exit point". HDD could take place either from land toward to sea ("land-based drilling") or from the seaward side of the saltmarsh to the HDD working compound ("marine drilling").

2.4.46 One entry / exit point will be located near to the Transition Jointing Bay inside the HDD working compound, a minimum of 20 m from the eastern edge of the sea defence. The other exit / entry point will be located within the cable working corridor on the beach at least 50 m away from the saltmarsh. The length of the HDD from entry to exit point will be between 335 m and 1,000 m. The exact location of the exit and entry points for the drilling will be decided at a later stage when cable specifications are known and geotechnical survey results have been evaluated.

2.4.47 HDD drilling begins by drilling a small diameter pilot hole along a predetermined path from the entry to the exit point, where the drill breaks out. As the hole is drilled, a drilling mud (typically Bentonite) will be injected into the hole behind the drilling head to ensure it is kept stable. Bentonite is an inert material consisting of a mixture of water (either saltwater or fresh water) and natural clays. If water cannot be provided by a nearby municipal supply, water will either be transported to site in tanks or pumped from the sea using a pipe laid along the cable working corridor.

2.4.48 A temporary mud lagoon will be required to capture and recycle the water-based drilling mud during the drilling process and to ensure it does not exit the site. The plan area of the lagoons may vary but will be a maximum of 5 m by 5 m and will be located onshore, within the HDD compound. The depth of the lagoon will generally be 0.8 m but this may vary according to local topography. Excavations will be plastic lined and protected with temporary fencing during construction. On completion of the HDD works, the lagoons will be drained into a tanker and disposed of at a suitably licensed waste management facility.

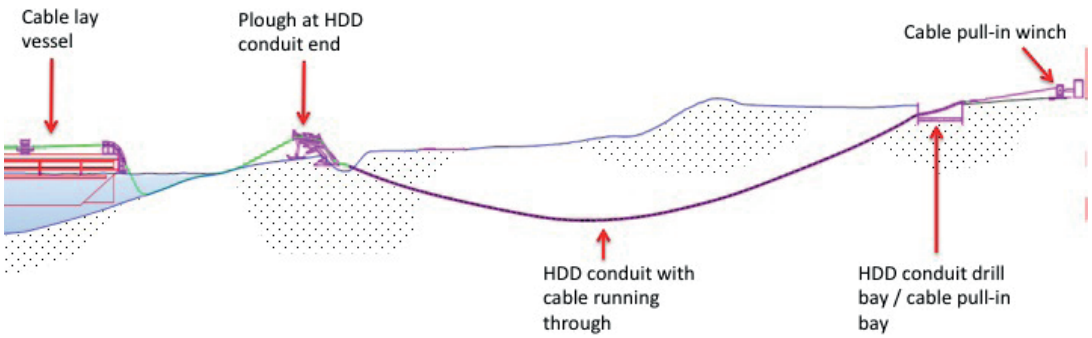


Figure 2-2: Illustration of cable installation at the landfall using HDD

2.4.49 After the pilot hole is drilled, a steel reamer is pulled back through the pilot hole enlarging the diameter of the hole as it progresses. Several drilling and reaming operations will be necessary to achieve the correct drill diameter to accommodate the duct for the offshore export cable. The duct will be a maximum of 1 m in diameter; the installation of the duct in the drilled hole is discussed further below. The drilling process described above would be repeated up to five times, once for each offshore export cable system. The process of drilling and installing a duct may take up to 2 months per cable system.

2.4.50 A working area, approximately 300 m long and 200 m wide, will be located by the drill exit point to contain the drill reamers and other associated plant. This area will be fenced off for the duration of the drilling works to maintain public safety. If the exit pit is underwater, the drill reamers and plant equipment will be delivered and stored on barges stationed near the exit point. Otherwise, HGVs will deliver the drill reamers and associated plant via Potts Corner.

ONSHORE CABLE INSTALLATION

2.4.51 The export power cables connect the offshore wind farm substation(s) to the onshore grid. The export cable system consists of a maximum of five subsea (offshore) cable systems which are connected to onshore cables at transition joint bays, where the onshore export and offshore export cable are jointed together. The transition joint bay will not be constructed in the marine environment; it will be located on the landward side of the sea defence and will be located entirely within the terrestrial environment (onshore). Chart 2-5 shows the outline of the onshore Project Site, including cable corridor and onshore substation site. The length of the onshore cable system from the transition joint bay to the onshore substation is 3.7 km and the total maximum duration of all construction activities required to install the onshore cables will be 18 months.

TRANSITION JOINT BAY CONSTRUCTION AND SEA DEFENCE WORKS

2.4.52 The transition joint bays are underground structures a maximum of 4 m wide and 14 m long with concrete walls. The transition joint bays are back-filled, with cement bounded sand or Powercrete, after installation of the cables; this is to ensure the correct ambient conditions for the cable system when in use.

2.4.53 Each transition joint bay will be constructed within the cable working corridor,

but separated by between 1 m and 15 m (edge to edge) to minimise the thermal interference between each cable system.

2.4.54 During installation of a single transition joint bay, a temporary onshore working area of 40 m by 40 m will be required for deposit of soil, winch, auxiliary power supply, access roads and work containers for tools and excavators.

2.4.55 In preparation for the offshore cable pull-in, temporary anchors ("deadman anchors") will be required to secure the winches used for pulling in the offshore cable. After the offshore cable has been pulled into the transition joint bay, it is jointed to the onshore cables under controlled conditions. The area above the transition joint bay will be fully reinstated to the former land use. The only visible structures following construction will be the two accessible surface covers.

2.4.56 Constructing each transition joint bay is expected to take approximately 10 weeks and is likely to be carried out prior to the offshore cable pull-in operation. When the offshore cable has been pulled in, the jointing of the onshore cable with the offshore cable will take approximately 4 weeks per cable system, followed by reinstatement of the area above the transition joint bay.

2.4.57 2.4.57 HDD will be used to cross under the sea defences. The indicative total installation duration for nearshore works is 12 months.

ONSHORE SUBSTATION

2.4.58 The onshore grid connection location agreed with National Grid Electricity Transmission (NGET) is at the proposed Middleton 400 kV substation, located south of Heysham and north of the village of Middleton. Up to two 400 kV underground cables will connect the Project onshore substation to the adjacent NGET substation. The onshore substation will include the electrical equipment required to transmit the power from the offshore wind farm to the grid, and comply with the Grid Code. This equipment is likely to include up to four onshore transformers, up to four HV switchgear systems (up to two air insulated, up to two gas insulated), up to four harmonic filters and reactive compensation devices. The substation footprint will have a maximum area of 28,900 m^2 (equivalent to 170 m x 170 m). Further detail of the onshore substation can be found in the Environmental Statement Chapter 4, "Project Description".

2.5 Operation and maintenance

2.5.1 The wind farm will be operated based on experience gained from existing DONG Energy wind farms, including the operational procedures, plans and instructions. The overall strategy has not been finalised for the Walney Extension Project, although it is anticipated that this will occur once the operations and maintenance onshore base location and technical specification of the wind farm are known. Generally, crew vessels and helicopters will be relied upon for the services that will be performed at the wind farm. Maintenance activities can be categorised into two levels: preventative and corrective. Preventative maintenance is according to schedules services whereas corrective maintenance covers unexpected repairs, component replacements, retrofits and breakdowns. Further details of proposed operations and maintenance activities are found in ES Chapter 4 (Project Description").

VESSEL OPERATIONS

2.5.2 Crew vessels being considered for the wind farm range from 12 to 24 passenger capacity and will meet the required specifications of the MCA. It is anticipated that the majority of the preventative and corrective maintenance activities will rely

on the use of the crew vessels. Vessels will support technicians, as well as equipment and consumables, when required. When transferring potentially hazardous consumables from the crew vessels, relevant HSE and pollution control procedures will be adhered to in order to mitigate the risk of spillage. It has been estimated that there will be up to eight crew vessel departures per day. Certain corrective maintenance activities, such as blade and major component replacements will require a jack-up vessel for the operation.

HELICOPTER OPERATIONS

2.5.3 Helicopter operations may be used to transport technicians and/or equipment to the wind turbines or substations primarily for corrective maintenance operations although in certain circumstances they may be used for preventative maintenance operations. Helicopter types considered for the Project include the EC135, EC155, AW-109 Grand S, AW-139 and Sikorsky S76, however this may be altered depending on the selected turbine type. Normally 4 – 6 technicians including spare parts and tools can be transported to a helideck (placed on a substation). The location of the onshore helicopter landing facilities has not been finalised.

2.5.4 It has been estimated that a maximum of 2,100 return flights per year will be required for helicopter operations. This is based on the maximum number of turbines (207 x 3.6 MW) being considered for the project and a number of worst case assumptions:

- Every WTG requires fault repair up to 5 times per year on average;
- All of these repairs will be undertaken by helicopter; and
- Each fault involves up to two helicopter return flights.

2.6 Repowering

2.6.1 Although The Crown Estate (TCE) lease is for 50 years, the turbines have a design lifetime of up to 25 years. After 25 years the Project may be "re-powered" depending on the integrity of the offshore structures. Re-powering is likely to involve replacing existing turbines and electrical plant (contained within the substations) with newer, more efficient versions although this will only be necessary if the original structures/plant are no longer functional. It should be noted that re-powering is not within the scope of the current consent application. Changes in technology would mean that the re-powered Project would be very likely to be significantly different from that currently being applied for. It is likely, therefore, that any such re-powering would require new consents and would be the subject of a new EIA and HRA, subject to the statutory consent process in effect at that time.

2.7 Decommissioning

2.7.1 If extending the life-time of the wind farm by re-powering is not a viable option, then the project will be decommissioned.

2.7.2 Decommissioning the wind farm at the end of its life is a condition of TCE"s lease and a legal requirement under the Energy Act 2004. A decommissioning plan must be agreed with the regulatory authorities before construction can commence and the law places an obligation on the Applicant to ensure that sufficient funding is in place throughout the lifetime of the project to carry out decommissioning activities. The following section provides a high level description of what the anticipated decommissioning process is and a detailed plan will be prepared and assessed at a later stage.

REMOVAL OF WIND TURBINES

2.7.3 The dismantling and removal of turbine components will largely be a reversal of the installation process and subject to the same constraints. Using present technology, dismantling of the turbines will require a jack-up vessel to ensure adequate control and to cope with the relatively high lifts and high crane hook loads. If a turbine"s foundation is a monopile or jacket, it is likely that the foundation and turbine will be disassembled at the same time.

REMOVAL OF WIND TURBINE FOUNDATIONS

2.7.4 The foundations will be removed after the turbine/substation topside has been removed. This will be carried out according to best practice at the time of decommissioning. The following section outlines the anticipated removal methods assuming today"s technology.

Monopile foundations

2.7.5 It is expected that initially, the transition piece will be cut just above the grouted connection and removed by crane. The monopile will then be cut below the seabed level to a depth that will ensure the remaining foundation is unlikely to become exposed. This is likely to be approximately one metre below sea level although the exact depth will depend upon the seabed conditions and site characteristics at the time of decommissioning. The cutting process is likely to be via a mechanical or water jet cutter. Alternatively, if the soil conditions allow for it, the monopiles can be reverse vibrated out of the ground.

Gravity base foundations

2.7.6 The top of the foundation, which consists of reinforced concrete of steel, will be demolished by the use of conventional demolition tools: jackhammers, diamond saw, and/or hydraulic splitting. The ballast will be recovered for reuse. For this work, backhoes and barges will be needed. Concrete casing/ containers will be crushed by concrete subsea working crushers or jackhammers. The method depends on the requirements for seabed clearance after the decommissioning.

Jacket foundations

2.7.7 The decommissioning process for jacket foundations will be similar to that of monopiles. The legs of the jacket structure will be cut just above the piles and removed by crane. Following this, the piles will either be cut or vibrated out and also removed by crane. The parts will then be processed for reuse, recycling or disposal.

Suction caisson foundations

2.7.8 The decommissioning process is likely to involve pumping seawater inside the foundation shaft forcing the foundation out of the seabed. A crane will then lift the structure to a transport vessel for transportation to shore where parts will be processed for reuse, recycling or disposal.

Scour protection

2.7.9 It may be preferable to leave the scour protection in-situ to preserve the marine habitat that may have established over the life of the wind farm. Relevant stakeholders and regulators will be consulted to establish what the best approach will be. If deemed necessary, the removal sequence will be the recovery of rock armour by grab vessel and the filter layer dredged, with both being disposed of at a licensed disposal area.

DECOMMISSIONING OF OFFSHORE ELECTRICAL INFRASTRUCTURE

Offshore substation

2.7.10 The dismantling and removal of the offshore substation will include the complete topside and the foundation (substructure) and will follow a similar process to that described for the turbines and turbine foundations.

2.7.11 Firstly, all electrical control and power cables will be de-energised and isolated from

the national grid and SCADA system. All cables and unsecured loose items will be removed and potentially hazardous/polluting chemicals contained. The topside structure will be removed by crane. It is anticipated that this will be with one lift and so the topside will not need to be dismantled. This will be transported to shore where interconnections will be dismantled and oil removed from transformers before the parts are processed for reuse, recycling or disposal. The foundations will be decommissioned using the same methods as used for turbine foundations.

Offshore cables

2.7.12 Relevant stakeholders and regulators will be consulted to determine which sections of the offshore cables will need to be removed. If there are no issues with stakeholders / regulators and the risk of the cable becoming exposed is minimal, then the cables will be left in-situ. The ends of the cables will be cut as close to the foundation as possible either prior to foundation removal, or at the same time. The ends will be weighted down and buried (probably using an ROV) to ensure that they do not interfere with vessels etc.. At cable or pipeline crossings the cables are likely to remain in place to avoid unnecessary risk to the integrity of the other cable or pipeline.

2.7.13 It is noted that decommissioning effects have not been expressly stated in the screening and assessment stage that follows. This is for two reasons: (i) the time that will elapse prior to this stage is such that the precise effects of decommissioning cannot be known, and (ii) we can be confident that decommissioning effects will not be greater than (and in most cases will be less than) construction stage effects.

2.7.14 No consultee has, to date, expressed concern at the absence of express reference to the decommissioning stage effects.

2.8 Design Envelope

2.8.1 A Design Envelope, also known as the "Rochdale Envelope", is a well-established approach in planning consent for offshore wind farms in the UK. This approach fixes key parameters, such as the boundary of the site, the maximum number of turbines, maximum dimensions and maximum power output of the scheme, but allows flexibility for the final choice of configuration to be made later on – typically after consent has been awarded. The key requirement of this approach is that the Environmental Assessment (including any HRA) is based on the "worst realistic case" scenario when considering the environmental impacts of the proposed scheme. The Design Envelope parameters for the Project are detailed above in Tables 2.1 to 2.8 above.



3.0 THE HABITATS REGULATIONS ASSESSMENT

3.1 Introduction

3.1.1 This section of the HRA identifies the protection afforded to certain sites under European and domestic legislation and policy, and also explains the process of screening and assessment that the Applicant is required to undertake when carrying out a HRA

3.2 Protection under European and domestic law and policy

3.2.1 Council Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive") protects habitats and species of European nature conservation importance. Together with Council Directive (2009/147/EC) on the conservation of wild birds (the "Birds Directive"), the Habitats Directive establishes a network of internationally important sites designated for their ecological status. Special Areas of Conservation (SACs) and Sites of Community Importance (SCIs) are designated under the Habitats Directive and promote the protection of flora, fauna and habitats. Special Protection Areas (SPAs) are designated under the Birds Directive in order to protect rare, vulnerable and migratory birds.

3.2.2 In England and Wales, the Habitats Directive and Birds Directive are implemented through the Habitats Regulations 2010, the Offshore Habitats Regulations (on which, see Footnote 1 above; together "the Habitats Regulations") and the Wildlife and Countryside Act 1981. The Habitats Regulations seek to provide strict protection to sites designated for nature conservation, which incorporate not only SACs, candidate SACs ("cSACs") and SCIs, but also all SPAs. Consequently, the protections afforded to European Sites under the Habitats Directive apply to SPAs designated under the Birds Directive. These sites combine to create a Europe-wide "Natura 2000" network of protected sites, which are hereafter referred to as "European Sites".

3.2.3 In addition to sites designated under European nature conservation legislation, UK Government policy (ODPM Circular 06/2005) is to apply to internationally important wetlands designated under the Ramsar Convention 1971 (Ramsar sites) and proposed SPAs ("pSPAs") the same protection as SPAs and SACs for the purpose of considering development proposals that may affect them.

3.2.4 Therefore, for the purposes of this assessment, the term "European Site" should also be read as including Ramsar sites and pSPAs.

3.3 Procedure and process

3.3.1 Regulation 61(1) of the Habitats Regulations 2010 identifies the procedure for the assessment of the implications of plans or projects on European sites[3]. Under this Regulation, if a proposed development is not directly connected with, or necessary to, the management of the site and is likely to have a significant effect on the site, the competent authority must undertake an "appropriate assessment" of the implications for the site in view of the site"s conservation objectives. The requirements of Regulation 25 of the Offshore Habitats Regulations are substantially similar, and so are not referred to hereafter.

3.3.2 The Planning Inspectorate has issued "Advice Note 10: Habitat Regulations Assessment relevant to nationally significant infrastructure projects (January 2013)" in which four stages of the process known as HRA are set out:

"STAGE 1

Screening: Determining whether the plan or project "either alone or in-combination with other plans or projects" is likely to have a significant effect on a European site (or sites). If the answer is "no" then a "No Significant Effects Report" (NSER) should be submitted in accordance with Regulation 5(2)(g) of the APFP Regulations 2009, in which any European sites potentially affected by the proposed development are identified. The NSER is required to be clear, supported by sufficient information that the conclusion is supported, including confirmation from the Statutory Nature Conservation Bodies and other relevant bodies, and provide reasons why the Applicant has reached the view that there are no significant effects and that an appropriate assessment will not be required. Advice Note 10 presents screening matrices to be completed for each European site included in the assessment. If the answer is "yes" then the Applicant must continue to Stage 2.

STAGE 2

Appropriate Assessment: Determining whether the plan or project proposed has implications for the site"s conservation objectives. If so, it will be necessary to ascertain whether the proposal will adversely affect the integrity of the site. If it can be established beyond reasonable scientific doubt that the project will not adversely affect the site"s integrity then no further assessment is required and the development consent sought may be granted. However, if there is uncertainty or the conclusion is reached that there will be an adverse effect on the integrity of a European site then the Applicant must continue to stage 3.

STAGE 3

Assessment of Alternatives: If there is or may be an adverse effect on the integrity of the site, then it is necessary to consider whether there are conditions or other restrictions that would enable it to be concluded that the proposal would not adversely affect the integrity of the site. This gives rise to the need to give consideration to alternative solutions. In the event that alternative solutions are identified then this would require a redraft of the project and a return to Stage 2. If there are no alternative solutions then Stage 4 must be considered if the Applicant continues to seek the issue of the development consent.

STAGE 4

Assessment of IROPI: Whether or not there are "Imperative Reasons of Overriding Public Interest" ("IROPI") in granting consent for a project is, broadly speaking, the test applied to determine whether or not development consent can be granted for a project notwithstanding its adverse effect on the integrity of a European site(s). The IROPI test differs slightly depending on whether or not the proposed development might adversely affect a habitat or species on the European Site which is classified as a "priority" habitat or species. If the habitat or species affected is not a priority one, then authorisation may be granted subject to the Secretary of State securing necessary compensatory measures and notification to the European Commission of these where the IROPI are of a social or economic nature, or where they relate to human health, public safety or important environmental benefits. If, however, priority habitats or species may be adversely affected by the proposed development then consent may only be granted where the IROPI relate to human health, public safety or important environmental benefits, unless the competent authority first consults and has due regard to the opinion of the European Commission. Again, the grant of authorisation is subject to the Secretary of State securing compensatory measures and notifying the European Commission."

All four stages of the process are referred to collectively as the HRA, to clearly distinguish the whole process from the step within it (Step 2) referred to as the "Appropriate Assessment".

3.3.3 With respect to the second stage, the integrity of a site, upon which the adverse effect must assesed, is conventionally defined as "the coherence of the site"s ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated." An adverse effect on integrity, therefore, is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation.

3.3.4 The Planning Inspectorate"s Advice Note Ten (AN10) describes how the Habitats Regulations Assessment fits within the 2008 Act process and details the information to be provided, in the form of an HRA Report, with the development consent application. Figure 3.1, taken from this Advice Note, sets out the stages in this process. This HRA Report aligns with the Planning Inspectorate"s Stages 1 and 2.

3.3.5 AN10 also advises that the Integrity Matrices appended to the advice note should be completed in order to summarise the assessment of the effects on the integrity of a European site. Completed Integrity Matrices can be found at Annex 4 to this HRA Report.

3.3.6 AN10 advises that the HRA Report should include:

- Evidence about the project"s impacts on the integrity of protected sites (see Chapters 5, 6, 7, and 8 of this HRA Report).
- A description of any mitigation and measures proposed which avoid or reduce each impact, and any residual effect (see Chapter 9 of this HRA Report).
- A schedule indicating the timing of mitigation measures in relation to the progress of development (see Chapter 9 of this HRA Report).
- Cross references to the relevant DCO requirements and development consent obligations that secure these mitigation measures, and identification of any factors that might affect the certainty of their implementation (see Chapter 9 of this HRA Report).
- A statement as to whether any residual effects constitute an adverse impact on the integrity of European sites (see Chapter 8 of this HRA Report).
- Evidence that demonstrates that the Applicant has fully consulted and had regard to comments received by the relevant SNCBs during pre-application consultation (see Chapter 10 of this HRA Report).

3.3.7 English Nature"s (now Natural England"s) Habitats Regulations Guidance Note 1 (HRGN1) describes how an appropriate assessment (i.e. step 2 above) should be undertaken. This guidance bases the assessment on a series of nine key steps. These steps include consultation, data collection, impact identification and assessment, project modification and/or restriction, and reporting.

3.3.8 In the determination of likely significant effect, guidance has been provided in Habitat Regulations Guidance Note 3 (HRGN3), "The Determination of Likely Significant Effect under the Habitats Regulations". This involves a preliminary consideration of whether a qualifying feature is likely to be directly or indirectly affected (in which case there is a presumption that a significant effect is likely). In such a case, a fuller consideration should then be applied, using further analysis and information, to confirm and justify the

presence or absence of "likely significant effect" (LSE). Appropriate assessment is needed in cases where LSE is identified or cannot reasonably be excluded.

3.3.9 LSE, in this context, is any effect that may be reasonably predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, excluding trivial or inconsequential effects.

3.3.10 In determining significance, those carrying out assessments should also take note of the decision of the European Court of Justice in Waddenzee (Case C-127/02), where it was said that: "…any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site"s conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects… [and that a plan or project may only be authorised]…where no reasonable scientific doubt remains as to the absence of such effects".

3.3.11 The undertaking of the appropriate assessment is, however, the responsibility of the "Competent Authority" (here, the Secretary of State). This Report aims to provide the information required by the Competent Authority to enable it to undertake an appropriate assessment of the project, if necessary, in accordance with Article 61 of the Habitats Regulations 2010 and Article 25 of the Offshore Habitats Regulations.

3.3.12 It should also be recalled that Regulation 61 of the Habitats Regulations requires the Competent Authority to make an Appropriate Assessment of any plan or project which is likely to have a significant effect on a European site, not only taken alone, but in-combination with other plans or projects.

3.3.13 For the purposes of this Report, the in-combination test includes "other plans or projects" which fall in the following categories:

- Approved but as yet uncompleted plans or projects;
- Permitted on-going activities (e.g. discharge consents or abstraction licences);
- Plans and projects for which an application has been made and which are currently under consideration but not yet approved by the competent authorities; and
- Other plans or projects which have not yet been submitted to a Competent Authority for consideration, but that are proposed or could be reasonably anticipated to happen.

3.3.14 The in-combination assessment of this Project with other such plans and projects is detailed in Section 8 of this Report.

3.4 Study area and relevant European Sites

3.4.1 This section defines the study area for this HRA and lists the European Sites within that study area for which the Project may potentially have a significant effect.

3.4.2 An overview of the baseline environment for the Project is presented in section 4 for each study area and an initial screening for likely significant effect is presented in section 5.

STUDY AREA

3.4.3 DONG Energy is applying for a Development Consent Order for the proposed Project. The works area for the Project comprises the following marine and terrestrial areas:

- Marine – The Project wind farm Site (i.e. the proposed offshore development site within The Crown Estate lease area) and the Export Cable Corridor to the landfall site (including the Intertidal Works Area).
- Terrestrial – The Onshore Cable Corridor and works areas, and the Onshore Substation works area.

3.4.4 The study area for each receptor group is the relevant works area (marine or terrestrial) plus buffer area together with a wider area whose extent reflects the spatial extent of a potential mechanism for an effect on the receptor by the Project.

3.4.5 Some receptors, notably birds, may have multiple study areas defined depending on season and behaviour. (For example, to pick up spatial differences in the distribution of breeding, migrating, or wintering bird species).

Table 3.1 defines the study area used for each receptor group considered in this HRA.

Table 3.1: Definition of study areas for receptor groups considered in the HRA

Receptor group	Study area	Justification
Annex I habitat	Works area plus buffer zone	For direct effects a precautionary buffer zone of 500m beyond the boundary of the Project wind farm Site, the Export Cable Corridor (including the Intertidal Works Area), the Onshore Cable Corridor, and the Onshore Substation works area. For sub-tidal marine Annex I habitats an approximate extent of one tidal excursion4 is considered for indirect effects. One tidal excursion is considered to be the appropriate buffer distance for consideration of the impact of short-term suspended sediment plumes associated with Project construction activity.
Fish	Eastern Irish Sea	SAC rivers and estuaries within the eastern Irish Sea area for which diadromous fish are qualifying features. For fish the potential impact with the greatest geographical extent is considered to be underwater noise from piling activity. The study area for migratory fish (shown on Chart 4.3) includes this extent and, for completeness, includes SAC sites (where migratory fish are qualifying features) beyond this boundary. In the absence of any information linking, say, Atlantic salmon present within the Project area and specific SAC rivers the study area boundary limits are in this case likely to be arbitrary.
Marine mammals	Irish sea zone	The wide-ranging foraging and migratory behaviour exhibited by marine mammal species means potential interaction with the Project Site from animals of a regional population. The marine mammal study area therefore includes SAC sites on the south and east coasts of the Irish Republic and the northern coast of Northern Ireland, together with sites in Scotland and Wales, depicted on Chart 5.1.

Table 3.1: Definition of study areas for receptor groups considered in the HRA

Receptor group	Study area	Justification
Birds	Extent of Project wind farm Site plus a 4km buffer area Passage and over-wintering birds	Zone out to which displacement effects may potentially occur. This extent (4 km) is beyond the predicted range for any displacement effect but is used here as it reflects the buffer zone used for Project wind farm Site bird surveys. (Chart 4.4 shows the extent of the 4 km buffer). For over-wintering species the zone of influence is defined by their wintering location(s) and known migratory routes.
	Breeding seabird colonies	The zone of influence for seabirds during the breeding season is defined by the mean maximum foraging range from the colony (using values from Thaxter et al 2012). Outside of the breeding season the biologically defined minimum population scale (BDMPS) concept is used (see HRA Report Annex 3).



RELEVANT EUROPEAN SITES

3.4.6 Based on the study areas presented in Table 3.1 a number of European Sites (and Ramsar sites) are scoped into the assessment. These are shown in Table 3.2. For presentation purposes the sites are listed here by UK national areas.

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Scotland		
Ailsa Craig SPA	Ailsa Craig is a cone-shaped granitic island, rising to 338 m, situated in the outer part of the Firth of Clyde, western Scotland. Cliffs up to 100 m encircle the island and provide nesting sites for a range of seabird species, notably one of the largest colonies of Gannet *Morus bassanus* in the world. The seabirds nesting here feed in surrounding waters outside the SPA as well as further afield.	Breeding gannet Breeding lesser black-backed gull Internationally important breeding seabird assemblage
Eileanan agus Sgeiran Lios mór SAC	A group of small islands and skerries in Argyll and Bute off the west coast of Scotland.	Annex II species that are a primary reason for selection of this site: Common seal *Phoca vitulina*
River Bladnoch SAC	The River Bladnoch supports a high-quality salmon population in south-west Scotland, which unusually for rivers in this area still supports a spring run of salmon.	Annex II species that are a primary reason for selection of this site: Atlantic salmon *Salmo salar*
South East Islay Skerries SAC	The skerries, islands and rugged coastline of the Inner Hebridean island of Islay hold a nationally-important population of the common seal *Phoca vitulina*.	Annex II species that are a primary reason for selection of this site: Common seal *Phoca vitulina*
Treshnish Isles SAC	The Treshnish Isles are a remote chain of uninhabited islands and skerries situated in south-west Scotland. The islands, numerous skerries, islets and reefs support a breeding colony of grey seals *Halichoerus grypus*, contributing just under 3% of annual UK pup production.	Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Reefs Annex II species that are a primary reason for selection of this site: Grey seal *Halichoerus grypus*



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Scotland / England		
Upper Solway Flats and Marshes Ramsar	The flats and marshes of the Upper Solway Firth form one of the largest continuous areas of intertidal habitat in Britain. The whole estuarine complex is a site of national and international importance for wintering wildfowl and wading birds and is a vital link in a chain of west coast estuaries used by migrating birds.	Supports over 10% of the British population of natterjack toad *Bufo calamita* Species with peak counts in winter: 135720 waterfowl (5 year peak mean 1998/99-2002/2003) Species with peak counts in spring/autumn: Eurasian oystercatcher, *Haematopus ostralegus ostralegus*, Species with peak counts in winter: Whooper swan, *Cygnus cygnus*, Pink-footed goose, *Anser brachyrhynchus*, Barnacle goose, *Branta leucopsis*, Northern pintail, *Anas acuta*, Greater scaup, *Aythya marila marila*, Red knot, *Calidris canutus islandica*, Bar-tailed godwit, *Limosa lapponica lapponica,* Eurasian curlew, *Numenius arquata arquata*, Common redshank, *Tringa totanus totanus*, Species/populations identified subsequent to designation for possible future consideration under criterion 6. Species regularly supported during the breeding season: Lesser black-backed gull, *Larus fuscus graellsii*, Herring gull, *Larus argentatus argentatus* Species with peak counts in spring/autumn: Ringed plover, *Charadrius hiaticula*, Species with peak counts in winter: Dunlin, *Calidris alpina alpina*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Upper Solway Flats and Marshes SPA	The Upper Solway Flats and Marshes SPA lies on the west coast on the border between England and Scotland. The flats and marshes of the Upper Solway form one of the largest continuous areas of intertidal habitat in Britain. The geomorphology and vegetation of the estuarine saltmarshes or merses are of international importance, with broad transitions to mature 'upper-marsh' being particularly well represented. The whole estuarine complex is of importance for wintering wildfowl (ducks, geese and swans) and waders, and is a vital link in a chain of west coast UK estuaries used by migrating waterbirds. The SPA supports virtually all of the Svalbard population of Barnacle Goose Branta leucopsis over the winter.	Over winter; Bar-tailed Godwit *Limosa lapponica*, Barnacle Goose *Branta leucopsis*, Golden Plover *Pluvialis apricaria*, Whooper Swan *Cygnus cygnus*, Curlew *Numenius arquata*, Dunlin *Calidris alpina alpina*, Knot *Calidris canutus*, Oystercatcher *Haematopus ostralegus*, Pink-footed Goose *Anser brachyrhynchus*, Pintail *Anas acuta*, Redshank *Tringa totanus*, On passage; Ringed Plover *Charadrius hiaticula*, Over winter, the area regularly supports 133,222 individual waterfowl (5 year peak mean 1991/2 - 1995/6)
Northern Ireland		
Copeland Islands SPA	The Copeland Islands site comprises three islands, together with associated islets, off the north-east County Down coast and close to the entrance to Belfast Lough.	Breeding puffin Breeding Arctic tern
Lough Foyle Ramsar	Lough Foyle lies on the north-west coast of Northern Ireland and straddles the international border with the Irish Republic. The site comprises a large, shallow sea lough that includes the estuaries of the rivers Foyle, Faughan and Roe.	Species with peak counts in spring/autumn: Whooper swan, *Cygnus cygnus* Light-bellied brent goose, *Branta bernicla hrota* Species with peak counts in winter: Bar-tailed godwit, *Limosa lapponica lapponica*
Lough Foyle SPA	Lough Foyle lies on the north-west coast of Northern Ireland and straddles the international border with the Irish Republic. The site comprises a large, shallow sea lough that includes the estuaries of the rivers Foyle, Faughan and Roe. The site contains extensive intertidal mud-flats and sand-flats (with Mussel *Mytilus edulis* beds), saltmarsh and associated brackish ditches.	Over winter; Bar-tailed Godwit *Limosa lapponica* Bewick's Swan *Cygnus columbianus bewickii* Golden Plover *Pluvialis apricaria* Whooper Swan *Cygnus cygnus* Light-bellied Brent Goose *Branta bernicla hrot* Over winter, the area regularly supports 37,310 individual waterfowl (5 year peak mean 1991/2 - 1995/6)

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Lough Neagh and Lough Beg SPA	Lough Neagh is situated in the centre of Northern Ireland. It is the largest freshwater lake in the UK covering an area of 383 sq. km. The lough is very shallow for its size with a mean depth of 8.9 m (at deepest only 34 m). This site also contains a smaller lake, Lough Beg (covering 1,125 ha) to the north, as well as a small satellite lake, Portmore Lough (286 ha), to the east of Lough Neagh.	During the breeding season; Common Tern *Sterna hirundo*, Black-headed Gull *Larus ridibundus*, Great Crested Grebe *Podiceps cristatus,* Over winter; Bewick's Swan *Cygnus columbianus bewickii*, Golden Plover *Pluvialis apricaria*, Whooper Swan *Cygnus cygnus*, Goldeneye *Bucephala clangula*, Great Crested Grebe *Podiceps cristatus*, Pochard *Aythya ferina*, Scaup *Aythya marila*, Tufted Duck *Aythya fuligula*, On passage; Great Crested Grebe *Podiceps cristatus*, Over winter; During the breeding season, the area regularly supports 67,690 individual seabirds Over winter, the area regularly supports 99,221 individual waterfowl (5 year peak mean 1991/2 - 1995/6)
Lough Neagh and Lough Beg Ramsar	Lough Neagh is situated in the centre of Northern Ireland. It is the largest freshwater lake in the UK covering an area of 383 sq. km. The lough is very shallow for its size with a mean depth of 8.9 m (at deepest only 34 m). This site also contains a smaller lake, Lough Beg (covering 1,125 ha) to the north, as well as a small satellite lake, Portmore Lough (286 ha), to the east of Lough Neagh.	Ramsar criterion 1: Largest freshwater lake Ramsar criterion 2: Site supports over 40 rare or local vascular plants Ramsar criterion 3: supports substantial numbers of waterfowl Ramsar criterion 4: This site is of special value as the habitat of plants or animals at a critical stage of their biological cycles Ramsar criterion 7: Population of pollan *Coregonus autumnalis* Ramsar criterion 5: Waterfowl assemblage Tundra swan Whooper swan Common pochard Tufted duck Greater scaup Common golden eye

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Murlough SAC	Murlough is one of the most diverse and natural dune systems in Northern Ireland. The site is an ancient system with acidic sands and a long history of traditional management.	Annex I habitats that are a primary reason for selection of this site: Fixed dunes with herbaceous vegetation ("grey dunes") * Priority feature 2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) * Priority feature Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) Annex II species that are a primary reason for selection of this site: Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia* Annex II species present as a qualifying feature, but not a primary reason for site selection: Common seal *Phoca vitulina*
Skerries and Causeway SAC	Skerries and Causeway SAC is sited on the north coast of Northern Ireland. It is the eastern part of a 30km wide embayment that has the Inishowen peninsular to its west and Benbane Head to its east. The site is influenced oceanographically and biologically both by the warming gulf stream and by the strong tidal currents that flow through the North Channel to and from the Irish Sea. The site is predominantly marine although there are significant influxes of freshwater, from the River Bann to the west and the River Bush to the east, which can influence the immediate coastal areas.	Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Reefs Submerged or partially submerged sea caves Annex II species present as a qualifying feature, but not a primary reason for site selection: Harbour porpoise *Phocoena phocoena*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Strangford Lough SAC	Strangford Lough on the east coast of Northern Ireland is an outstanding example of a large, enclosed fjardic sea lough. Sea water enters the Lough through a narrow entrance, expanding into a broad, mostly shallow basin that has a central deep channel (30-60 m deep), which carries rapid currents and causes great turbulence in some parts, particularly the Narrows. With a wide range of tidal stream strengths and depths, there is a remarkable marine fauna within Strangford Lough and it is one of the most diverse sea loughs in the UK.	Annex I habitats that are a primary reason for selection of this site: Mudflats and sandflats not covered by seawater at low tide Coastal lagoons * Priority feature Large shallow inlets and bays Reefs Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Annual vegetation of drift lines Perennial vegetation of stony banks Salicornia and other annuals colonising mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Annex II species present as a qualifying feature, but not a primary reason for site selection: Common seal *Phoca vitulina*
The Maidens SAC	The Maidens SAC is a group of rocky reefs detached from the coast, north east of Larne, Northern Ireland. The Maidens (or Hulin Rocks) are identified on the Admiralty Charts as a group of small rocky reefs either awash or just emergent, and in only two cases are they large enough to be termed islands and to carry buildings.	Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Reefs Annex II species present as a qualifying feature, but not a primary reason for site selection: Grey seal *Halichoerus grypus*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Upper Lough Erne Ramsar	Upper Lough Erne is a very large and complex freshwater system. A series of flooded drumlins in the course of the River Erne give rise to a complex of islands, bays and many lakes bordered by damp pastures, fens, reedswamp and alder/willow carr and oak woodland.	The site is a particularly good representative example of a eutrophic lake and associated swamp, fen and wet grassland. The site supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant and animal. The site is of special value for maintaining the genetic and ecological diversity of Northern Ireland because of the quality and peculiarities of its flora and fauna. The site regular supports internationally important numbers of wintering Whopper Swan *Cygnus cygnus*. The birds using the site form the core of a population of birds which use both the site and the extensive improved agricultural grassland surrounding the areas.
Upper Lough Erne SPA	Upper Lough Erne is a very large and complex freshwater system located in the south of Northern Ireland. It lies within the catchment of the River Erne, a river shared with the Irish Republic. The site supports a wide range of breeding and wintering waterbirds, but is especially important for wintering Whooper Swan *Cygnus cygnus*.	Over winter; Whooper Swan *Cygnus cygnus*, 352 individuals representing at least 3.5% of the wintering population in Ireland (5 year peak mean, 1991/2-1995/6)
Republic of Ireland		
Blasket Islands SAC	A group of small islands at the end of the Dingle peninsula in Co. Kerry.	Annex I habitats - vegetated sea cliffs, dry heath, marine caves and reefs. Annex II species - grey seal and harbour porpoise.
Horn Head and Rinclevan SAC	A diverse coastal site in Co. Donegal containing a wide range of habitats from high rocky quartzite cliffs in the north to mud flats, sand flats, dunes and a brackish lake in the south.	Fixed and shifting dunes Slender Naiad *Najas flexilis* Grey seal
Lambay Island SPA	Lambay Island lies approximately 4 km off the north Dublin coastline and is separated from it by a channel of 10-13 m in depth. East of Lambay the water deepens rapidly into the Irish Sea basin.	International importance: Cormorant (675 pairs), Shag (1,122 pairs), Razorbill (4,337 individuals) and Guillemot (59,824 individuals). National importance: Fulmar (635 pairs), Lesser Black-backed Gull (309 pairs), Herring Gull (1,806 pairs), Great Black-backed Gull (193 pairs) and Kittiwake (4,091 pairs). Peregrine (1 pair);

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Lambay Island SAC	Lambay Island lies approximately 4 km off the north Dublin coastline and is separated from it by a channel of 10-13 m in depth. East of Lambay the water deepens rapidly into the Irish Sea basin.	Breeding colony grey seal
Lough Swilly SPA	This site, situated in the northern part of Co. Donegal, comprises the inner part of Lough Swilly, a long inlet of the sea that cuts through a variety of metamorphic rocks on the west side of the Inishowen Peninsula.	Lough Swilly supports internationally important numbers of Greenland White-fronted Geese and Greylag Geese.
Lower River Shannon SAC	This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head.	The site is selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays. The site is also selected for the following Annex II species – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.
Roaringwater Bay and Islands SAC	Roaringwater Bay, Co. Cork, is a wide shallow bay located on the southwest coast of Ireland. The site includes the immediate coastline on the mainland from Long Island to Baltimore together with the whole bay and most of the islands.	Annex I habitats: Dry heaths Sea cliffs large shallow inlets and bays marine caves reefs Annex II species: Grey seal Otter Harbour porpoise
Rockabill to Dalkey Island cSAC	This site includes a range of dynamic inshore and coastal waters in the western Irish Sea. These include sandy and muddy seabed, reefs, sandbanks and islands. This site extends southwards, in a strip approximately 7 km wide and 40 km in length, from Rockabill, running adjacent to Howth Head, and crosses Dublin Bay to Frazer Bank in south county Dublin. The site encompasses Dalkey, Muglins and Rockabill islands.	Annex II species: Harbour porpoise

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Rutland Island and Sound SAC	Rutland Island and Sound lies between Aran Island and Burtonport in north-west Donegal, 5km north-west of Dunglow. Besides Rutland itself a number of other small rocky islets are also included in the site.	Annex I habitats: Coastal lagoons Large shallow inlets and bays Reefs Annual vegetation of drift lines Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) Fixed coastal dunes with herbaceous vegetation (grey dunes) Humid dune slacks Annex II species: Common seal *Phoca vitulina*
Saltee Islands SPA	The site comprises the two islands, Great Saltee and Little Saltee, situated some 4-5 km off the south Wexford coast. Both islands have exposed rocky cliffs on their south and east – those on Great Saltee being mostly c. 30 m high, those on Little Saltee about half this height.	Fulmar *Fulmarus glacialis* Gannet *Morus bassanus* Cormorant *Phalacrocorax carbo* Shag *Phalacrocorax aristotelis* Lesser Black-backed Gull *Larus fuscus* Herring Gull *Larus argentatus* Kittiwake *Rissa tridactyla* Guillemot *Uria aalge* Razorbill *Alca torda* Puffin *Fratercula arctica*
Saltee Islands SAC	This site comprises the Saltees Islands and a large area of the surrounding seas. There are two islands (Great Saltee and Little Saltee) and a constellation of islets and rocks. The islands are situated between 4 and 5 km off the south Wexford coast.	Annex I habitats: Mudflats and sandflats not covered by seawater at low tide Large shallow inlets and bays Reefs Vegetated sea cliffs of the Atlantic and Baltic coasts Submerged or partly submerged sea caves Annex II species: Grey seal *Halichoerus grypus*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Slaney River Valley SAC	This site comprises the freshwater stretches of the River Slaney as far as the Wicklow Mountains; a number of tributaries the larger of which include the Bann, Boro, Glasha, Clody, Derry, Derreen, Douglas and Carrigower Rivers; the estuary at Ferrycarrig and Wexford Harbour in south-east Ireland.	Annex I habitats: Estuaries Mudflats and sandflats not covered by seawater at low tide Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation Old sessile oak woods with Ilex and Blechnum in British Isles Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* Annex II species: Freshwater pearl mussel *Margaritifera margaritifera* Sea lamprey *Petromyzon marinus* Brook lamprey *Lampetra planeri* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Twaite shad *losa fallax fallax* Salmon *Salmo salar* Otter *Lutra lutra*
West Connacht Coast SAC	This site consists of a substantial area of marine waters lying off the coasts of counties Mayo and Galway in the west of Ireland.	Bottlenose Dolphin *Tursiops truncatus*
Wales		
Aberdaron Coast and Bardsey Island SPA	The site consists of the island of Bardsey (Ynys Enlli) and part of the tip of the Lleyn Peninsula, together with two smaller islands – the Gwylans. The coastline is rocky, with many crags, screes and low cliffs. The Aberdaron coast consists of a series of heather-covered hills rising to about 190 m, separated by valleys occupied by pastures.	Breeding and wintering chough Breeding Manx shearwater
Afon Gwyrfai a Llyn Cwellyn SAC	The Gwyrfai is a good example of the small, steep rivers that occur in north-west Wales. Llyn Cwellyn, north Wales, is an oligotrophic glacial lake (Type 3) representative of oligotrophic lakes found in the mountains of Snowdonia.	Annex II species that are a primary reason for selection of this site: Atlantic salmon Salmo salar Floating water-plantain Luronium natans Annex II species present as a qualifying feature, but not a primary reason for site selection Otter Lutra lutra

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Cardigan Bay SAC	A large marine and coastal site in west Wales notable for its population of bottlenose dolphin.	Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time; Reefs; Submerged or partially submerged sea caves. Annex II species that are a primary reason for selection of this site: Bottlenose dolphin *Tursiops truncates* Annex II species present as a qualifying feature, but not a primary reason for site selection: Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Grey seal *Halichoerus grypus*
Cors Fochno and Dyfi Ramsar	A bar-built estuarine complex, comprising the Dyfi estuary, two calcareous dune systems, and the largest expanse of raised mire in lowland Britain.	Annex I habitats: Active raised bogs Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the *Rhynchosporion* Mudfalts and sandflats Saltmarsh
Dyfi Estuary SPA	The Dyfi Estuary is located on the west coast of Wales on the boundary between Ceredigion, Gwynedd and Powys. The SPA comprises the estuary, with adjoining saltmarsh, marshy grassland and improved grassland.	Wintering Greenland white-fronted goose *Anser albifrons flavirostris*
Grassholm SPA	Grassholm is a small island which lies about 18 km west of the mainland coast of Pembrokeshire in south-west Wales. It is a rather low, flat-topped basalt island with limited terrestrial vegetation owing to the effects of large numbers of breeding seabirds, together with the influence of salt spray and wind exposure.	Breeding gannet *Morus bassanus*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Lleyn Peninsula and the Sarnau SAC	A large coastal and estuarine site in north-west Wales.	Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Estuaries Coastal lagoons * Priority feature Large shallow inlets and bays Reefs Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Mudflats and sandflats not covered by seawater at low tide Salicornia and other annuals colonising mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Submerged or partially submerged sea caves Annex II species present as a qualifying feature, but not a primary reason for site selection Bottlenose dolphin *Tursiops truncates* Otter *Lutra lutra* Grey seal *Halichoerus grypus*



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Pembrokeshire Marine SAC	Pembrokeshire Marine includes the Daugleddau estuary, a ria estuary in south-west Wales, formed in the upper reaches of one of the best examples of a ria in the UK. Associated with the wide range of environmental conditions, particularly seabed substrates, tidal streams and salinity gradients, there is a wide diversity of communities and species.	Annex I habitats that are a primary reason for selection of this site: Estuaries Large shallow inlets and bays Reefs Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Coastal lagoons * Priority feature Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Submerged or partially submerged sea caves Annex II species that are a primary reason for selection of this site Grey seal *Halichoerus grypus* Shore dock *Rumex rupestris* Annex II species present as a qualifying feature, but not a primary reason for site selection Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Twaite shad *Alosa fallax* Otter *Lutra lutra*



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
River Dee and Bala Lake SAC	The source of the River Dee lies within the Snowdonia National Park and its catchment contains a wide spectrum of landscapes from high mountains around Bala, steep-sided wooded valleys, near Llangollen, to the rich agricultural plains of Cheshire and north Shropshire. The downstream boundary of the SAC extends to Connah's Quay in the tidal river.	Annex I habitats that are a primary reason for selection of this site: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation Annex II species that are a primary reason for selection of this site: Atlantic salmon *Salmo salar* Floating water-plantain *Luronium natans* Annex II species present as a qualifying feature, but not a primary reason for site selection: Sea lamprey *Petromyzon marinus* Brook lamprey *Lampetra planeri* River lamprey *Lampetra fluviatilis* Bullhead *Cottus gobio* Otter *Lutra lutra*
Skokholm and Skomer SPA	Skomer, Skokholm and Middleholm are three islands lying off the extreme south-west tip of Pembrokeshire in south-west Wales. They are bounded by cliffs that reach 70 m on Skomer. The plateau vegetation is much affected by salt spray, rabbit grazing and nutrient enrichment from seabirds.	During the breeding season; Chough *Pyrrhocorax pyrrhocorax*, Short-eared Owl *Asio flammeus*, Storm Petrel *Hydrobates pelagicus*, Lesser Black-backed Gull *Larus fuscus,* Manx Shearwater *Puffinus puffinus,* Puffin *Fratercula arctica,* During the breeding season, the area regularly supports 67,278 individual seabirds
Ynys Feurig, Cemlyn Bay and The Skerries SPA	The SPA of Ynys Feurig, Cemlyn Bay and The Skerries is located on the north and west coasts of the island of Anglesey off north-west Wales. The SPA comprises three separate areas. Ynys Feurig lies on Anglesey's west coast close to Valley airfield, with Cemlyn Bay situated on the north coast about 20 km away. The Skerries lie 3 km off Carmel Head. Ynys Feurig consists of a series of low-lying islands extending about 1 km out to sea from a sandy shore. There is little vegetation, except on the highest outer islands. At Cemlyn Bay, a shingle storm beach forms a bar between a tidal lagoon and the open shore. The shingle habitats, together with saltmarsh developing around the lagoon and brackish pools further inland are an unusual ombination of habitats. The Skerries are a group of sparsely vegetated islets, 17 ha in extent.	During the breeding season; Arctic Tern *Sterna paradisaea*, Common Tern *Sterna hirundo,* Roseate Tern *Sterna dougallii,* Sandwich Tern *Sterna sandvicensis*,

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
	They are protected by strong currents but are very exposed to strong westerly and northerly winds. The site is of importance for four species of breeding terns. The three separate areas are treated as a single site as a consequence of regular movement by birds between the component parts.	
Wales / England		
Dee Estuary SAC	The Dee Estuary lies on the boundary between England and Wales on the north-west coast of Britain. It is a large, funnel-shaped, sheltered estuary that supports extensive areas of intertidal sand-flats, mud-flats and saltmarsh.	Annex I habitats that are a primary reason for selection of this site: Mudflats and sandflats not covered by seawater at low tide Salicornia and other annuals colonising mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Estuaries Annual vegetation of drift lines Vegetated sea cliffs of the Atlantic and Baltic coasts Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed dunes with herbaceous vegetation ("grey dunes") * Priority feature Humid dune slacks Annex II species present as a qualifying feature, but not a primary reason for site selection: Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Petalwort *Petalophyllum ralfsii*



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Dee Estuary SPA	The Dee Estuary lies on the boundary between England and Wales on the north-west coast of Britain. It is a large, funnel-shaped, sheltered estuary that supports extensive areas of intertidal sand-flats, mud-flats and saltmarsh.	During the breeding season; Common Tern *Sterna hirundo* Little Tern *Sterna albifrons* On passage; Sandwich Tern *Sterna sandvicensis* Redshank *Tringa tetanus* Over winter; Bar-tailed Godwit *Limosa lapponica* Black-tailed Godwit *Limosa limosa islandica* Curlew *Numenius arquata* Dunlin *Calidris alpina alpine* Grey Plover *Pluvialis squatarola* Knot *Calidris canutus* Oystercatcher Haematopus ostralegus Pintail *Anas acuta* Redshank *Tringa tetanus* Shelduck *Tadorna tadorna* Teal *Anas crecca* Over winter, the area regularly supports 130,408 individual waterfowl (5 year peak mean 1991/2 - 1995/6)
Liverpool Bay SPA	A large marine SPA stretching north from the coast of north Wales up towards Morecambe Bay.	Over wintering red-throated diver Over-wintering common scoter Outside the breeding season 55,597 waterfowl 5 year peak mean 2001/02 - 2006/07



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
The Dee Estuary Ramsar	The Dee Estuary lies between the Wirral peninsula, in England and the Flintshire estuarine coastline of north-east Wales. The site also includes the open coast westwards in Wales from the Point of Ayr in Flintshire to Prestatyn in Denbighshire.	Extensive intertidal mud and sand flats (20 km by 9 km) with large expanses of saltmarsh towards the head of the estuary. breeding colonies of the vulnerable Natterjack Toad, ***Epidalea calamita*** Non-breeding season regularly supports 120,726 individual waterbirds (5 year peak mean 1994/5 – 1998/9) Species with peak counts in spring/autumn: Redshank, ***Tringa totanus,*** Species with peak counts in winter Teal, ***Anas crecca,*** Shelduck, ***Tadorna tadorna*** Oystercatcher, ***Haematopus ostralegu***s, Curlew, ***Numenius arquata*** Pintail, ***Anas acuta,*** Grey plover, ***Pluvialis squatarola,*** Knot, ***Calidris canutus islandica,*** Dunlin, Calidris alpina alpina Black-tailed godwit, ***Limosa limosa islandica,*** Bar-tailed godwit, ***Limosa lapponica ,*** Redshank, ***Tringa totanus***,
England		
Bowland Fells SPA	The Bowland Fells are an extensive upland area in Lancashire, in north-west England. It forms a western outlier of the Pennines, with summits mostly in the range 450-550 m. The geology is millstone grit-capped fells overlying softer Bowland shales, resulting in predominantly acidic vegetation types. The major habitats are heather-dominated moorland and blanket mire. It is important for its upland breeding birds, especially breeding Merlin ***Falco columbarius*** and Hen Harrier ***Circus cyaneus***.	Breeding hen harrier Breeding merlin Breeding lesser black-backed gull

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Drigg Coast SAC	Drigg is an example of a small, bar-built estuary on the north-west coast of England. It is fed by three rivers (the Irt, Mite and Esk) which discharge through a mouth that has been narrowed by large sand and shingle spits.	Annex I habitats that are a primary reason for selection of this site: Estuaries Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) * Priority feature Dunes with Salix repens ssp. argentea (*Salicion arenariae*) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Mudflats and sandflats not covered by seawater at low tide Salicornia and other annuals colonising mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed dunes with herbaceous vegetation ("grey dunes") * Priority feature Humid dune slacks



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Duddon Estuary SPA	The Duddon Estuary is located north-west of Morecambe Bay on the coast of Cumbria in north-west England. It is formed where the River Duddon and the smaller Kirkby Pool opens into the Irish Sea.	Breeding Sandwich Tern Sterna sandvicensis Passage ringed plover *Charadrius hiaticula* Passage sanderling *Calidris alba* Wintering Knot *Calidris canutus* Wintering pintail *Anas acuta* Wintering redshank *Tringa tetanus* Over winter, the area regularly supports 78,415 individual waterfowl (5 year peak mean 1991/2 - 1995/6).
Duddon Estuary Ramsar	Duddon Estuary is formed by the River Duddon and the smaller Kirkby Pool opening into the Irish Sea in south-western Cumbria.	Intertidal sand and mudflats, important for large numbers of wintering and passage waterfowl. A range of grazed and ungrazed saltmarsh habitats occur around the edge of the estuary, especially the sheltered inner section. The site is the most important in Cumbria for sand-dune communities including large areas of calcareous dunes at Sandscale and Haverigg Haws and contrasting acid dunes on North Walney. Artificial habitats include slag banks and a flooded mine working known as Hodbarrow Lagoon, the largest coastal lagoon in north-west England.
Martin Mere SPA	Martin Mere is located north of Ormskirk in West Lancashire, north-west England. It occupies part of a former lake and mire that extended over some 1,300 ha of the Lancashire Coastal Plain during the 17th century. The complex comprises open water, seasonally flooded marsh and damp, neutral hay meadows overlying deep peat.	Over winter; Bewick's Swan Cygnus columbianus bewickii, Whooper Swan *Cygnus cygnus,* Pink-footed Goose *Anser brachyrhynchus,* Pintail *Anas acuta*, Over winter, the area regularly supports 46,196 individual waterfowl (5 year peak mean 1991/2 - 1995/6)

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Martin Mere Ramsar	Martin Mere occupies part of a former lake and mire which extended over some 1300 hectares of the Lancashire Coastal Plain during the 17th century. In 1972 the Wildfowl and Wetlands Trust purchased 147 hectares of the former Holcrofts Farm, consisting mainly of rough damp pasture, with the primary aim of providing grazing and roosting opportunities for wildfowl. Since acquisition the rough grazed pastures have been transformed by means of positive management into a wildfowl refuge of international importance.	Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 25306 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance. Species with peak counts in spring/autumn: Pink-footed goose, *Anser brachyrhynchus*, Species with peak counts in winter: Tundra swan, *Cygnus columbianus bewickii*, Whooper swan, *Cygnus cygnus,* Eurasian wigeon, *Anas penelope,* Northern pintail, *Anas acuta,*
Mersey Estuary Ramsar	The Mersey is a large, sheltered estuary which comprises large areas of saltmarsh and extensive intertidal sand and mudflats, with limited areas of brackish marsh, rocky shoreline and boulder clay cliffs, within a rural and industrial environment. The intertidal flats and saltmarshes provide feeding and roosting sites for large and internationally important populations of waterfowl. During the winter, the site is of major importance for duck and waders. The site is also important during spring and autumn migration periods, particularly for wader populations moving along the west coast of Britain.	Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 89576 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance. Species with peak counts in spring/autumn: Common shelduck, *Tadorna tadorna*, Black-tailed godwit, *Limosa limosa islandica*, Common redshank, *Tringa totanus totanus*, Species with peak counts in winter: Eurasian teal, *Anas crecca*, Northern pintail, *Anas acuta*, Dunlin, *Calidris alpina alpina*,
Mersey Estuary SPA	The Mersey Estuary is located on the Irish Sea coast of north-west England. It is a large, sheltered estuary which comprises large areas of saltmarsh and extensive intertidal sand- and mud-flats, with limited areas of brackish marsh, rocky shoreline and boulder clay cliffs, within a rural and industrial environment.	Over winter; Golden Plover *Pluvialis apricaria*, Dunlin *Calidris alpina alpina,* Pintail *Anas acuta,* Redshank *Tringa totanus,* Shelduck *Tadorna tadorna,* Teal *Anas crecca*, On passage; Redshank *Tringa totanus*, Ringed Plover *Charadrius hiaticula*, Over winter, the area regularly supports 99,467 individual waterfowl (5 year peak mean 1991/2 - 1995/6).

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Mersey Narrows and North Wirral Foreshore pSPA	The Mersey Narrows and North Wirral Foreshore pSPA is located on the north-west coast of England at the mouths of the Mersey and Dee estuaries. The site comprises intertidal habitats at Egremont foreshore, man-made lagoons at Seaforth Nature Reserve and the extensive intertidal flats at North Wirral Foreshore.	Over winter; Redshank *Tringa totanus*, Turnstone *Arenaria interpres*, Over winter, the area regularly supports 20,269 individual waterfowl (5 year peak mean 1991/2 - 1995/6).
Mersey Narrows and North Wirral Foreshore pRamsar	Mersey Narrows and North Wirral Foreshore is located on the north west coast of England at the mouths of the Mersey and Dee estuaries. The site comprises intertidal habitats at Egremont foreshore, man-made lagoons at Seaforth and the extensive intertidal flats at North Wirral Foreshore. Egremont is most important as a feeding habitat for waders at low tide whilst Seaforth is primarily a high tide roost site. North Wirral Foreshore supports large numbers of feeding waders at low tide and also includes important high tide roost sites.	The Pramsar site is a Wetland of International Importance because: The site qualifies under Criterion 4 because it regularly supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions: During 2004/05 - 2008/09 the Mersey Narrows and North Wirral Foreshore pRamsar site supported important numbers of passage little gulls and common terns. The site qualifies under Criterion 5 because it regularly supports 20,000 or more waterbirds: During the winters 2004/05 - 2008/09, the Mersey Narrows and North Wirral Foreshore pRamsar site supported an average peak of 32,402 individual waterbirds. The site qualifies under Criterion 6 because it regularly supports 1% of the individuals in the populations of the following species or subspecies of waterbird in any season: During the winters 2004/05 - 2008/09, the Mersey Narrows and North Wirral Foreshore pRamsar site supported 2.4% of the (wintering) population of knot and 2.8% of the (wintering) population of bar-tailed godwits.

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Morecambe Bay Ramsar	Morecambe Bay lies between the coasts of South Cumbria and Lancashire, and represents the largest continuous intertidal area in Britain. Morecambe Bay comprises the estuaries of five rivers and the accretion of mudflats behind Walney Island. The area is of intertidal mud and sandflats, with associated saltmarshes, shingle beaches and other coastal habitats. It is a component in the chain of west coast estuaries of outstanding importance for passage and overwintering waterfowl (supporting the third-largest number of wintering waterfowl in Britain), and breeding waterfowl, gulls and terns.	Ramsar criterion 4 The site is a staging area for migratory waterfowl including internationally important numbers of passage ringed plover *Charadrius hiaticula.* Ramsar criterion 5 Species with peak counts in winter: 223709 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying species/populations (as identified at designation): Species regularly supported during the breeding season: Lesser black-backed gull, *Larus fuscus graellsii*, Herring gull, I Sandwich tern, Sterna (Thalasseus) *sandvicensis sandvicensis,* Species with peak counts in spring/autumn: Great cormorant, *Phalacrocorax carbo carbo,* Common shelduck, *Tadorna tadorna* Northern pintail, *Anas acuta,* Common eider, *Somateria mollissima mollissima* Eurasian oystercatcher, *Haematopus ostralegus ostralegus,* Ringed plover, *Charadrius hiaticula,* Grey plover, *Pluvialis squatarola,* Sanderling, *Calidris alba,* Eurasian curlew, *Numenius arquata arquata*, Common redshank, *Tringa totanus totanus,* Ruddy turnstone, *Arenaria interpres interpres,* Lesser black-backed gull, *Larus fuscus graellsii,*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
		Species with peak counts in winter: Great crested grebe, *Podiceps cristatus cristatus,* Pink-footed goose, *Anser brachyrhynchus*, Eurasian wigeon, *Anas penelope,* Common goldeneye, *Bucephala clangula clangula,* Red-breasted merganser, *Mergus serrator,* European golden plover, *Pluvialis apricaria apricaria,* Northern lapwing, *Vanellus vanellus,* Red knot, *Calidris canutus islandica,* Dunlin, *Calidris alpina alpina,* Bar-tailed godwit, *Limosa lapponica lapponica*



Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Morecambe Bay SAC	Morecambe Bay in north-west England is the confluence of four principal estuaries, the Leven, Kent, Lune and Wyre (the latter lies just outside the site boundary), together with other smaller examples such as the Keer. Collectively these form the largest single area of continuous intertidal mudflats and sandflats in the UK and the best example of muddy sandflats on the west coast. The estuaries are macro-tidal with a spring tidal range of 9 m. The significant tidal prisms of the estuaries result in the Bay being riven by large low-water channel systems. The Kent, Leven and Lune estuaries have been modified variously by railway embankments, flood embankments and training walls but support extensive intertidal areas. Although cobble 'skears' and shingle beaches occur at their mouths, the estuaries consist predominantly of fine sands and muddy sands.	Annex I habitats that are a primary reason for selection of this site: Estuaries Mudflats and sandflats not covered by seawater at low tide Large shallow inlets and bays Reefs with fucoid algal communities. Perennial vegetation of stony banks Salicornia and other annuals colonising mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritima*e) Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed dunes with herbaceous vegetation ("grey dunes") * Priority feature Humid dune slacks Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Coastal lagoons * Priority feature Reefs Embryonic shifting dunes Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) * Priority feature Dunes with Salix repens ssp. argentea (*Salicion arenariae*) Annex II species that are a primary reason for selection of this site 1166 Great crested newt *Triturus cristatus*

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Morecambe Bay SPA	Morecambe Bay is located on the Irish Sea coast of north-west England. It is one of the largest estuarine systems in the UK and is fed by five main river channels (the Leven, Kent, Keer, Lune and Wyre) which drain through the intertidal flats of sand and mud. Mussel Mytilus edulis beds and banks of shingle are present, and locally there are stony outcrops. The whole system is dynamic, with shifting channels and phases of erosion and accretion affecting the estuarine deposits and surrounding saltmarshes. The flats contain an abundant invertebrate fauna that supports many of the waterbirds using the bay. The capacity of the bay to support large numbers of birds derives from these rich intertidal food sources together with adjacent freshwater wetlands, fringing saltmarshes and saline lagoons, as well as dock structures and shingle banks that provide secure roosts at high tide. The site is of European importance throughout the year for a wide range of bird species. In summer, areas of shingle and sand hold breeding populations of terns, whilst very large numbers of geese, ducks and waders not only overwinter, but (especially for waders) also use the site in spring and autumn migration periods. The bay is of particular importance during migration periods for waders moving up the west coast of Britain.	During the breeding season; Little Tern ***Sterna albifrons***, Sandwich Tern ***Sterna sandvicensis***, Over winter; Bar-tailed Godwit ***Limosa lapponica,*** Golden Plover ***Pluvialis apricaria,*** During the breeding season; Herring Gull ***Larus argentatus,*** Lesser Black-backed Gull ***Larus fuscus***, On passage; Ringed Plover ***Charadrius hiaticula*** Sanderling ***Calidris alba***, Over winter; Curlew ***Numenius arquata***, Dunlin ***Calidris alpina alpina,*** Grey Plover ***Pluvialis squatarola***, Knot ***Calidris canutus***, Oystercatcher ***Haematopus ostralegus***, Pink-footed Goose ***Anser brachyrhynchus*** Pintail ***Anas acuta***, Redshank ***Tringa totanus***, Shelduck ***Tadorna tadorna***, Turnstone ***Arenaria interpres***, During the breeding season, the area regularly supports 61,858 individual seabirds (5 year peak mean for 1991/92 to 1995/96) Over winter, the area regularly supports 210,668 individual waterfowl (5 year peak mean for 1991/92 to 1995/96)

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Ribble and Alt Estuaries Ramsar	A large area including two estuaries which form part of the chain of west coast sites which fringe the Irish Sea. The site is formed by extensive sand and mudflats backed, in the north, by the saltmarsh of the Ribble Estuary and, to the south, the sand dunes of the Sefton Coast. The tidal flats and saltmarsh support internationally important populations of waterfowl in winter and the sand dunes support vegetation communities and amphibian populations of international importance.	Ramsar criterion 2 This site supports up to 40% of the Great Britain population of natterjack toads ***Bufo calamita.*** Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 222038 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying species/populations (as identified at designation): Species regularly supported during the breeding season: Lesser black-backed gull, ***Larus fuscus graellsii,*** Species with peak counts in spring/autumn: Ringed plover, ***Charadrius hiaticula,*** Grey plover, ***Pluvialis squatarola,*** Red knot, ***Calidris canutus islandica***, Sanderling, ***Calidris alba,*** Dunlin, ***Calidris alpina alpina*** Black-tailed godwit, ***Limosa limosa islandica***, Common redshank, ***Tringa totanus totanus,*** Lesser black-backed gull, ***Larus fuscus graellsii,*** Species with peak counts in winter: Tundra swan, ***Cygnus columbianus bewickii***, Whooper swan, ***Cygnus cygnus***, Pink-footed goose, ***Anser brachyrhynchus***, Common shelduck, ***Tadorna tadorna***, Eurasian wigeon, ***Anas penelope,*** Eurasian teal, ***Anas crecca***, Northern pintail , ***Anas acuta***, Eurasian oystercatcher, ***Haematopus ostralegus ostralegus,*** Bar-tailed godwit, ***Limosa lapponica lapponica***

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Ribble and Alt Estuaries SPA	The Ribble and Alt Estuaries SPA lies on the coast of Lancashire and Merseyside in north-west England. It comprises two estuaries, of which the Ribble Estuary is by far the larger, together with an extensive area of sandy foreshore along the Sefton Coast. It forms part of the chain of western SPAs that fringe the Irish Sea. There is considerable interchange in the movements of wintering birds between this site and Morecambe Bay, the Mersey Estuary, the Dee Estuary and Martin Mere	During the breeding season; Common Tern ***Sterna hirundo,*** Ruff ***Philomachus pugnax*** Lesser Black-backed Gull ***Larus fuscus***, Over winter; Bar-tailed Godwit ***Limosa lapponica*** Bewick's Swan Cygnus ***columbianus bewickii,*** Golden Plover ***Pluvialis apricaria***, Whooper Swan ***Cygnus cygnus,*** Black-tailed Godwit ***Limosa limosa islandica***, Dunlin ***Calidris alpina alpina***, Grey Plover ***Pluvialis squatarola*** Knot ***Calidris canutus,*** Oystercatcher ***Haematopus ostralegus***, Pink-footed Goose ***Anser brachyrhynchus***, Pintail ***Anas acuta***, Redshank ***Tringa totanus***, Sanderling ***Calidris alba***, Shelduck ***Tadorna tadorna*** Teal ***Anas crecca***, Wigeon ***Anas penelope***, On passage; Ringed Plover ***Charadrius hiaticula***, Sanderling ***Calidris alba*** During the breeding season, the area regularly supports 29,236 individual seabirds including: Black-headed Gull ***Larus ridibundus***, Lesser Black-backed Gull ***Larus fuscus***, Common Tern ***Sterna hirundo***. Over winter, the area regularly supports 301,449 individual waterfowl (5 year peak mean 1991/2 - 1995/6)

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
River Derwent and Bassenthwaite Lake SAC	The Derwent is a particularly good example of a large oligotrophic river flowing over base-poor geology, providing a contrast to the more mesotrophic River Eden. Low intensity land-use in the catchment means there is good water quality throughout much of the system. This water quality, coupled with the presence of extensive gravel shoals, makes it a particularly suitable river for breeding salmon and enables it to support a large population.	Annex I habitats that are a primary reason for selection of this site: Oligotrophic to mesotrophic standing waters with vegetation of the ***Littorelletea uniflorae*** and/or of the ***Isoëto-Nanojuncetea*** Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Water courses of plain to montane levels with the ***Ranunculion fluitantis*** and ***Callitricho-Batrachion*** vegetation Annex II species that are a primary reason for selection of this site: Marsh fritillary butterfly ***Euphydryas (Eurodryas, Hypodryas)*** aurinia Sea lamprey ***Petromyzon marinus*** Brook lamprey ***Lampetra planeri*** River lamprey ***Lampetra fluviatilis*** Atlantic salmon ***Salmo salar*** Otter ***Lutra lutra*** Floating water-plantain ***Luronium natans***
River Eden SAC	The river flows over both calcareous limestone and sandstone, giving a diversity of ecological conditions, ranging from oligotrophic to mesotrophic. This river has 184 recorded plant species, more than any other river in the UK.	Annex I habitats that are a primary reason for selection of this site: Oligotrophic to mesotrophic standing waters with vegetation of the ***Littorelletea uniflorae*** and/or of the ***Isoëto-Nanojuncetea*** Water courses of plain to montane levels with the ***Ranunculion fluitantis*** and ***Callitricho-Batrachion*** vegetation Alluvial forests with ***Alnus glutinosa*** and ***Fraxinus excelsior*** (***Alno-Padion, Alnion incanae, Salicion albae***) * Priority feature Annex II species that are a primary reason for selection of this site: White-clawed (or Atlantic stream) crayfish ***Austropotamobius pallipes*** Sea lamprey ***Petromyzon marinus*** Brook lamprey ***Lampetra planeri*** River lamprey ***Lampetra fluviatilis*** Atlantic salmon ***Salmo salar*** Bullhead ***Cottus gobio*** Otter ***Lutra lutra***

Table 3.2: European sites considered in the Habitats Regulations Assessment

Region / Site name	Description	Qualifying features
Shell Flat and Lune Deep SAC	The site is characterised by a deep water channel (Lune Deep) and a large sandbank feature (Shell Flat) at the mouth of Morecambe Bay surrounded by shallower areas to the north and south.	Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Reefs
Solway Firth SAC	The Solway is a large, complex estuary on the west coast of Britain. It is one of the least-industrialised and most natural large estuaries in Europe. Tidal streams in the estuary are moderately strong and levels of wave energy can be high. There is considerable seasonal fluctuation in water temperature, owing to the shallow nature of the estuary.	Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time Estuaries Mudflats and sandflats not covered by seawater at low tide Salicornia and other annuals colonising mud and sand . Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Reefs Perennial vegetation of stony banks Fixed dunes with herbaceous vegetation ("grey dunes") * Priority feature Annex II species that are a primary reason for selection of this site Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis*
Offshore		
Croker Carbonate Slabs SAC	The Croker Carbonate Slabs is an area in the mid-Irish Sea, approximately 30km west of Anglesey, where a total area of over 800 ha of the Annex I feature "submarine structures made by leaking gases" have been identified. The site lies in 70m water depth in the north descending down to approximately 100m at the south west corner.	Annex I feature "submarine structures made by leaking gases"
Pisces Reef Complex SAC	The Pisces Reef Complex is located in the western Irish Sea, in the north-west mud basin. It is approximately midway between the Isle of Man and the coast of Northern Ireland. The area consists of an extensive mud plain through which three areas of Annex I bedrock and boulder-dominated stony reef protrude.	Annex I habitats that are a primary reason for selection of this site: Reefs

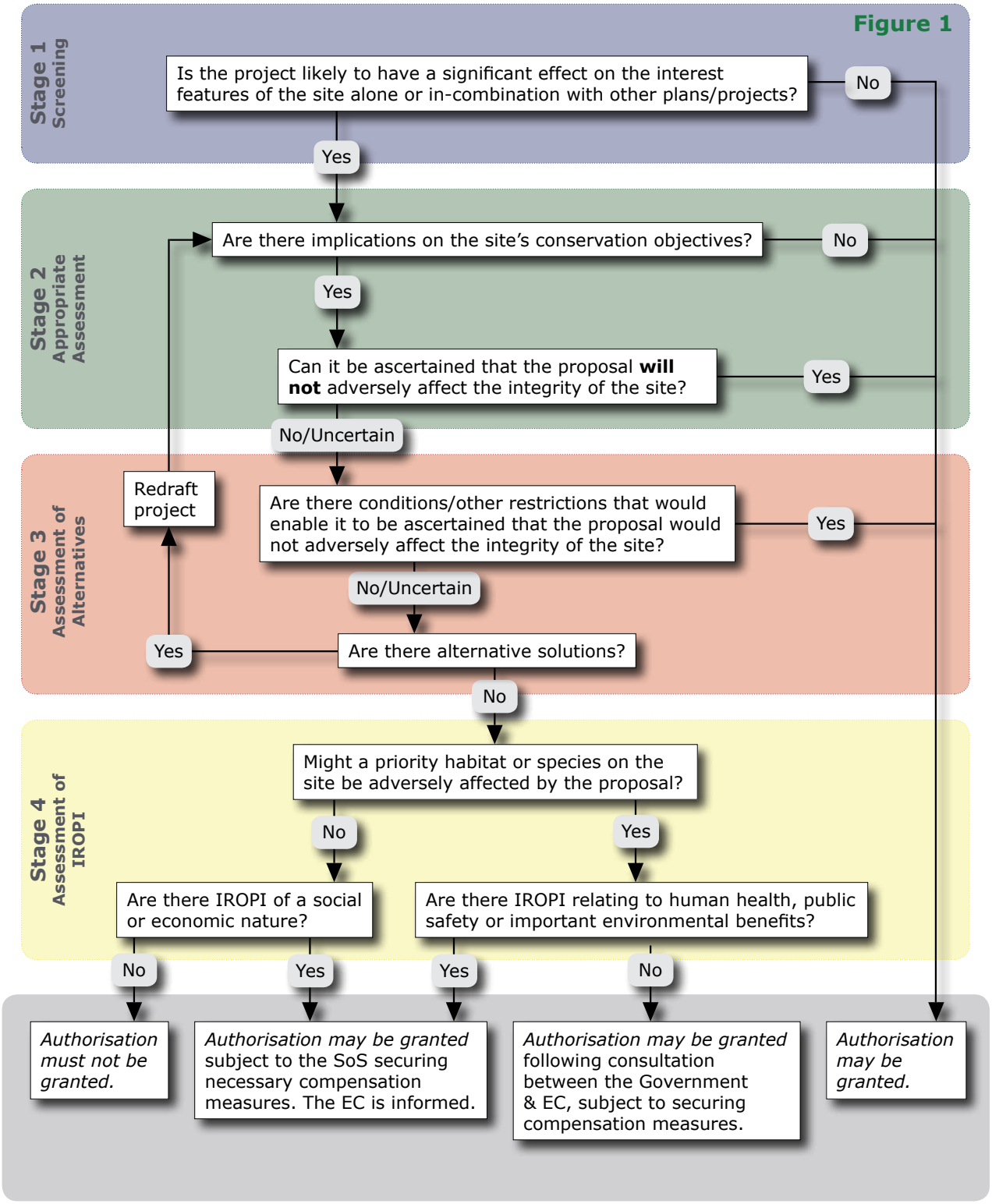


Figure 3.1: The Habitats Regulations process (PINS Advice Note 10)

(Taken from Planning Inspectorate Advice Note 10: Habitats Regulations Assessment relevant to nationally significant infrastructure projects, Version 4, January 2013. Adapted from: Defra (2012) Report of the Habitats and Wild Birds Directives Implementation Review (Annex E)).

4.0 BASELINE ENVIRONMENT IN THE PROJECT STUDY AREA

4.1 Introduction

4.1.1 The following sections provide an overview of the baseline environment relevant to the assessment of the effect of the Project on European Sites. This information is provided here in order to provide the basis for the assessment presented in Section 5.

4.1.2 Further, more detailed, baseline information relevant to the assessment, is presented in Chapters 7 – 29 of the Environmental Statement.

4.2 Metocean and coastal processes

INTRODUCTION

4.2.1 A full description of the baseline environment and assessment of potential impacts of the Project on metocean and coastal processes can be found in the ES Chapter 7 "Metocean, Coastal Processes, Geology and Geomorphology". A baseline characterisation is provided which describes the present morphological characteristics of the study area as well as the marine physical process regimes (hydrodynamics and sediment transport) which act upon them.

BASELINE

4.2.2 Information to describe the baseline metocean environment has been collected from a number of relevant sources. The nearby Walney, West of Duddon Sands, Barrow and Ormonde offshore wind farms in the Eastern Irish Sea ("the Existing Wind Farms") were consented on the basis of a number of technical metocean and coastal process studies (amongst other EIA topics), some of which included the targeted use of detailed numerical modelling to quantify the environmental baseline and scheme impacts. These previous studies were utilised and built upon, in conjunction with historical and newly collected field data, using an 'evidence based approach'.

4.2.3 At the Existing Wind Farms, the prevailing wind direction is W–SW, with an average wind speed of over 9 m/s. This is likely to be higher within the Project Site which is located approximately 10 km to 17 km further offshore, where coastal impacts become less significant. Based on the wave data from the Existing Wind Farms, the dominant wave direction is from W-SW. However the largest waves originate from the SW and NW, from the south and north of the Irish landmass.

4.2.4 The seabed in the project area is predominantly coarse sand and gravel, and is relatively stable in nature (ABPmer, 2012). Sandwaves present along the northern edge of the site suggest bathymetry may be temporally variable in some locations, otherwise, seabed levels are assumed to be relatively stable. There is a broad east west division in seabed sediments across the offshore elements of the Project study area and surrounding area. Sediment transport in the NW part of the Project Site is relatively more dynamic (a net sediment transport area) and is characterised by relatively sandy seabed sediments (although with a significant mud content). In comparison, the south eastern part of the Project site is subject to weaker tidal currents that are also more rotational, leading to low net transport rates and a tendency to deposit fine sediment (a net sediment sink area) forming part of the Irish Sea mud belt, an established feature of the superficial geology of the Eastern Irish Sea. There is a transitional zone of intermediate character between the two areas.

4.2.5 The water depths at lowest astronomical tides (LAT[5]) vary between 23 m and 55 m within the Project Site, with the greatest water depths along the western boundary. Seabed levels are relatively stable. However, potentially mobile sandbanks present in the northern edge of the Site imply bathymetry may be temporally and spatially variable in some locations.

4.2.6 The water levels in the area are a summation of the astronomical tidal level and a surge component primarily driven by meteorological influences. In addition to this is predicted a sea level rise caused by climate changes and land movement. The tidal water levels displays a typical semi-diurnal pattern with a large range with some variability across the Site. In the west, tides range from 3.4 m (mean neap) to 6.7 m (mean spring), with the largest astronomical range being 8.4 m. In the east, the mean neap and spring tide range is 3.7 m to 7.5 m respectively and the largest astronomical tide range is 9.4 m. Surges up to 2 m are observed in the region, although extreme total water levels are unlikely to exceed the normal tidal range by more than 9% of the maximum tidal range. Tidal currents at the Project Site are generally aligned in an east-west axis with peak flows typically less that 0.7 m/s.

4.2.7 Being located in the Irish Sea, the Project Site is exposed to large wave events developed over considerable fetch distances of up to 200 km. The waves are most common and largest from the west south-west. They are a combination of swell waves and locally generated wind waves. The typical wave heights during large storms are between 2.7 and 5.7 m (1:1 to 1:10yr), but up to 6.2 m for a 1 in 50 year event.

4.2.8 Geophysical surveys and sediment sampling have been undertaken at the Project Site. The geology at the seabed comprise marine sediments of variable thickness (typically 12 m) including sand, gravelly sand and slightly gravelly sand in the north western part of the site and muddy sand in the south eastern part. These overlay the Western Irish Sea Formation, a glacial till. Refer to Chapter 7 of the ES, "Metocean, Coastal Processes, Geology and Geomorphology" for further detail.

4.2.9 Net sediment transport is from west to east in offshore areas. This transport is driven by strong tidal currents with the primary transport direction determined by tidal asymmetry and / or residual flows. Rates of sediment transport are enhanced by surge and wave action during occasional storm events. Due to the relative orientation of the coastline to the dominant wave regime, the net littoral sediment transport is northwards on adjacent coastlines.

4.2.10 Concentrations of suspended sediments in the water column are regionally controlled by a combination of tidal, wave, fluvial and anthropogenic factors (e.g. dredging). The naturally occurring background levels of 3 to 6 mg/l are present in surface waters within the vicinity of the Project. During the summer months, these levels drop to between 1 and 2 mg/l. Background suspended sediment concentration levels are expected to be higher in areas affected by wave action at the bed, particularly during storm events.

4.2.11 The morphological elements encountered within the study can be broadly separated into "active" and "relict" features. A number of active features have been identified across the Project Site and wider study area and include sand banks, gravel and sand wave fields and sand ribbon fields. With respect to the Project Site, a sedimentary wave field can be found intersecting the north-west corner. The side-scan sonar survey also identified a large sand wave field running through the Project Site marking a boundary from silty sand in the east of the Site to sand across the centre and occasionally to the west. There are no relict features within the Site, but these can be found across the wider study area. The majority of these were formed by glacial processes associates with the British and Irish Ice Sheet which transgressed the region during the Last Glacial Maximum around 25,000 years ago.

4.2.12 At the proposed export cable landfall location, the frontage at Pott's Corner, the coast comprises a wide sandy foreshore fronting an area of saltmarsh drained by creeks and channels flowing south towards the Lune Estuary. An earth embankment, reinforced with a rock revetment at Pott's Corner, runs towards Sunderland Point to the south.

4.3 Subtidal benthic ecology

INTRODUCTION

4.3.1 A full description of the baseline environment and assessment of potential impacts of the Project on subtidal benthic ecology can be found in ES Chapter 10, "Benthic Ecology". Published information relating to subtidal benthic ecology of the Project Site, Lancashire, Cumbrian and Isle of Man coasts, and the eastern Irish Sea in general, was collated and reviewed to provide background information and context for the local study area (marine environment immediately surrounding the Project Site) and the regional study area (eastern Irish Sea). Data includes information acquired from site-specific benthic and intertidal characterisation surveys and monitoring surveys relating to the existing and proposed offshore wind farms and other developments (such as pipelines, oil platforms and aggregate extraction areas) in this area of the eastern Irish Sea.

BASELINE

4.3.2 Subtidal benthic characterisation surveys were conducted between November 2011 – January 2012, including:

- Grab sampling (samples analysed for sediment particle size, total organic content, metal contaminants and infaunal invertebrates);
- Beam trawling (to provide semi-quantitative data on epifaunal invertebrates); and
- Underwater camera surveys.

4.3.3 Chart 4.1 shows the sample locations and identifies that the sampled sediments are dominated by sands and muddy sands (according to BGS classification). As shown in Chart 4.1, mud is dominant in the east of the offshore Project study area, sand in the centre and gravelly sand in the west. Coarser sediments with reduced mud content are found further offshore.

4.3.4 Chemical analysis shows that iron and aluminium levels are high across the site compared to other metals (Cole et. al., 1999; Langston et. al., 2003). Arsenic levels are elevated at four sites, nickel and cadmium at one site, but all are below Probable Effect Levels (PEL). Mercury is slightly raised above PEL at one site, but is below other guideline levels (Camacho-Ibar, 1992). This is not uncommon, due to terrestrial input from geological erosion and historical industrial sources (Camacho-Ibar, 1992).

4.3.5 Biotic analysis identifies that infaunal communities are dominated by polychaete worms and bivalve molluscs, with crustacea and echinoderms crustaceans also being reasonably well represented. Higher numbers of individuals are recorded inshore along the cable route compared to the offshore sites. These numbers are attributable to super-abundant species such as molluscs. Two benthic habitats are recorded at the Project Site and surrounding offshore area, which include the offshore control areas: a muddy sand assemblage dominated by brittlestars and bivalve species in the eastern half of the Project Site area and mixed sediment (sand and gravelly sand) with bivalve species in the western half. Comparison of data with information from adjacent offshore wind farms show these benthic assemblages have been recorded previously within this part of the Irish Sea.

4.3.6 Camera images of the seabed show the mud habitat in the east of the Project Site area to be 'burrowed mud' habitat with burrows created by mega fauna such as crustacea and tube worms. Sand with shell fragments was the dominant sediment type revealed by the camera at the Project Site area.

4.3.7 Epifaunal invertebrates targeted by the beam trawl sampling were dominated by pink shrimp and brittlestars. Commercial shellfish, mainly scallops, were also present in low numbers.

4.3.8 There is a known area of Annex I 'stony reef' located inshore of the Project Site within Lune Deep (a deep submerged canyon located at the entrance to Morecambe Bay, to the north of the cable route) (see Chart 10-4). Characterisation survey sites located in close proximity to this area of Annex I habitat did not reveal stony reef and a review of the geophysical data confirmed this (see CMACS, 2012). However, due to the alteration in location of the Offshore Cable Corridor since the original bethic characterisation surveys were completed, there are now areas of the Offshore Cable Corridor identified as having the potential to contain stony reef habitat.

4.3.9 Geophysical surveys were completed on the revised Export Cable Corridor in March 2013 and an underwater camera investigation was completed in May 2013 to investigate areas identified from the geophysical data as potential areas for 'stony reef' habitat. Details of this survey and analysis are provided in ES Chapter 10 "Benthic Ecology", Annex B.4.K.

4.3.10 Results of the data analysis found the sea bed along the Offshore Cable Corridor to be predominantly soft sediments (sand and mud) from the Project Site to the coastal areas. Inshore, sidescan sonar imagery which suggested hard substratum in small areas was ground-truthed.

4.3.11 Following ground truthing by the May 2013 camera survey, shell fragments, including whole dead mussel shells, Mytilus edulis and small gravel pieces in the sand were the cause of the shadowing on the sidescan sonar imagery for most of this inshore area. Cobbles and pebbles with an overlay of silt were present in one area. Epifauna was sparse with only starfish, Asterias rubens, a few anemones, Urticina falcata and sparse low lying turf bryozoans. This habitat was assessed as being of 'low reefiness' (see ES Chapter 10, Annex B.4.K for habitat classification). This type of habitat has been found over a wide area inshore of the Lune Deep during benthic surveys completed for other offshore wind farms (see Chapter 10 Annex B.4.K). Annex I reef habitats are a qualifying feature of the Morecambe Bay SAC which the export cable crosses. According to Irving (2009), 'low reefiness' areas are unlikely be considered of suitable quality for designation as Annex 1 habitat.

4.4 Intertidal benthic ecology

INTRODUCTION

4.4.1 A full description of the baseline environment and assessment of potential impacts of the Project on intertidal benthic ecology can be found in Chapter 10 of the ES. The proposed export cable landfall site is located to the immediate south of Potts Corner at Middleton Sands, Lancashire. This area of tidal sand flats is located within the Morecambe Bay SAC, SPA and Ramsar sites (European Sites) and the Lune Estuary Site of Special Scientific Interest (SSSI).

BASELINE

4.4.2 Intertidal survey techniques (walk over, hand search, and sediment coring) of the area around the proposed export cable landfall was undertaken in order to produce intertidal biotope maps.

4.4.3 The surveys, conducted in November 2011, identified a generally sandy foreshore, illustrated in Chart 4.2, dominated by polychaete worms with occasional burrowing

amphipods. The species and communities identified were typical of the Irish Sea. The landfall position of the cable route is straddled by the two transect undertaken as part of the characterisation survey. Zonation of intertidal biotope habitats was very similar for both of these transects running parallel down the beach and Middleton Sands is a very homogenous sand flat. A walk over survey of beach between the two surveyed corridors was carried out as part of the original characterisation survey and was the same expansive sand habitat as recorded at the two transects either side of this area.

4.4.4 The mid and lower seashore are classified as large expanses of rippled medium-fine sands with some shell fragments. Some of these large sand expanses are slightly raised sand banks and thus had better drainage. Other areas are wetter with drainage channels running between the higher banks. Fauna is very sparse with the upper shore dominated by the small gastropod Hydrobia ulvae, amphipods Bathyporeia sp and venerid bivalves. Polychaete worms are also present. Faunal densities are higher at the upper shore sites than the lower shore. It is likely that the sands on the lower part of the shore are subject to far greater movement than those on the upper part of the shore due to tidal action. All species recorded are typical of the intertidal sediments found within the eastern Irish Sea.

4.4.5 The mid to upper shore area has an expanse of Macoma baltica and Arenicola marina in littoral sandy mud (LS.LSa.MuSa.MacAre), which grade into LS.LSa.MuSa.Batcare higher up the shore (Bathyporeia pilosa and Corophium arenarium in littoral muddy sand).

4.4.6 At the back of the shore is a shallow bank of cobble and pebble with a strandline of debris deposited by high tides. This was classified as LS.LSa.St.Tal (Talitrids on the upper shore and strandline). Chart 4.2 shows the distribution of biotopes.

4.4.7 No Annex I habitat was found within the Project wind farm Site.

4.5 Migratory fish ecology

INTRODUCTION

4.5.1 A full description of the baseline environment and assessment of potential impacts of the Project on fish ecology can be found in ES Chapter 11, "Fish and Shellfish Resource".

BASELINE

Spawning and nursery grounds

4.5.2 The Project Site and the Export Cable Corridor fall within the spawning and nursery grounds of a number of species (Coull et al., 1998; Ellis et al. 2012). These are presented together with spawning times and intensity of spawning (where it has been defined) in Table 4.3. The spawning periods given are as provided in Coull et al. (1998) and Ellis et al. (2012), and the spawning/nursery intensity as described in Ellis et al. (2012).

4.5.3 Spawning grounds for sole, plaice, cod, whiting, sandeels (Ammodytidae spp.), mackerel (Scomber scombrus), sprat, Nephrops and lemon sole have all been defined within the area of the Project Site and export cable corridor. Spawning grounds of herring have been defined approximately 17 km to the northwest of the Project Site, off the Isle of Man.

4.5.4 Nursery grounds have been identified in the Project Site and the Offshore Cable Corridor for the species mentioned above (except sprat), as well as thornback ray, tope (Galeorhinus galeus), spotted ray, spurdog and anglerfish (Lophius budegassa/Lophius piscatorius).

4.5.5 In the case of thornback ray and spotted ray, there is currently insufficient data on the occurrence of egg-cases or egg-bearing females in the spawning season with which to delineate spawning grounds, it is however considered that these should broadly overlap with nursery grounds (Ellis et al. 2012).

4.5.6 Diadromous fish of conservation concern are listed in Table 4.5. A number of diadromous1 migratory species could potentially transit the study area during certain phases of their life cycle. Salmon (Salmo salar), sea lamprey (Petromyzon marinus) and river lamprey (Lampetra fluviatilis) are qualifying features in a number of Special Areas of Conservation (SACs) in the wider region. SACs where diadromous fish are qualifying features for site selection are listed in Table 4.2 and illustrated in Chart 4.3. As shown, there are no SAC rivers in which diadromous species are qualifying features in the proximity of the Project Site nor in the vicinity of the Offshore Cable Corridor.

4.5.7 There is insufficient information available to date to allow migratory routes and patterns of salmon and lamprey to be defined at the spatial resolution ideally required in this assessment. The available data and information do not allow for the numbers and the origin of the fish potentially migrating through or near the Project wind farm Site to be estimated or otherwise quantified. In addition to data gaps relating to migratory patterns and behaviour, there is no detailed information on the potential for the offshore Project study area to be used by these species in other ways.

Table 4.2: Qualifying status of diadromous fish species of conservation importance in SACs located within the study area

Special Area of Conservation (SACs) Rivers	Annex II species present as primary reason for SAC Site Selection	Annex II species present as qualifying feature, but not primary reason for site selection	Indicative sea distance from Project wind farm Site to SAC boundary
River Bladnoch SAC	Atlantic salmon		100 km
Solway Firth SAC	Sea lamprey, river lamprey		80 km
River Eden SAC	River lamprey, Atlantic salmon		140 km
River Derwent and Bassenthwaite Lake SAC	Sea lamprey, river lamprey, Atlantic salmon		75 km
River Dee and Bala Lake SAC	Atlantic salmon	Sea lamprey and river lamprey	100 km
Dee Estuary SAC		Sea lamprey and river lamprey	75 km
Afon Gwyrfai a Llyn Cwellyn SAC	Atlantic salmon		120 km

Table 4.3: Species with spawning and nursery grounds in the Project Site, the Offshore Cable Corridor and their vicinity, together with spawning times and intensity (Coull et al. 1998; Ellis et al. 2012)

Species	Spawning Intensity		Spawning Seasonality												Nursery Intensity	
	Project Site	Offshore cable corridor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Project Site	Offshore cable corridor
Herring ●	n/a															
Sole						*										
Plaice			*	*												
Cod				*	*											
Whiting																
Sandeel																
Mackerel (Western)							*	*								
Sprat							*	*							n/a	
Nephrops						*	*	*								
Lemon sole																
Thornback ray	n/a					*	*	*	*	*						
Spotted ray	n/a					?	*	*	*	?						
Tope shark	n/a		Viviparous species (gravid females can be found all year)													
Spurdog	n/a		Viviparous species (gravid females can be found all year)													
Anglerfish	n/a		n/a													

Legend

	spawning period
	high intensity spawning/nursery ground
	low intensity spawning/nursery ground
	unknown spawning/nursery intensity
(*)	peak spawning
(n/a)	no overlap with spawning/nursery ground
(•)	herring spawning grounds ~17 km west of Project

Common Name	Scientific Name	Conservation Status						
		OSPAR List	IUCN Red List	Bern Convention	Habitats Directive	The Wildlife & Countryside Act 1981	The Conservation of Habitats and Species Regulations 2010	UK BAP species
European eel	Anguilla anguilla	✔	Critically endangered	-	-	-	-	✔
Allis shad	Alosaalosa	✔	Least concern	✔	✔	✔	✔	✔
Twaite shad	Alosa fallax	-	Least concern	✔	✔	✔	✔	✔
Sea Lamprey	Petromyzon marinus	a	Least concern	✔	✔	-	-	✔
River Lamprey	Lampetra fluviatilis	-	Least concern	✔	✔	-	✔	✔
Smelt	Osmerus eperlanus	-	Least concern	-	-	-	-	✔
Salmon	Salmo salar	ü	Lower Risk/least concern	✔	✔	-	✔	✔
Sea Trout	Salmo trutta	-	Least concern	-	-	-	-	✔

4.6 Marine mammals

INTRODUCTION

4.6.1 A full description of the baseline environment and assessment of potential impacts of the Project on Marine Mammals can be found in ES Chapter 12, "Marine Mammals".

BASELINE

4.6.2 The waters adjacent to the northern Irish Sea are not rich areas for cetaceans compared with other parts of the UK. Harbour porpoise, bottlenose dolphin and the short-beaked common dolphin are the most likely cetaceans to be recorded (ABPmer Ltd., 2003). For the purpose of this assessment, relevant information on the occurrence, density and abundance of the key species occurring in the Irish Sea was collated from previous research.

Site specific marine mammal surveys were conducted between June 2011 and November 2012 for the Project Site plus 4 km buffer area alongside the ornithology surveys. The results can be seen in Chart 4.4. A 4 km buffer has been used for assessment, with the overall study area assumed to be the Irish Sea zone.

4.6.3 More than twenty species of cetacean have been recorded in UK waters, eighteen of which have been recorded in the Irish Sea region. However, only five of these species are known to occur regularly within the Irish Sea; harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin and minke whale. The remaining species, including white-beaked dolphin, are considered to be rare or occasional visitors (Hammond et al. 2005; Baines and Evans, 2009).

4.6.4 Only two pinniped species are known to live and breed in UK waters; grey seal and common (harbour) seal. The greatest concentrations of these species are within Scottish waters. Within the Irish Sea, the majority of haul out sites for grey seal are located on the coast of Wales and Ireland, however, the Isle of Man also supports some important sites including the Calf of Man, The Sound, Langness and Maughold. The Calf of Man is also a pupping site for small numbers of grey seals (Hanley et al. 2012). There is also a grey seal haul out site (but not a breeding site) on Walney Island at south walney.

4.6.5 Of the marine mammal species known to regularly occur within the Irish Sea, only two were regularly recorded in site-specific surveys for the Project, harbour porpoise and grey seal.

4.6.6 Site-specific boat-based and aerial surveys were undertaken across the Project site and 4 km buffer to inform assessment and to characterise the commonly occurring marine mammals in the region, a summary is provided in Table 4.5. Data were collated as part of the ornithological site characterisation surveys, during which marine mammal sightings were recorded concurrently.

4.6.7 To inform the assessment of potential impacts on marine mammals (and prey fish species) during wind farm development, modelling of subsea noise for the Project has been undertaken by Subacoustech Ltd. Full details of survey information can be found in the ES Chapter 10, “Marine Mammals” and ES Technical Annex B.6, “Marine Mammals”.



Table 4.4: Marine mammal species accounts

Species	Regional abundance and distribution	Project specific abundance and distribution
Harbour porpoise	Although harbour porpoise are known to be present in the Irish Sea, density estimates from the SCANS II data sets indicate they occur at relatively low densities (0.2 to 0.5 animals per km²). The Wetlands and Wildlife Trust (WWT, 2009) carried out a study of cetacean and pinnipeds around the UK from aerial surveys spanning a period of eight years (2001 – 2008). The methods used to collect and analyse data were comparable to the SCANS project (Hammond et al. 2002) and demonstrated a similar distribution to the SCANS II data and the Cetacean Atlas. Relative densities were derived from the data collected and for harbour porpoise were found to be between 0.001 and 0.1 animals / km² for the Irish Sea region	Boat-based and aerial surveys demonstrate that harbour porpoise were the most abundant and frequently recorded marine mammal across the Project Site and 4 km buffer. Harbour porpoise were recorded in ten of the 12 boat based surveys and 17 of the 22 aerial surveys. Total numbers recorded across the Project Site and 4 km buffer were 67 and 132 in boat and aerial surveys respectively. Harbour porpoise encounter rates (mammals recorded per km) were generally low and did not exceed 0.23 animals / km² across the Project Site and 4 km (August, 2012). Encounter rates were generally highest during the summer months of 2012 (May to September). Sightings per hour were also low, with the highest frequencies recorded during the August 2012 survey (2.59 individuals per hour).
Grey seal	Grey seals are a common and important predator in the Irish Sea Region with haul-out sites recorded along the coasts of Northern Ireland, Wales and the southern Irish Sea. Grey seals are also found around the coasts of the Isle of Man, and the Calf of Man is noted as a minor colony and pupping site for small numbers of grey seals (Hanley et al. 2012). Estimates of grey seal populations within the Irish Sea have been made by Kiely et al. (2000). Estimates were made using pup census data, supported by photo-identification mark and recapture data, and provided ranges between 5,198 and 6,976 seals.	During aerial survey, it was not possible to identify every seal observed to species level, and thus the majority of observations were recorded as 'seal species'. All seals positively identified were grey seal. During boat-based survey, all seals recorded were grey seal. Considering these survey data, and the known distribution of grey (and common) seals within Irish waters, it is reasoned that the unidentified seal species recorded in aerial survey were likely to be grey seals. Grey seals were recorded at relatively low numbers and frequency in Project-specific surveys. Thirteen seals were recorded in boat-based surveys and ten recorded in aerial surveys. Density and abundance calculated from these survey data are thus low, with no clear trend in spatial or temporal distribution.



4.7 Intertidal Ornithology

INTRODUCTION

4.7.1 A full description of the baseline environment and assessment of potential impacts of the Project on intertidal ornithology can be found in ES Chapter 14, "Intertidal Ornithology".

4.7.2 The landfall for the Project Offshore Cable Corridor lies within the Morecambe Bay SPA and Ramsar sites. The Bay is one of the largest estuarine systems in the UK and is fed by five main river channels which drain through the intertidal flats of sand and mud. These habitats support a rich invertebrate fauna which in turn supports large numbers of waterbirds during both wintering and passage periods. Associated habitats also important for birds include freshwater wetlands, fringing saltmarshes and saline lagoons. Shingle banks and dock structures provide important and secure roost sites at high tide. In summer, areas of sand and shingle support breeding colonies of terns.

BASELINE

4.7.3 The Offshore Cable Corridor will make landfall on Middleton Sands at Pott's Corner situated between Heysham and Sunderland Point. The intertidal ornithological assessment has evaluated the importance to waterbirds of the area within the potential zone of influence from the proposed cable route installation works (taken to be 500 m either side of the Cable Corridor (itself 500 m wide across the intertidal sandflats and mudflats of Middleton Sands)).

4.7.4 Surveys of the area, outlined in Chart 4.5, were undertaken from November 2011 – March 2012 and September 2012 – October 2012, with a total of twenty-eight survey visits being made. The subdivisions observed in Chart 41 are as a result of different sediment characteristics and / or topography. Intertidal birds were mapped at six hourly intervals prior to and following high tide, with four visits being undertaken each month covering incoming and outgoing examples of neap and spring tides. The results of these surveys are summarised in Table 4.7.

4.7.5 In addition to the above Project-specific baseline survey, other data and literature was collected and reviewed. These are summarised in Table 4.6.



Table 4.6: Summary of key intertidal ornithology literature

Title	Source	Year	Reference
Waterbirds in the UK 2010/11	BTO/RSPB/ JNCC	2012	Holt et al. 2012
Morecambe Bay Natura 2000 Standard Data Form	JNCC	2006	JNCC 2006
Morecambe Bay. Information Sheet on Ramsar Wetlands	JNCC	2008	JNCC 2008
The Lune Estuary SSSSI Citation	Natural England	2012	Natural England 2012
The UK SPA network: its scope and content	JNCC	2001	Stroud et al. 2001
Waterbird Population Estimates	Wetlands International	2012	Wetlands International 2012
Wetland Bird Survey Alerts 2006/2007: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs)	BTO	2010	Thaxter et al. 2010
Wetland Bird Survey Core Count data	BTO/RSPB/ JNCC	2012	Marsh 2012

Table 4.7: Summary of intertidal ornithological survey results

Species	Distribution within study area
Shelduck	Shelduck were recorded throughout the survey period and tidal cycle, with numbers peaking in February. In winter, birds chiefly used the mudflats during the falling tide, with birds present throughout the tidal cycle as the population peaked. With the exception of a peak count of 51 birds, only small numbers were counted in autumn, all records during two surveys in October and not during ebb tide.
Wigeon	Wigeon were recorded on two dates, 15th January and 4th March. The maximum number recorded was 15 on the 15th January. Birds were observed on ebb and flood tides.
Eider	Eider were recorded on four dates in late winter, with a peak count of 35 on the 26th March. Birds were observed on ebb and flood tides.
Red-breasted merganser	Red-breasted merganser were recorded on three dates in late winter, with a count of two birds on each occasion. Birds were observed on high water, ebb and flood tides.
Cormorant	Cormorant were recorded on 9 dates, with all records occurring during the winter. A peak count of 6 was made on the 14th November. The species shows no pattern in its temporal occurrence on the site with records throughout the tidal cycle.
Oystercatcher	Oystercatcher were recorded by all surveys throughout the winter and autumn. Larger numbers were counted during autumn than winter when an exceptional peak count was recorded in October of 3,100 during a flood tide. Oystercatchers were distributed widely across the available mudflats when foraging, with no close association with the moving tide edge. In autumn, much greater use was made of the low and mid tide mudflats of the northern sectors. In winter, the species continued to chiefly use the north western quarter of the study area, though this was less marked.

Table 4.7: Summary of intertidal ornithological survey results

Species	Distribution within study area
Ringed plover	Small numbers of ringed plover were recorded in every month though not by all surveys. Numbers peaked in autumn at 37 birds on 5th September and in winter at 22 birds on 14th November. The majority of birds, irrespective of tidal state, were recorded in winter using the upper mudflats (sectors 6 and 24) and solely the upper northern mudflat (sector 6) in autumn.
Golden plover	The only record of golden plover was of a single bird at high water on 11th November.
Grey plover	Grey plover were recorded by all surveys during autumn and winter with the exception of 22nd March. The numbers of birds recorded in winter were already comparatively high by November, increasing in January to a winter peak (475 birds). Thereafter the number of birds counted declined, having more than halved by February. In autumn, numbers of birds peaked in September (525 birds) higher than in winter, declining by late October. In autumn, the areas used by grey plover during the low water periods were widespread though with greater abundance and frequency in the northern half of the study area. In winter, the species continued to chiefly use the northern half of the study area.
Knot	The numbers of knot recorded in winter were already high by November (peak count of 17,500 birds), from when numbers decreased in February by over 75%. This decline was reversed in March when the winter peak was attained (19,130 birds). Through autumn, increasing numbers of birds were recorded by the surveys, peaking in late October (12,100 birds). Knot closely followed the tide edge when foraging during the low water period particularly during ebb and flood tides. The species usage of the study area in autumn was widespread during the low water period though with greater abundance recorded in the northern half. In winter, the species high usage areas extended beyond the northern half of the study area to include the mid to high level mudflats in the south of the study area.
Lapwing	Lapwing were recorded on 3 dates, with all records occurring during the winter. A peak count of 23 was made on the 6th November. The species was recorded throughout the tidal cycle.
Dunlin	The numbers of dunlin recorded in the study area were already comparatively high in early November, increasing to a peak by mid-month (4,920 birds). Thereafter the numbers of birds counted declined, having more than halved by December, to then increase to a winter peak in January (5,210). A late winter decline left a maximum of 6 birds recorded on the 27th March. In autumn, the numbers of dunlin recorded in the study area were already comparatively high at the time of the first survey in early September (1001 birds). Numbers of birds recorded by each survey thereafter fluctuated with a substantial influx of birds occurring in late October when the seasonal peak was attained (6808 birds). Dunlin closely followed the tide edge when foraging during the low water period particularly during ebb and flood tides. In autumn and winter, the species usage of the study area was widespread during the low water period though with greater abundance and usage recorded in the northern half. In autumn, the species at high water chiefly used in great abundance exposed sectors in the north of the study area. No such difference in usage was recorded in winter with both the northern and southern parts of the site used on occasions by large numbers of roosting birds at high water.

Table 4.7: Summary of intertidal ornithological survey results

Species	Distribution within study area
Bar-tailed godwit	In early winter, the numbers of bar-tailed godwit recorded in the study area declined from a comparatively high count in early November (720). Thereafter a marked increase occurred in the numbers of birds to winter peak in late February (3,739 birds). Though autumn, increasing numbers of birds were recorded by the surveys, peaking in late October (2,180 birds). Bar-tailed godwit closely followed the tide edge when foraging during the low water period particularly during ebb and flood tides. In autumn, the species usage of the study area was widespread during the low water period though with much greater abundance and frequency in the northern half. In winter, the species high usage areas extended beyond the northern half of the study area to include at times mudflats in the south of the study area.
Curlew	Curlew were recorded using the study area by all surveys in winter and autumn. In winter the number of birds peaked in January (451 birds) thereafter declining to a survey maxima of no more than a hundred birds during March. The peak count in autumn (1,267 birds) occurred on 22nd October and was a significant increase from the comparative stability at much lower numbers recorded by the previous surveys. This species was distributed widely across the available mudflats when foraging, with no close association with the moving tide edge. Foraging birds would gradually move down across the exposed mudflats with the retreating tide edge. Though birds did concentrate at times in particular sectors, there was no consistent pattern of greater abundance or usage. Greater use of the higher mudflats was made during the low water period in winter than autumn, in particular in the southern half of the study area.
Redshank	Redshank were recorded using the study area by all surveys during autumn and most in winter. No birds were counted on 7th January and 4th February. Numbers of birds in winter peaked in mid-November (68 birds), thereafter fluctuating and never exceeding a site maxima of 38 birds. The numbers of birds counted in the study area during autumn increased to a peak in late October (87 birds). No more than ten birds were recorded using the southern half of the study area in winter during the high water period. A greater abundance and usage was recorded in the northern half of the study site. In autumn it was the southern half of the study area in which greater abundance and usage was recorded though with counts of only up to 31 birds and in the north 14 birds, on different tides.
Turnstone	Turnstone were recorded on 7 dates, with all records occurring during the winter. A peak count of 7 was made on the 14th December. The species shows no pattern in its temporal occurrence on the study area with records throughout the tidal cycle.
Black-headed gull	Black-headed gull were recorded using the study area by all surveys until February from when the species was occasionally recorded and then counts of no more than five birds. Numbers peaked in winter in December (172 birds). The species was recorded using the study area at all tidal states surveyed in winter though rarely between one and three hours after low tide. Use of the site by the species was however sporadic with no temporal or tidal pattern of use.
Lesser Black-backed Gull	Lesser Black-backed Gull were recorded by all surveys with the exception of two in January. These latter two surveys were within the period mid-November to mid-February, when no more than seven birds were recorded as a survey maxima. The winter peak count was recorded subsequently in February with 74 birds. Over 60% of all the winter records of the species using the site were of only one or two birds. Birds were recorded in all tidal states with no pattern of site usage evident either tidally or spatially.

4.8 Offshore Ornithology

INTRODUCTION

4.8.1 A full description of the baseline environment and assessment of potential impacts of the Project on Offshore Ornithology can be found in ES Chapter 13, "Offshore Ornithology".

BASELINE

4.8.2 Extensive ornithological surveys have been undertaken in the Irish Sea area in which the Project offshore Site is situated. In addition to aerial and boat-based surveys undertaken specifically to inform this assessment, the pre-construction and construction monitoring of Walney I and II offshore wind farms provides significant supporting information. The survey area for Walney I and II partly covers the west and south-west of the proposed Project Site.

Aerial surveys

4.8.3 During the period November 2010 to November 2012 a total of twenty-two aerial surveys were conducted at the Project Site by the Danish Centre for Environment and Energy at Aarhus University (DCE, 2012 & 2013). Table 4.8 provides the dates of all aerial surveys undertaken.

Table 4.8: Dates of aerial surveys carried out for Walney Extension Offshore Wind Farm

Month	2010	2011	2012
January			13th & 28th
February		16th	
March		1st & 18th	2nd & 18th
April		8th & 28th	15th
May			20th
June		3rd	
July		2nd & 30th	14th
August		22nd	
September			22nd
October		28th	13th
November	10th	6th	
December	8th		



4.8.4 The survey objective was to map bird distributions within the study area by monthly aerial image surveys. The surveys were conducted along 17 pre-defined transect lines over an image survey area of the wind farm site and a 4 km buffer, resulting in a total transect length of 229 km and a survey area of 463 km² .

4.8.5 Details on the aerial imagery process and analysis can be found in the ES Chapter 13 Technical Annex B.7, "Ornithology". The output of the analysis provides monthly and overall population sizes and densities. These data are seen as the primary source for assessing the importance of populations of individual species found at the Project Site and to inform other analysis such as collision risk modelling.

Boat-based surveys

4.8.6 A total of twelve surveys between June 2011 and November 2012 were undertaken by CMACS (CMACS, 2012). The surveys effectively covered one annual cycle with surveys being carried out on the dates shown Table 4.9. Survey dates were targeted towards providing coverage in all key parts of the annual cycle.

Table 4.9: Boat-based survey dates of Walney Extension Offshore Wind Farm

Month	2011	2012
January		13th – 14th
February		2nd – 3rd
March		28th
April		
May		21st
June	4th	
July	26th	9th
August	25th	10th
September	30th	
October		9th
November		15th – 16th
December		

4.8.7 The 149 km² Project Site was surveyed in addition to a 4 km buffer, giving a total surveyed area of 463 km² . The surveys were carried out from the survey vessels SB Seaguard or Fleur de Lys, which closely followed COWRIE (Collaborative Offshore Wind Research into the Environment) recommendations (Camphuysen et al., 2004) in being greater than 20 m in length and with an eye height of more than 5 m. The viewing platform was built according to CMSC specifications, allowing for unrestricted visibility. Two observers, including at least one JNCC accredited Marine Mammal Observer were present in each survey.

4.8.8 Transects followed five pre-determined transect lines totalling 151.2 km in length at a spacing of 4 km agreed between DONG Energy and statutory consultees (NIRAS, 2011).

4.8.9 Methods implemented for the surveys followed the recommendations of Camphuysen et al. (2004) for assessment of the ornithology of potential wind farms. In addition, the methods also considered the British Trust for Ornithology

(BTO) review of those recommendations (Maclean et al., 2009). The following were key components of the methodology:

- Survey bands subdivided into 0-50m, 50-100 m, 100-200 m, 200-300 m and 300+ m;
- Vessel speed 10 knots (range 5-15 kt);
- Viewing height >5 m above sea level;
- No observations at sea state five or more used in data analysis;
- Registration of tidal status (low, medium or high tidal);
- Qualified (i.e. experienced) observers for each survey;
- Observations on both sides of the vessel; and
- Registration of weather conditions including sea state, wind speed and wind direction.

4.8.10 The following information was recorded for each bird observation:

- Observation time;
- Position;
- Species;
- Numbers;
- Age classes (where possible);
- Distance band from the vessel;
- Flight height;
- Flight direction;
- Behaviour;
- Association (e.g. with fishing vessels); and
- Notes on prevailing meteorological conditions, sea state and visibility were made periodically throughout each survey.

4.8.11 All individual birds were assigned to a distance band category with the transects parallel to the boat (A: 0-50m; B: 50-100m; C: 100-200m; D: 200-300m and E: >300m). Birds recorded in bands A to D were taken as being within the transect, which assumes that all birds, no matter what size, were recorded within this 300m distance. All birds were also assigned to a height category when first seen, with this category maintained even if the bird altered its flight height. The three categories comprised 0-30m, 31-140m and greater than 130m. To provide greater accuracy and flexibility for analysis, the flight height bands were changed for surveys from March 2012 onwards. These are as follows:

- 0m (i.e.) sea surface.
- Band 1 = 0 - 22 m
- Band 2 = 22 - 30 m
- Band 3 = 30 - 222 m
- Band 4 = 222 m+

4.8.12 The direction of flying birds was recorded according to eight compass directions.

4.8.13 A hand-held GPS recorded the vessel's position every 10 seconds and thus real-time positions of observations were available after the survey. Observers were present on each side of the vessel swapping sides at the end of every other transect to account for observer bias. Each observer was equipped with binoculars and a dictaphone (voice recorder) to make audio records of sightings.

4.8.14 The boat-based survey data's primary utilisation within the assessment was to provide information on bird behaviour that could not be obtained from aerial survey work.

4.8.15 Behavioural analysis was carried out using three principal behaviour categories: foraging, resting and transiting. A fourth category was also used (associated with man-made structures) and is presented independently of the three principal categories due to the inter-relationships between the fourth category and the principal categories.

4.8.16 Analysis of prevailing flight direction was also undertaken. This was undertaken on all species for which a satisfactory quantity of

records were available (considered to be 20 records and above). Analysis was undertaken for breeding and wintering months separately.

4.8.17 As with aerial survey data, the boat-based survey was analysed to provide monthly (and overall) population size and density information. Whilst this data is not considered for primary use within the assessment and further analysis it is considered to provide important information supporting the aerial surveys.

4.8.18 The density of each species (presented as birds per km²) was calculated and then extrapolated to the Project offshore wind farm Site and / or the Site plus the 4 km buffer.

4.8.19 To provide appropriate population estimates Distance Sampling (Buckland et al., 2001; Thomas et al., 2010) was undertaken on boat-based data, for those species where it was considered that the results could potentially be valuable to the assessment. It was not possible to provide suitable results using this analysis for all species recorded during the survey due to the low number of observations in some cases. (See ES Chapter 13 Annex B.7.A for the Distance Sampling methodology).

4.8.20 Where Distance Analysis results were disregarded due to confidence interval issues a standard correction factor was applied to the data, full details of this analysis can be found in the ES Chapter 13 Annex B.7.A.

Monitoring surveys of Walney I & II

4.8.21 In 2007, DONG Walney (UK) Ltd. was granted consent for the Existing Walney I and II Offshore Wind Farms. A Food and Environmental Protection Act (FEPA) 1985 (as amended) Licence was issued in October 2008. This licence was replaced by a Marine Licence, which was issued to Walney Offshore Wind Farms Ltd on June 3rd, 2011. Construction of the Existing Walney I and II Offshore Wind Farms commenced in April 2010, with Walney I completed in December 2010 and Walney II completed in September 2011. Walney I first became operational in January 2011 with Walney II following in November 2011. Both offshore wind farms were in operation early 2012[6].

4.8.22 Annex 2 of the Marine Licence for Walney I and II states that the monitoring must fulfil the following objective:

> *"Determine whether there is change in bird distribution, use and passage, measured by species (with particular reference to Manx Shearwater, Lesser Black-backed Gull, red-throated diver & common scoter), abundance and behaviour, of the wind farm site, 1km and 2-4 km buffer zones and the reference site".*

4.8.23 In relation to the above objective, the environmental monitoring programme states the following null hypothesis:

- The establishing of Walney Offshore Wind farm does not lead to significant changes in bird distribution, use and abundance at the wind farm site and its vicinity;
- The establishing of Walney Offshore Wind farm does not lead to significant changes in bird behaviour at the wind farm site and its vicinity;
- The establishing of Walney Offshore Wind farm does not lead to significant changes in bird passage at the wind farm site and its vicinity.

4.8.24 The methodology for the monitoring was agreed to be regular boat-based surveys completed at the wind farm site including 0 - 1 km and 2 - 4 km buffer zones, and two reference areas using the technique from the pre-consent surveys. The boat surveys complied with the COWRIE guidance (Camphuysen et al, 2004).

4.8.25 Boat survey transects were conducted at 2 km spacing, covering the Walney I and II OWF and a 4 km buffer area surrounding the wind farm. Transect spacing at 2 km allowed survey of the entire area in one day during high summer (weather permitting). In some cases, it was necessary to survey reference areas on a consecutive day due to daylight availability.

4.8.26 Surveys focusing in particular on Manx Shearwater and Lesser Black-backed Gull were conducted during the summer including the late summer period (May, July, August and September). Flight height was registered for the species to provide information on potential collision risk estimations. Survey coverage is shown in Table 4.10.

Table 4.10: Boat based survey coverage

Date	Survey area
2008	Walney I, Walney I buffer zone, and reference area 1
2009 May	Walney I, Walney II, buffer zones for I and II, and reference areas 1 and 2
2009 July – September	Walney II, Walney II buffer zone, and reference area 2
2010	Walney I, Walney I buffer zone, and reference area 1
2011	Walney I, Walney II, buffer zones for I and II and Reference Areas 1 and 2 (See ES Chapter 13, Annex B.7.A).

4.8.27 The key objectives of analysis of the boat-based monitoring survey data were:

- To estimate population size and to describe data correction for detection and coverage;
- To distinguish between species groups and species (where possible);
- To differentiate between breeding season (May to August) and autumn migration (September), where sufficient data are available;
- To compare flight heights;
- To compare periods of development; and
- To compare survey areas (e.g. wind farm site and buffer).

4.8.28 A report was completed in April 2012 (NIRAS, 2012a) which reports on monitoring surveys during construction of the development and it is these results that are included in this report.

4.8.29 A report on bird surveys for the first operational year of the Walney Existing wind farms has recently (May 2013) been presented to the MMO. At the time of writing this report had not been reviewed by the MMO.

BERR/ DTI/ WWT AERIAL SURVEYS

4.8.30 In order to provide data on the numbers and distribution of waterbirds and seabirds for the Strategic Environmental Assessment (SEA) of offshore wind farm development, The Department of Trade and Industry (DTI, now Department of Energy and Climate Change DECC), commissioned large-scale aerial surveys of strategic inshore waters (DTI, 2006; BERR, 2007; WWT, 2009).

4.8.31 Of relevance to the Project is the NW3 area which intersects the proposed wind farm site. Data relating to twenty-two surveys undertaken between February 2004 and March 2011 were obtained from the Wildfowl and Wetlands Trust (WWT) in October 2012.

4.8.32 The DTI-commissioned aerial surveys were undertaken using the methodology developed by the National Environment Research Institute in Denmark (Kahlert et al., 2000). The methods utilised were based on physical observations rather than digital imaging although are directly comparable to those used for the Project.

4.8.33 A number of Partenavia PN68 aircraft were used, flying at an altitude of 76 m and a speed of approximately 185 km h-1. A series of north-south transects were spaced 2 km apart to cover nearshore waters. For each bird or flock of birds, the species, number, behaviour, distance band and the time at which it was perpendicular to the flight path of the aircraft was recorded. Full methodological details of the surveys are provided in the annual reports (e.g. WWT, 2009).

4.8.34 The data obtained from WWT for the NW3 sector was analysed in a similar way as with the site specific aerial and boat-based surveys, in that the aim was to provide density and population size outputs. Population sizes were determined for all species by the calculation of line transect density values, which could then be extrapolated to the wider study area of NW3.

Construction correction

4.8.35 Natural England requested that the potential impacts of construction activities at Walney I and II should be taken into consideration in terms of interpretation of the baseline data collected for the Project. It is considered that there is potential for the disturbance associated with these construction activities to influence baseline conditions in the Project study area through a displacement effect (or indeed potentially through attraction in certain species), (NIRAS, 2011). In simple terms, the densities of some species within the Project study area (including buffer area) may be depressed (or inflated) as a result of adjacent construction activities, leading to the impression that the area may be less (or more) important for birds than it is in reality.

4.8.36 The approach for management of the potential influence of this effect on the baseline data collected at the Project site involves:

- Collation and comparison of the dates on which birds surveys were undertaken and the periods during which construction (i.e. piling operations and turbine erection) was undertaken;
- Mapping and comparison of the locations of the survey transects and the specific locations of construction works for each survey event;
- Projection of a 2 km buffer around the location of the turbines that were installed on these dates to determine whether there is any overlap with the survey track; and
- If there is any overlap of survey tracks and construction buffers, data will be excluded from within the buffer from the baseline survey.

4.8.37 The above steps have been applied to both aerial and boat-based data sets. A single boat-based survey overlapped with construction activity at Walney I and II (4th June 2011), while four aerial surveys were potentially affected (8th April 2011, 28th April 2011, 3rd June 2011 and 2nd July 2011).

4.8.38 Analysis of this revised data set has been undertaken in parallel with the full data to allow direct comparison of results, and potentially some insight into displacement effects of construction. There were no major differences found between the two densities, see Chapter 13 Annex B.7.A of the ES for full details.

Species Accounts

4.8.39 This section presents summary accounts for each species recorded in the baseline surveys at the Project Site. Data is presented for both aerial and boat-based surveys, indicating population and density estimates for the Project offshore wind farm Site and 4 km buffer in both cases (Table 4.11).



Table 4.11: Ornithological species accounts from boat-based and aerial surveys

Species	Density and distribution within site 2
Common scoter	Aerial surveys of the Project Site recorded common scoters in low numbers in a limited number of surveys. A peak count of 28 birds (0.06 individuals / km²) occurred in August 2011. Peak numbers in boat-based surveys were higher reaching a peak of 451 birds in June 2011, although apart from in July 2011 this species was virtually absent at all other times. All common scoters recorded in the boat-based surveys were transiting the study area, suggesting that the site has little or no importance for this species for foraging.
Red-throated diver	Aerial surveys of the Project Site recorded red-throated divers (all unidentified divers were assumed to be this species) in moderate numbers in twelve of the twenty-two surveys. A peak count of 76 birds (0.16 individuals / km²) occurred in October 2012. Peak numbers in boat-based surveys were considerably lower reaching a peak of just 6 birds in September 2011 and January 2011.
Great northern-diver	Great northern divers were recorded in the aerial surveys only, where a population of 4 birds were estimated to be present in two surveys (March 2011 and January 2012).
Fulmar	Aerial surveys of the Project recorded fulmar in low numbers in seven of the twenty-two surveys. A peak count of 20 birds (0.04 individuals / km²) occurred in July 2011. Peak numbers in boat-based surveys were similar to those recorded in the aerial work reaching a peak of 12 birds in May 2012. These results correspond closely with the low densities recorded in the NW3 sector. Fulmar exhibited a mix of behaviour during the boat-based surveys. Substantial proportions were observed either foraging or transiting (40 and 45% respectively) while 15% were resting on the sea surface.
Manx Shearwater	Aerial surveys of the Project Site recorded Manx Shearwater in most surveys outside of winter months. Numbers were variable and a peak count occurred in May 2012 when 1417 birds were estimated to be present (a density of 3.06 birds / km²). A four figure count (1017) also occurred in September 2012, with other notable counts in April 2011 (445) and August 2011 (434). Boat-based survey estimates of Manx Shearwater numbers were generally higher than those from aerial survey work. High counts were present in four surveys, with a peak in May 2012 of 11,591 birds within the site and 4 km buffer (approximately half this number were within the Walney Extension site itself). Numbers in August 2012 were just below 8000 birds, while in June and July 2012 were at approximately 2000 birds. All peak counts were considerably higher than recorded for the NW3 count sector, however they were slightly lower than the peak densities reported in the Walney I and II monitoring work where it was suggested that densities of up to 41.95 individuals / km² occur within the Walney I and II wind farm area. Population estimates at Walney I & II were highest during the spring and summer period (as with the Project Site) with peaks of 2387 birds during construction. Manx Shearwaters observed during boat-based surveys exhibited a range of behaviours, with the highest number of birds observed resting (44%). Notable numbers were also observed foraging (29%) and transiting (27%). Manx Shearwaters were widely distributed in the boat-based surveys, although notable aggregations occurred primarily in the centre of the study area and to the south. Few individuals were found in the east of the Project Site study area, while lower densities were found in the extreme west.

Table 4.11: Ornithological species accounts from boat-based and aerial surveys

Species	Density and distribution within site 2
Gannet	Aerial surveys of the Project Site recorded Gannet in all but four surveys (December 2010 and January – March 2012). Numbers were variable and a peak count occurred in October 2012 when 592 birds were estimated to be present (a density of 1.28 birds / km²). A similar count (509 birds) occurred in April 2011, with other three figures counts occurring in six surveys. Boat-based survey estimates of Gannet numbers were generally slightly higher than those from aerial survey work. High counts were present in four surveys, with a peak (estimated through Distance analysis) in July 2012 of 1009 birds (2.18 / km²) within the Project site and 4 km buffer. Numbers in March 2012 were also at approximately 950 birds while all other boat-based survey population estimates were below the maximum count obtained from aerial work. Counts in the main extent of the breeding period (may and June) were low in both surveys. Estimated densities for the boat-based and aerial surveys of the Project site were higher than those given for the NW3 sector although are similar to that presented for the Irish Sea in Stone et al., (1995) where a peak density of 1.39 birds / km² occurred. This suggests that the Project area does not provide habitat of any particular importance to Gannet compared to the wider areas of the Irish Sea. Gannets observed during boat-based surveys exhibited a range of behaviours, with the highest number of birds observed resting (49%). Notable numbers were also observed transiting (39%), while a small proportion were observed foraging (9%).
Cormorant	Aerial surveys of the Project site recorded cormorant in only four of the 22 surveys undertaken. Numbers were low in all cases and a peak count occurred in April 2012 when 10 birds were estimated to be present (a density of 0.02 birds / km²). These population estimate does not approach thresholds of international or national importance. Boat-based survey results were similar in that the peak population was of 29 birds (0.06 birds / km²) in August 2012, with the species only being recorded in one other month (November 2012). Estimated densities for the boat-based and aerial surveys of Walney Extension were similar to those calculated for the NW3 sector. This suggests that the the Project site area does not provide habitat of any particular importance to cormorant compared to the wider areas of the Irish Sea. All cormorants observed during the boat-based surveys were transiting the study area, further suggesting that the the Project site is of limited importance to this species.
Arctic skua	Arctic skuas were not specifically recorded within the baseline surveys (although single individual species were recorded 'out of transect' in boat-based surveys in September 2011 and July 2012). A population of 17 unidentified skuas were estimated in November 2011 and are included here as a precautionary measure. Of the two Arctic skuas observed in the surveys, one bird was seen to be resting while the other was transiting through the study area.
Great skua	Great skuas were recorded on just two surveys, with the highest population estimate being 20 birds in July 2011 (with three birds estimated in October 2012). A population of 17 unidentified skuas were estimated in November 2011 and are included here as a precautionary measure. A single great skua was recorded 'out of transect' in August 2012 which was transiting through the study area.

Table 4.11: Ornithological species accounts from boat-based and aerial surveys

Species	Density and distribution within site 2
Kiitwake	Aerial surveys of Walney Extension recorded kittiwakes in all but two of the 22 surveys undertaken. Numbers were extremely variable and a peak count occurred in March 2012 when 1467 birds were estimated to be present (a density of 3.17 individuals / km²). Boat-based survey results were similar in that the peak population (through Distance Aanalysis) was of 1431 individuals (3.93 birds / km²), although this count was in November 2012. It is notable however that there was a substantial number in excess of 1300 birds noted in March 2012 during the boat-based surveys.
Black-headed gull	Aerial surveys of the Project site recorded black-headed gulls in just three of the 22 surveys undertaken. Numbers were extremely low in all cases and a peak count occurred in May 2012 when 11 birds were estimated to be present (a density of 0.02 birds / km²). Boat-based survey results were similar in that the peak population was of 16 birds (0.04individuals / km²), with this count was being in November 2012. Estimated densities for the boat-based and aerial surveys of the Project site were similar to those calculated for the NW3 sector, where low densities were again recorded. It is concluded that the the Project site study area has little importance for this species.
Little gull	Aerial surveys of the Project site recorded little gulls in just five of the 22 surveys undertaken. A peak count occurred in November 2011 when 28 birds were estimated to be present (a density of 0.06 individuals / km²). Boat-based survey results were similar in that the peak population was of 16 birds (0.04 individuals / km²), with this count was being in November 2012.
Common gull	Aerial surveys of the Project site recorded common gulls in thirteen of the 22 surveys undertaken. Population estimates were low (<25 birds) with the exception of November 2011 (142 birds) and March 2012 (108 birds). Boat-based survey results were generally also low throughout the surveys, although an outstanding peak count occurred in February 2012 with 371 birds present (at 0.80 individuals / km²).
Lesser Black-backed Gull	Aerial surveys of the Project site recorded Lesser Black-backed Gulls in twelve of the 22 surveys undertaken. A peak count occurred in November 2011 when 154 birds were estimated to be present (a density of 0.33 birds / km²). The majority of surveys (10 of 12) where this species was recorded involved densities of less than 0.10 birds / km² . Boat-based survey results for Lesser Black-backed Gulls involved a large peak in numbers in March 2012 of a population estimated through Distance analysis at 1599 birds at a density of 3.45 individuals / km² . Lesser Black-backed Gulls recorded within the boat-based surveys were found to be, in the main, either resting or transiting in the study area (39 and 40% of observations respectively). A smaller proportion (14%) were found to be foraging.
Herring Gull	Aerial surveys of the Project site recorded Herring Gulls in seventeen of the 22 surveys undertaken. A peak count occurred in March 2012 when 221 birds were estimated to be present (a density of 0.48 birds / km²). Herring Gulls were generally present in low numbers in autumn to spring , while absent or rare in summer. Herring Gulls recorded within the boat-based surveys were found to be, in the main, either resting or transiting in the study area (52 and 40% of observations respectively). A small proportion (6%) were found to be foraging. Boat-based survey results for Herring Gulls involved a notable peak in numbers in March 2012 of a population estimated through Distance analysis at 1328 birds at a density of 2.87 individuals / km² . Otherwise, boat-based survey population estimates were lower than 250 birds (with the species being absent in summer months).

Table 4.11: Ornithological species accounts from boat-based and aerial surveys

Species	Density and distribution within site 2
Great black-backed gull	Aerial surveys of the Project site recorded great black-backed gulls in fifteen of the 22 surveys undertaken. A peak count occurred in November 2011 when 236 birds were estimated to be present (a density of 0.51 birds / km²). Great black-backed gulls were generally present in low-moderate numbers in autumn to spring, while absent or rare in summer. Boat-based survey results for great black-backed gulls involved a dramatic peak in numbers in March 2012 (as with lesser black-backed and Herring Gulls) of a population estimated at 1042 birds at a density of 2.25 individuals / km² . Otherwise, boat-based survey population estimates were lower than 200 birds (with the species being absent in summer months).
Arctic and common terns	Arctic and common tern are often impossible to distinguish at range during surveys, and are often recorded as 'commic' terns. However, positive identification of Arctic tern was made during the aerial surveys. No common tern were specifically identified in either the aerial or boat-based surveys. Arctic tern were recorded in negligible numbers during both aerial (0.01 individuals / km²) and boat-based (0.01 individuals //km²) surveys of the Project site.
Sandwich tern	Sandwich tern were recorded in negligible numbers during both aerial and boat-based surveys of the Project site. A peak count of 6 birds were recorded in boat-based surveys (0.01 individuals / km²).
Guillemot	Guillemots were the most abundant species recorded in the baseline work and were recorded in each of the 22 aerial surveys. A peak estimated population occurred in July 2012 when 6580 birds were considered to be present in the study area (at a density of 14.21 individuals / km²). Guillemots were abundant throughout the late summer and autumn, with noticeably less birds present in winter. Boat-based survey results show a dramatic peak in numbers in August 2012, where 22,107 birds were estimated by Distance Analysis to be present in the study area. This count is over 18,000 greater than any other boat-based survey count and presumably represents some post-breeding dispersal from colonies within the wider region. The vast majority of guillemots recorded in the boat-based surveys were observed resting on the sea surface (94% of observations), with small proportions either transiting (4%) or foraging (2%).
Razorbill	Razorbills were an abundant species within baseline surveys and were specifically identified in nine of the 22 aerial surveys. A peak estimated population occurred in November 2011 when 6624 individuals (14.21 / km²) were estimated be present (based on rations of auks species recorded in boat-based work). Boat-based survey results show a peak population (calculated by Distance analysis) of 4265 birds in March 2012. The vast majority of guillemots recorded in the boat-based surveys were observed resting on the sea surface (94% of observations), with small proportions either transiting (4%) or foraging (2%).
Puffin	Puffins were recorded in ten of the 22 aerial surveys, generally at a low density. A peak population of 191 birds was estimated within June 2011 (at a density of 0.40 individuals / km²). Puffins were recorded in two boat-based surveys only, with 29 birds in July 2011 representing the peak count. The majority of Puffins recorded in the boat-based surveys were observed resting on the sea surface (63% of observations), with a smaller proportion transiting (37%).

OTHER SPECIES OF RELEVANCE TO THE PROJECT SITE (not recorded in the bird surveys)

Whooper Swan

4.8.40 The wintering UK population of Whooper Swan is currently estimated at 16,502 birds, which is derived from a census in 2010 (Hall et al. 2012). The majority of birds wintering in Britain are from the Icelandic breeding population, although it appears that small numbers of birds breeding in Scandinavia and north European Russia also occur here (c.200 according to Laubek et al., 1998). It is notable that an additional 10,452 birds are estimated to winter in Ireland.

4.8.41 In the UK, most Whooper Swans occur in northern Britain and Northern Ireland. The large wintering flock that occurs at the Ouse Washes has doubled over the past ten years making this site the species' main wintering area in Britain. Lough Neagh and Lough Beg are by far the most important sites in Northern Ireland. Around the eastern coasts of the Irish Sea there are two main wintering areas. The most important site is at WWT Martin Mere and the surrounding Lancashire Mosses where numbers of international importance (sites with more than 1% of the national population) are found.

Pink-footed Goose

4.8.42 The wintering UK population of Pink-footed Goose is currently estimated at 360,000 birds (Musgrove et al., 2011). Numbers of this species have been noted to have risen steadily over recent years, with the above estimate being taken from the peak British count from autumn 2009 (Mitchell, 2010).

4.8.43 Pink-footed geese arrive in the UK during September and October, birds staging at several well-defined staging areas, especially in eastern and southern Scotland (Mitchell and Hearn, 2004) followed by a rapid onward movement of some birds to Lancashire, these arriving in the region along the west coast (eastern Irish Sea). The spring migration northwards in Britain is largely the reverse of southward migration.

4.8.44 The majority of pink-footed geese recorded during a radar study undertaken at Walney Island (Budgey 2010) migrating along the eastern Irish Sea coast were found close to land with approximately 88% of flightlines within 6 km of the shore or overland.

4.9 Terrestrial ecology

INTRODUCTION

4.9.1 A description of the terrestrial baseline environment and assessment of potential impacts of the Project on terrestrial ecology can be found in ES Chapter 24, "Terrestrial Ecology and Nature Conservation". Chart 4.6 identifies statutory and non-statutory nature conservation sites in the vicinity of the export cable landfall, the cable corridor, and the onshore substation site. A summary of the site citations is given in Table 4.10.

4.9.2 The Morecambe Bay SAC, SPA, Ramsar sites are the only European Sites within the vicinity of the proposed intertidal / onshore works. The Lune Estuary SSSI is largely co-incident with the Morecambe Bay sites and where interest features of that SSSI are shared with qualifying features of the Morecambe Bay SAC / SPA / Ramsar the assessment of the likely significant effects on those features in this Report is considered relevant also to those aspects of that SSSI.

4.9.3 The Heysham Moss SSSI is not assessed as supporting features relevant to the Natura 2000 sites, so potential impacts on that SSSI are not considered in this Habitats Regulations Assessment Report. The potential impact of the Project on the Heysham Moss SSSI (through construction and operational noise

and impacts on local hydrology) is however assessed in the Environmental Statement (Chapters 22, 23, & 24).

4.9.4 Similarly, the four Biological Heritage Sites shown on Chart 4.6 within the vicinity of the onshore works are not assessed as providing a supporting function to the Morecambe Bay SAC / SPA / Ramsar sites and as such are not considered further in this HRA Report.

4.9.5 The Applicant is likewise not aware of any other terrestrial location within the study area - but outside of the Natura 2000 site boundaries - that provides a supporting function (such as a high tide bird roost) for interest features of the SAC / SPA / Ramsar sites and which is potentially impacted by the Project.

Table 4.12: Summary citations for near shore / onshore nature conservation sites

Site Name, Designation, Location – Description
Morecambe Bay SSSI, SPA, SAC and Ramsar - lies between the coasts of South Cumbria and Lancashire, and represents the largest continuous intertidal area in Britain. Comprises the estuaries of five rivers and the accretion of mudflats behind Walney Island. The area is of intertidal mud and sandflats, with associated saltmarshes, shingle beaches and other coastal habitats. It is of importance for passage and overwintering waterfowl and breeding waterfowl, gulls and terns.
Heysham Moss, SSSI, Local Nature Reserve (LNR) – located three kilometres south of Morecambe. About 5 ha of this moss supports bog vegetation (the rest being covered in wet woodland). It occupies a natural depression on the coastal plain of the Lune Estuary. This SSSI is a surviving core fragment of a much larger mossland shown on eighteenth century maps. Heysham Moss is important as the second best example of a cut-over raised mire in the county after Winmarleigh Moss.
Lune Estuary, SSSI - is situated on the coast of Lancashire extending from Heysham in the north and the Wyre Estuary in the south inland to the outskirts of Lancaster. It forms part of the Morecambe Bay intertidal system and includes extensive sand/silt flats together with saltmarsh in the form of a number of discontinuous saltings fringing the estuary.
Middleton Former Refinery Site, BHS - The site comprises a mosaic of grassland habitats and areas of standing water on a former petroleum refinery. A number of the ponds across the site support good numbers of breeding Great Crested Newt along with exceptional populations of Common Toad and Smooth Newt. The water bodies attract water birds during the winter months and the site supports a significant assemblage of breeding birds.
Carr Lane Meadows, BHS - The site comprises a field of neutral grassland adjacent to Carr Lane, Middleton. The field supports areas of grassland referable to the National Vegetation Classification MG8 Cynosurus cristatus-Caltha palustris grassland and to the NVC MG11 Festuca rubra-Agrostis stolonifera-Potentilla anserine grassland.
Middleton Marsh, BHS - The site comprises a shallow valley between Middleton Road and the link road to Middleton Waste Transfer Station, to the north of Middleton. The valley carries a number of slow flowing drains either side of which the wet habitat supports swamp and fen vegetation.
Heysham Moss-Land Adjoining SSSI, BHS - The site comprises an area of low lying marshy grassland, semi-natural woodland and scrub situated on the coastal plain, some 3km south of Morecambe. It adjoins the northern, eastern and southern boundaries of Heysham Moss Site of Special Scientific Interest, a small lowland raised bog representing the remains of a once larger area of peat on the Heysham peninsula.

BASELINE

Saltmarsh

4.9.6 Middleton saltmarsh is an extensive area of mid-upper saltmarsh vegetation dissected by creeks. It is understood to be extensively grazed by livestock and has a short, uniform sward dominated by Festuca rubra (Red Fescue) and Juncus gerardii (Saltmarsh Rush) with frequent Agrostis stolonifera (Creeping Bent), Glaux maritima (Sea-milkwort) and Plantago maritima (Sea Plantain), and occasional Armeria maritima (Thrift) and Triglochin maritimum (Sea Arrowgrass). The creek sides are more frequently inundated and support lower saltmarsh vegetation consisting of species such as Aster tripolium (Sea Aster), Atriplex portulacoides (Sea-purslane), Puccinellia maritima (Common Saltmarsh-grass) and Suaeda maritima (Annual Sea-blite). This is mostly a complex of the NVC (National Vegetation Classification) communities SM16 Festuca rubra salt-marsh community and SM13 Puccinellia maritima salt-marsh community.

4.9.7 The uppermost zone of the marsh at the landfall has a tall sward dominated by Agrostis stolonifera (Creeping Bent), Elytrigia atherica (Sea Couch) and Festuca rubra (Red Fescue), together with the rush Juncus maritimus (Sea Rush). Other species include the sedge Carex distans (Distant Sedge) and the forbs Atriplex prostrata (Spear-leaved Orache), Oenanthe lachenalii (Parsley Water-dropwort) and Trifolium repens (White Clover). This is referable to the NVC community SM18 Juncus maritimus salt-marsh community.

4.9.8 The total saltmarsh habitat at Middleton saltmarsh is approximately 78 ha (calculated using aerial photography). NVC surveys along the cable corridor have shown approximately 50 % of the salt marsh as SM18 Juncus maritimus salt-marsh community and 50 % as SM16



Festuca rubra salt-marsh community or SM13 Puccinellia maritima salt-marsh community.

4.9.9 Saltmarshes exhibit a zonation of vegetation which is influenced by the degree of tidal innundation, in turn related to the level, or height of the deposited sediment on which the saltmarsh has developed. This zonation is generally displayed as bands of characteristic vegetation communities. Salt-marsh community SM18 Juncas maritimus is predominantly upper-marsh community but the sub-communities differ in their tolerance of tidal submersion.

Upper foreshore

4.9.10 Disturbed sand and shingle around the car park at Potts Corner support patches of pioneering vegetation, which are dominated by Honckenya peploides (Sea Sandwort) or Leymus arenarius (Lyme-grass) and referable to the NVC types SD2 and SD5, respectively.

4.9.11 Saltmarsh is an Annex I Habitat under the European Habitats Directive 1992 and a primary reason for the selection of the Morecambe Bay SAC.

Cable corridor

4.9.12 Much of proposed cable route will cross under areas of previously disturbed ground (including tracks and the footings of the sea

wall) and bare ground associated with the car park, together with an area of SM18 Juncus maritimus salt-marsh community (although to a much reduced extent in comparison with the proposed cable route further south (cable route option 2, see ES Chapter 5: "Site Selection and Alternatives")).

4.9.13 The UK BAP Priority Species invertebrate, the Belted Beauty moth (Lycia zonaria), has been recorded from this site in areas of suitable habitat, corresponding to the NVC type SM18 Juncus maritimus salt-marsh community. This species, which has an extremely limited distribution in Great Britain, is not a qualifying feature of the Natura 2000 sites and as such is noted but not assessed in this Report. The ES (Chapter 24, "Ecology and Nature Conservation") considers the potential impact on this population which is considered to be avoided by the proposal to use horizontal directional drilling to tunnel under the saltmarsh rather than open cut trenching to cross the saltmarsh.



5.0 HABITATS REGULATIONS ASSESSMENT: INITIAL SCREENING FOR LIKELY SIGNIFICANT EFFECT

5.1 Introduction

5.1.1 The Project is not directly connected with, or necessary to, the management of any European Site and therefore as described in AN10, the initial stage of the HRA process is to determine whether the plan or project 'either alone or in-combination with other plans or projects' is likely to have a significant effect on a European Site (or Sites), a process known as "screening." This section of the HRA identifies the process undertaken for, and presents the results of, the screening exercise carried out by the Applicant in respect of the Project.

5.1.2 A three step approach was used to determine the potential for likely significant effect ("LSE") at the screening stage:

- Determine which sites are present in the study area and which sites are outside the study area but support interest features of European Sites;
- Review existing literature and site surveys to determine species presence within the study area; and
- Determine possible mechanisms for an effect.

5.1.3 For mobile species such as seabirds and marine mammals further steps are taken in the screening process, these are detailed in the relevant sections below.

5.2 Identification of potentially affected sites

5.2.1 Section 3.4 of this Report and Table 3.2 identify those European Sites that are considered in this HRA. Screening is a relatively coarse filter to identify those sites and features for which LSE cannot be discounted. It is an on-going process that reflects the status of the knowledge and available data at the time of the assessment. The screening exercise for the Project (documented in DONG Energy, 2012a) was conducted in the light of the site specific surveys, consultation with Statutory Nature Conservation Bodies (SNCBs) and interested parties, and discussions with the Planning Inspectorate.

5.2.2 The Project Site does not lie within or directly affect any European Site. The Offshore Cable Corridor lies on the boundary of the Shell Flat and Lune Deep SAC and runs through the northern extent of the Liverpool Bay SPA, crossing the Morecambe Bay SPA, SAC and Ramsar to make landfall at Middleton Sands.

5.2.3 The Applicant is not aware of any onshore (terrestrial) Natura 2000 sites directly affected by, or likely to be indirectly affected by, the Onshore Cable Corridor or Onshore Substation Site. Similarly no other terrestrial sites have been identified that support interest features of Natura 2000 sites and are potentially affected by the onshore cabling, substation construction or operation.

5.2.4 The identified European Sites considered at this stage of the assessment are shown in Charts 5.1 and 5.2.

5.3 Identification of possible effect on European Sites

5.3.1 The approach to screening applied in The Crown Estate's Appropriate Assessment of the Round 3 Plan (Entec, 2009) has been used as a starting point for screening effects in relation to the Project. This Round 3 Habitats Regulations Assessment is relevant because it comprehensively examines the European

Site features that could be affected by offshore wind farms at a large scale.

5.3.2 This approach identified five categories of European Sites for which LSE arising from offshore wind farm development could not be excluded:

- SACs containing bat interest features;
- SACs and Ramsar sites containing diadromous fish interest features;
- SACs and Ramsar sites containing Annex I habitats which could be affected;
- SACs and Ramsar sites containing marine mammal interest features; and
- SPAs and Ramsar sites containing bird interest features.

5.3.3 Below is set out a series of high-level assessments, addressing whether or not the possibility of the Project (as described in Section 2 above) having LSE on the broad categories of European Sites identified above can be excluded. Unless stated otherwise, the specific European Sites upon which LSE may be considered are identified in Section 3.4 above

5.4. Bat interest features

5.4.1 Four species of bats are qualifying features for SAC sites in the UK, lesser horseshoe, greater horseshoe, barbastelle, and Bechstein's. The closest SAC sites with bat qualifying features (lesser horseshoe bat) are in north Wales, approximately 80 km distant from the Project offshore wind farm Site and considered too distant for there to be any mechanism for an effect from the Project activities.

5.4.2 Other SAC sites containing bat interest features are in south and west England and East Anglia. There are 41 SAC sites where bats (lesser horseshoe bat) are qualifying features in the Irish Republic.



5.4.3 The SAC sites mentioned in the preceding paragraph have not been listed in this report due to their distance from the Project Site. They are too distant for there to be any mechanism for an effect from the Project.

5.4.4 Consequently SAC sites where bats are qualifying features are screened out from further consideration in this HRA.

5.5 Diadromous fish features

5.5.1 Fish species included in Annex II of the Habitats Directive which have a marine component in their life cycle are:

- Sea lamprey (Petromyzon marinus);
- River lamprey (Lampetra fluviatilis);
- Allis shad (Alosa alosa);
- Twaite shad (Alosa fallax); and
- Atlantic salmon (Salmo salar).

5.5.2 Table 4.2 and Chart 4.3 show the SACs designated for diadromous fish located within and adjacent to the study area. All of the SAC sites indicated are located some distance from the Project Site and are considered to lie beyond the range of a potential effect (principally - behavioural disturbance as a result of piling noise). Consequently, no likely significant effect is predicted from any of the Project activities on any diadromous fish features of European Sites and effects on such features are screened out from further assessment in this HRA.

5.5.3 Natural England agree that diadromous fish can be screened out of this assessment.

5.6 Annex I Habitats

5.6.1 No terrestrial SACs lie within the study area associated with the Onshore Cable Corridor (500m buffer either side of the cable corridor) or within, or adjacent to, the onshore substation (see Chart 4.6).

5.6.2 The nearest terrestrial nationally designated site is Heysham Moss SSSI (a small area of lowland raised bog) located approximately 500 m north of the proposed electricity sub-station site. This site is not understood to support interest features that are qualifying features of the European Sites considered in this assessment.

5.6.3 Consequently, this assessment considers only the following marine, coastal and halophytic habitat features listed in Annex I of the Habitats Directive:

- Sandbanks which are slightly covered by sea water all the time;
- Estuaries;
- Mudflats and sandflats not covered by seawater at low tide;
- Coastal lagoons;
- Large shallow inlets and bays;
- Reefs;
- Submarine structures made by leaking gases;
- Annual vegetation of drift lines;
- Perennial vegetation of stony banks;
- Vegetated sea cliffs of the Atlantic and Baltic coasts;
- Salicornia and other annuals colonising mud and sand;
- Spartina swards (Spartinion maritimae);
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae);
- Inland salt meadows;
- Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi); and
- Submerged or partially submerged sea caves.

5.6.4 Table 5.1 identifies the coastal and halophytic Annex I habitats present within the study area.

Table 51: SACs with Annex I habitat features located within the study area.

Site name	Distance from Project Site	Feature
Morecambe Bay SAC	20 km from the Project Site. The Offshore Cable Corridor runs through 15 km of the SAC	Annex I Habitats a primary reason for site selection: Estuaries Mudflats and sandflats not covered by seawater at low tide Large shallow inlets and bays Perennial vegetation of stony banks Salicornia and other annuals colonising mud and sand Atlantic salt meadows Annex I habitats present as qualifying feature, but not primary reason for site selection: Sandbanks which are slightly covered by seawater all the time Coastal lagoons Reefs
Shell Flat and Lune Deep SAC	20 km from the Project Site. The Offshore Cable Corridor is located on the SAC boundary.	Annex I Habitats a primary reason for site selection: Sandbanks which are slightly covered by sea water all the time Reefs
Drigg Coast SAC	29 km from the Project Site.	Annex I Habitats a primary reason for site selection: Estuaries Annex I habitats present as qualifying feature, but not primary reason for site selection: Mudflats and sandflats not covered by seawater at low tide. Salicornia and other annuals colonising mud and sand Atlantic salt meadows
Crocker Carbonate Slabs Offshore SAC	120 km from the Project Site	Annex I habitats primary reason for site selection Submarine structures made by leaking gases
Pisces Reef Complex Offshore SAC	110 km from the Project Site	Annex I habitats primary reason for site selection Reefs

POTENTIAL EFFECTS

Project Site

5.6.5 5.6.5 The potential effects on the habitat features listed in Table 5.1 as a result of activity in the Project Site are listed below.

During the construction phase:

- Direct habitat loss and disturbance from foundation installation and inter-array cable laying; and
- Increases in suspended sediment concentration (SSC) as a result of foundation installation and inter-array cable laying.

During the operational phase:

- Increases in SSC as result of scour; and
- Changes to hydrodynamics due to foundation presence resulting in an alteration to the sediment transport regime.

Offshore Cable Corridor

5.6.6 The potential effects on the habitat features listed in Table 5.1 as a result of the installation and operation of the export power cable are:

During the construction phase:

- Direct habitat loss and/or disturbance as a result of export cable installation; and
- Increases in SSC, bed level change and seabed textural change following redeposition of suspended sediments (export cable burial).

During the operational phase:

- Scour effects due to the exposure of the export cables or the use of additional cable protection measures

5.6.7 The distance from the Project Site to the Shell Flat and Lune Deep SAC is 20 km and 29 km to the Drigg Coast SAC. Chart 5.3 shows the Project Offshore Cable Corridor in relation to the Shell Flat and Lune Deep SAC and the Drigg Coast SAC. Chart 5.4 shows the location of potential Annex I cobble reef habitat in relation to the export cable corridor.

ASSESSMENT

Offshore Cable Corridor

5.6.8 Effects during the operational phase of the Project may be considered to arise as a result of changes to the sediment transport regime due to the presence of the wind farm at the Project Site. It has been shown (ABPmer, 2012) however that the predicted effect of wind farm foundations on tidal currents will be confined to a small proportion of the total Project wind farm Site. The footprint of effect will rotate and reverse with the tide throughout the tidal cycle, with effects only being experienced within the order of tens of metres from each foundation (ABPmer, 2012).

5.6.9 No far-field effects on the hydrodynamic regime are anticipated as a result of the presence of the wind farm at the Project Site and therefore no likely significant effects are predicted on the Drigg Coast SAC, the Crocker Carbonate Slabs Offshore SAC and the Pisces Reef Complex Offshore SAC due to their distance from the Project Site.

5.6.10 As stated in Table 5.1, and shown on Chart 5.3, the Offshore Cable Corridor is located on the boundary of the southern section of Lune Deep. There is therefore potential for a likely significant effect on the Sandbanks and Reefs Annex I habitats present within this site during the construction and operation phases associated with the export cable.

5.6.11 The Offshore Cable Corridor runs through the Morecambe Bay SAC (as shown on Chart 2.3). The construction methodology for installing the cable is likely to be either ploughing, trenching or jetting, or a combination of these techniques. Table 5.2 shows the potential for a likely significant effect on the features of the Morecambe Bay SAC as result of the export power cable installation.

Table 5.2: Potential effect on Annex I habitat features of Morecambe Bay SAC

Morecambe Bay designated feature	Potential effect on feature	Potential for LSE?
Estuaries	Disturbance to sub-features - mudflats and sandflats	No. The offshore wind farm site is located too far away from the estuary to account for any direct or indirect effects on the Estuary feature but there is a potential for LSE on estuary sub-features (qv) from the export cable installation.
Mudflats and sandflats	Habitat disturbance and increase in SSC	Yes.
Large shallow inlets and bays	Disturbance to sub-features – mudflats and sandflats	No. The offshore wind farm site is located too far away from these features to account for any direct or indirect effects but there is a potential for LSE on mudflat and sandflat sub-features (qv) from the export cable installation.
Perennial vegetation of stony banks	Habitat loss and disturbance	No. No effect predicted due to distance between features and Offshore Cable Corridor, no mechanism for effect on perennial vegetation of stony banks.
Salicornia and other annuals colonising mud and sand	Habitat loss and disturbance	Yes
Atlantic salt meadow	Habitat loss and disturbance	Yes
Sandbanks which are slightly covered by seawater all the time	Damage / disturbance to feature	No. No effect predicted due to distance between features and Offshore Cable Corridor, no mechanism for effect.
Coastal lagoons	Damage to feature	No. No effect predicted due to distance between features and Offshore Cable Corridor, no mechanism for effect.
Reefs	Damage to feature	No. No effect predicted due to distance between features within the Morecambe Bay SAC and the Offshore Cable Corridor, no mechanism for effect. There are no confirmed areas of Annex I reef along the export cable corridor within the Morecambe Bay SAC (see Chapter 10 of the ES, Annex B.4.K).

CONCLUSION

5.6.12 No likely significant effect is predicted on the Drigg Coast SAC, the Crocker Carbonate Slabs Offshore SAC, or the Pisces Reef Complex Offshore SAC as a result of the distance of the Project wind farm Site and Offshore Cable Corridor from these SAC sites. These SACs are screened out from further assessment in this HRA. Natural England has expressly agreed the scoping out of effects on the Drigg Coast SAC.

5.6.13 There is potential for a likely significant effect on the following features of the Morecambe Bay SAC:

- Mudflats and sandflats;
- Salicornia and other annuals colonising mud and sand; and
- Atlantic salt meadow

5.6.14 There is potential for a LSE on the following features of the Shell Flat and Lune Deep SAC:

- Sandbanks which are slightly covered by sea water all the time; and
- Reefs

5.6.15 These potential LSE will therefore be carried forward for further assessment. See Section 6 below.



5.7 Marine Mammals

5.7.1 This section is informed by data from site-specific surveys and desk studies undertaken by CMACS (Centre for Marine and Coastal Studies), DCE (Danish Centre for Environment and Energy) and NIRAS Consulting Ltd, notably in relation to offshore renewable energy developments in and around the Project study area, and by wider marine mammal sighting data collation programmes such as that coordinated by JNCC and Sea Watch Foundation. Baseline survey data for the Project Site is shown in Table 4.5 where the two marine mammals recorded were harbour porpoise and grey seal.

5.7.2 Marine mammals listed in Annex II of the Habitats Directive include:

- Harbour porpoise (Phocoena phocoena);
- Bottlenose dolphin (Tursiops truncatus);
- Common (harbour) seal (Phoca vitulina); and
- Grey seal (Halichoerus grypus).

5.7.3 The most commonly recorded cetaceans in the Irish Sea are harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin and minke whale (Hammond et al., 2005; Baines and Evans, 2009).

5.7.4 Within the Irish Sea, the majority of haul out sites for grey seal are located in Wales and Ireland. Since the early 1990's grey seals have been seen off Walney island (they have been present off the Isle of Man for many years previous to that). Increasing numbers now haul out on the spit at South Walney, with between 20 and 50 usually present and occasionally over 100, and similar numbers may be present in summer at a low water haul out on a Solway sandbank (http://www.cumbria-wildlife.org.uk/greyseal.html accessed 25/03/2013).

5.7.5 Although common seals generally have a much wider distribution than grey seals, very few occur in the Irish Sea (SCOS, 2011). There are very occasional sightings of common seal around the west Cumbrian coast and in recent years several pups have been born at midsummer on the Duddon Estuary. They are also recorded sometimes in Morecambe Bay in the Ulverston Channel and off Humphrey Head (http://www.cumbria-wildlife.org.uk/greyseal.html accessed 25/03/2013)

POTENTIAL EFFECTS

5.7.6 The Project has the potential to affect Annex II marine mammals via the following activities.

During the construction phase:

- Construction and piling noise causing lethal and sub-lethal effects;
- Construction and piling noise causing displacement of prey species; and
- Disturbance and displacement of marine mammals resulting from the noise and vibration from servicing and maintenance vessels.

5.7.7 During the operational phase:

- Disturbance due to operational noise;
- Displacement from the Project site due to maintenance activity; and
- EMF effects.

5.7.8 Table 5.3 provides information on the marine mammals recorded at the Project site and surrounding area.



Table 5.3: Marine mammal characterisation at SACs located within the regional study area

Species	Irish Sea distribution	Local characterisation	SAC information	Potential for LSE
Harbour porpoise	Present throughout the year with concentrations in the Irish Sea	Total of 132 harbour porpoise observed in aerial surveys with a maximum density of 0.23 ind / km² . Maximum density observed in boat based survey 0.04 ind / km² .	Rockabill to Dalkey Island cSAC (Republic of Ireland) 170 km from the Project site Skerries and Causeway SAC (Northern Ireland) 250 km Roaringwater Bay and Islands SAC (Republic of Ireland) > 530 km Blasket Islands SAC (Republic of Ireland) 640 km	No potential for LSE due to the distance of the Project site from the SAC sites
Bottlenose dolphin	Concentrated in Cardigan Bay Wales and south-east coast of Ireland	None observed during aerial and boat-based surveys.	Pen Llyn a`r Sarnau / Lleyn Peninsula and the Sarnau SAC (Wales) 145 km from Project site Cardigan Bay / Bae Ceredigion SAC (Wales) 220 km West Connacht Coast cSAC (Republic of Ireland) > 520 km Lower River Shannon SAC (Republic of Ireland) > 730 km	No potential for LSE due to distance from SAC and cSAC sites
Common (harbour) seal	Northern Irish coast and Western Isles	5 unidentified seals records during aerial surveys, maximum density of 0.029 ind / km² .	Murlough SAC (Northern Ireland) 124 km from Project site Strangford Lough SAC (Northern Ireland) 127 km South-East Islay Skerries SAC (Scotland) 230 km Slaney River Valley SAC (Republic of Ireland) 280 km Eileanan agus Sgeiran Lios mór SAC (Scotland) 380 km Rutland Island and Sound SAC (Republic of Ireland) 380 km	No potential for LSE due to distance from designated sites. Seals identified during site surveys are likely to be from local haul out sites.

Table 5.3: Marine mammal characterisation at SACs located within the regional study area

Species	Irish Sea distribution	Local characterisation	SAC information	Potential for LSE
Grey seal	St. George's Channel and Bristol Channel	Grey seals were recorded at relatively low numbers and frequency in Project-specific surveys. Thirteen seals were recorded in boat-based surveys and ten recorded in aerial surveys. Encounter rates and sightings per unit effort (per hour) were also calculated for boat-based surveys. These are difficult to interpret due to the low number of observations and lack of observations for a number of the months surveyed. Encounter rates did not exceed 0.05 individuals per km (July, 2011), and sightings per unit effort were no higher than 0.43 individuals per hour (July, 2011). Grey seals are also found around the coasts of the Isle of Man, and important haul-out sites include The Sound, Langness, Maughold and the Calf of Man. The Calf of Man is noted as a minor colony and pupping site for small numbers of grey seals (Hanley et al. 2012). South Walney Island, whilst not a colony, is also identified as a haul-out site for grey seals. Located 20 km from the Project Site at its closest point, the island accommodates summer visitors from the Isle of Man and between 20 and 50 individuals are usually present.	Pen Llyn a`r Sarnau / Lleyn Peninsula and the Sarnau SAC 145 km from Project site Lambay Island SAC (Republic of Ireland) 170 km The Maidens SAC (Northern Ireland) 170 km Cardigan Bay / Bae Ceredigion SAC (Wales) 220 km Pembrokeshire Marine SAC 278 km from project site Saltee Islands SAC (Republic of Ireland) 300 km Horn Head and Rinclevan SAC (Republic of Ireland) 350 km Treshnish Isles SAC (Scotland) 360 km	No potential for LSE due to distance from designated sites. Seals identified during site surveys are likely to be from local haul out sites

CONCLUSION

5.7.9 Due to the distance of the project site from the European Sites where marine mammals are qualifying features and the low numbers of marine mammals observed in Site surveys, there is considered to be no potential for a likely significant effect on SAC sites with marine mammal interest features as a result of the Project. This conclusion is agreed with both Natural England and CCW.

5.8 Intertidal Ornithology

5.8.1 The Birds Directive provides for the protection, management and control of all species of naturally occurring wild birds in the European territory of Member States. Special Protection Areas (SPAs) are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive (2009). They are classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.

5.8.2 The Project Site lies 20 km offshore from the boundary of the Morecamble Bay SPA / Ramsar site, and the Project Offshore Cable Corridor runs through that site to a landfall at Middleton Sands (Chart 2.3).

5.8.3 Morecambe Bay SPA qualifies under the Birds Directive by supporting:

- Internationally important populations of breeding little tern (Sterna albifrons) and Sandwich tern (Sterna sandvicensis).
- Breeding Herring Gull (Larus argentatus)
- Breeding Lesser Black-backed Gull (Larus fuscus)
- Passage ringed plover (Charadrius hiaticula) and sanderling (Calidris alba)
- Wintering bar-tailed godwit (Limosa lapponica)
- Wintering golden plover (Pluvialis apricaria)
- Wintering curlew (Numenius arquata), dunlin (Calidris alpina alpine), grey plover (Pluvialis squatarola), knot (Calidris canutus), oystercatcher (Haematopus ostralegus), Pink-footed Goose (Anser brachyrhynchus), pintail (Anas acuta), redshank (Tringa tetanus), shelduck (Tadorna tadorna), turnstone (Arenaria interpres)
- A breeding season seabird assemblage of international importance
- A wintering season waterfowl assemblage of international importance

5.8.4 The potential for likely significant effects on SPA / Ramsar bird populations using the intertidal is considered for the construction phase and the operational phase of the Project.

5.8.5 During the construction phase (installation of the export cable):

- Construction disturbance and displacement of birds resulting in temporary loss of foraging / roosting areas on the intertidal area and the onshore cable installation area in the vicinity of the landfall site;
- Construction disturbance and displacement of breeding bird SPA / Ramsar features; and
- Indirect impact from the installation and burial of the export cable on prey availability in the mudflat and sandflat habitats.

5.8.6 During the operational phase (offshore wind turbines and export power cable):

- Collision risk to wintering bird populations moving between intertidal habitats at SPA / Ramsar sites; and
- Disturbance and displacement of birds resulting in loss of foraging / roosting areas due to scheduled maintenance activity in the intertidal zone.

ASSESSMENT - CONSTRUCTION PHASE

Disturbance to passage and wintering birds in the intertidal

5.8.7 During intertidal bird surveys fifteen species listed as interest features of the Morecambe Bay SPA and Ramsar were identified; Shelduck, oystercatcher, golden plover, grey plover, ringed plover, curlew, bar-tailed godwit, redshank, knot, dunlin, sanderling, turnstone, cormorant, Lesser Black-backed Gull, and black-headed gull. The following SPA assemblage features were also identified; wigeon, eider, red-breasted merganser and lapwing (Marsh, 2012).

5.8.8 The baseline survey of the intertidal area (reported in Table 4.7) shows that the intertidal mudflats (shown in Chart 4.5) are utilised by nationally and / or internationally important numbers of four key species; knot, dunlin, bar-tailed godwit, and grey plover. Knot and dunlin are present in very large numbers (peaks of 27,030 and 6808) during the winter period feeding in tight but mobile flocks across the mudflats, not limited to specific feeding areas but moving in response to the position of the tideline. The area north of Potts Corner (Area 6, Chart 4.5) was used as a roosting area on neap and lower spring tides with birds using the Middleton saltmarsh (Area 24SM, Chart 4.5) on higher tides, in particular the area of the saltmarsh further to the south away from anthropogenic disturbance around Pott's Corner (Marsh, 2012).

5.8.9 The Offshore Cable Corridor crosses the intertidal mudflats / sandflats from the estuary channel to the immediate south of Potts Corner and then crosses the northern tip of the Middleton saltmarsh parallel to the sea defence before crossing the sea defence into the field located at grid reference SD 41675 57105 (see Chart 2.5).

5.8.10 A 500 m wide construction corridor is assumed through the mudflats and sandflats above the low tide mark. The indicative total installation time for each cable system from the subtidal within the Bay across the intertidal and under the saltmarsh and sea defence to a jointing bay on the landward side of the defence is up to 3 months.

5.8.11 Due to the location (Morecambe Bay SPA / Ramsar), nature (potential for noise and visual disturbance), and duration (up to 3 months per cable system) of the engineering operation and the sensitivity of the Middleton Sands area for qualifying features of these Natura 2000 sites there is a potential for a likely significant effect on these Natura 2000 sites as a result of disturbance and displacement of wintering and passage birds.

Disturbance to breeding birds

5.8.12 Morecambe Bay SPA / Ramsar site is designated for breeding little tern and Sandwich tern, breeding Lesser Black-backed Gull, Herring Gull and a breeding seabird assemblage. None of these breeding bird colonies are within the vicinity of Middleton Sands - the closest colonies are understood to be at South Walney (on the north side of the Bay) and the intertidal zone in the Offshore Cable Corridor is not identified as providing a significant feeding resource for these qualifying features. Consequently, the construction works in the intertidal zone are assessed as not likely to have a significant effect on the breeding bird features of the Morecambe Bay SPA and Ramsar sites.

Reduction in prey availability

5.8.13 Mudflats within the intertidal zone provide a key feeding resource for some of the passage and wintering birds that are qualifying features of the Morecambe Bay SPA and Ramsar sites. The benthic survey carried out for this Project identified the presence of a generally sandy foreshore dominated by

polychaete worms with occasional burrowing amphipods with no particular concentrations or "hot spots" that would provide preferential feeding areas.

5.8.14 This assumed resource distribution is reflected in the observed feeding behaviour of birds on the intertidal where no area is preferred over another other than determined by the time since exposure by the ebbing tide and by implication the availability of prey species close to the sediment surface (Marsh, 2012).

5.8.15 The HDD operation to cable under the saltmarsh and sea defences will require the excavation of an exit / entry pit on the mudflat / sandflat. Each cable system will require a separate pit.

5.8.16 The cable trenching and re-instatement for the export cable installation across the mudflat / sandflat will cover approximately 24,500 m² (2.45 ha) of mudflat / sandflat habitat in the intertidal zone (a nominal 3,500m length from the mean low water mark to the HDD drill exit point at least 50 m seaward of the saltmarsh habitat by a nominal 1.4 m width trench x 5 trenches). This represents approximately 0.41 % of the estimated 600 ha of mudflat / sandflat habitat available on Middleton sands. The disturbance to surface sediments during the trenching operation will result in a localised but temporary disturbance to prey species along the surface footprint of the trenches. Given the small scale of this effect, and the likelihood that benthic fauna will subsequently recolonise these areas, no likely significant effect on intertidal bird populations is predicted from reduced prey availability.

ASSESSMENT - OPERATIONAL PHASE

5.8.17 Collision risk to wintering bird populations

5.8.18 A suite of waterbird species found in the intertidal zone have the potential to pass through or over the Project wind farm Site during passage periods and are potentially at collision risk from operational wind turbines. Given the size of the migratory and wintering waterbird populations using the Morecambe Bay SPA / Ramsar site (209,498 birds, 5 year average to 2010/11 (Holt et al., 2012)) a likely significant effect cannot be excluded at this stage.

Disturbance from scheduled maintenance activity

5.8.19 The burial depth of cables will be monitored routinely after installation. For cables buried offshore a remotely operated vehicle housing an electromagnetic system will be used. This system may be applicable for sections of the intertidal at high tide, additionally a land-based survey technique may be used involving a vehicle incorporating a cable tracker. It is expected that routine inspection of the cable burial depth will be a condition of the marine licence and that an inspection regime of twice yearly inspections for the first three years and yearly thereafter will be required. In addition, the cable joints (onshore) will be routinely inspected and tested, this is predicted to occur yearly and take up to a week and will require vehicle access to the field(s) landward of the sea defence. This (low) level of scheduled maintenance activity is such that it is assessed as not likely to have a significant effect on any of the intertidal interest features of the Morecambe Bay SPA / Ramsar sites.



5.9 Offshore Ornithology

5.9.1 The Birds Directive provides for the protection, management and control of all species of naturally occurring wild birds in the European territory of Member States. Special Protection Areas (SPAs) are strictly protected sites classified in accordance with Article 4 of the Birds Directive (2009). They are classified for rare and vulnerable birds (as listed in Annex I of the Directive), and for regularly occurring migratory species.

5.9.2 The potential sensitivities of bird species to the offshore aspects of the wind farm development are:

- Disturbance and displacement of birds from the Project Site resulting from the noise and visual presence of construction vessels and other associated equipment;
- Reduction in prey availability through the disturbance and displacement of fish and other prey species from the Project Site during construction;
- Displacement of birds from the Project Site resulting from the presence of operational turbines and maintenance vessels; and
- Collision with rotating turbine blades.

ASSESSMENT - SEABIRDS

5.9.3 Table 5.4 details the potential for likely significant effect on seabirds as result of the Project based on the proximity to European Sites and the densities of species within the Project Site and 4 km buffer.



Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Red-throated diver	A peak count of 76 birds (0.16 individuals / km²) occurred in October 2012. Peak numbers in boat-based surveys were considerably lower reaching a peak of just 6 birds in September 2011 and January 2011.	N/A	N/A (Red-throated diver is however a designated feature of Liverpool Bay SPA 17 km to the south of the Project offshore wind farm Site) Proposed feature of the Upper Solway Flats and Marshes SPA	Offshore Cable Corridor runs through northern extent of Liverpool Bay SPA. 75 km	Yes. The export cable runs through the northern extent of Liverpool Bay SPA. However, low densities within the Project area and Liverpool Bay SPA 17 km from Project Site. No potential for LSE on Upper Solway Flats and Marshes SPA due to distance.
Common scoter	Aerial surveys of the Project Site recorded common scoters in low numbers in a limited number of surveys. A peak count of 28 birds (0.06 individuals / km²) occurred in August 2011. Peak numbers in boat-based surveys were higher reaching a peak of 451 birds in June 2011 (0.97 individuals / km²), although apart from in July 2011 this species was virtually absent at all other times	N/A	N/A (Common scoter is however a designated feature of Liverpool Bay SPA 17 km to the south of the Project ofshore wind farm Site) Ribble and Alt Estuaries SPA (wintering)	Export cable runs through northern extent of Liverpool Bay SPA. 34 km	Yes. The export cable runs through the northern extent of Liverpool Bay SPA. However, low densities within the Project area and Liverpool Bay SPA 17 km from Project Site Ribble and Alt Estuaries SPA located too far from Project Site boundary or Offshore Cable Corridor for effect to occur.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Manx Shearwater	Peak count occurred in May 2012 when 1417 birds were estimated to be present (a density of 3.06 birds / km²). A four figure count (1017) also occurred in September 2012, with other notable counts in April 2011 (445) and August 2011 (434). During boat based surveys peak count in May 2012 of 11591 birds (25.04 km²).	330	Aberdaron Coast & Bardsey Island SPA (breeding) Skokholm and Skomer SPA (breeding) Copeland Islands SPA (breeding)	147 km 287 km 120 km	Yes. Project site within foraging range of 3 SPAs, with high densities present throughout the summer months. The Project site is considered to be beyond the range of two Scottish SPAs - Rum (more than 400 km distant) and St Kilda (more than 500 km distant).
Little gull	Aerial surveys of the Project Site recorded little gulls in just five of the 22 surveys undertaken. A peak count occurred in November 2011 when 28 birds were estimated to be present (a density of 0.06 birds / km²). Boat-based survey results were similar in that the peak population was 16 birds (0.04 birds / km²), with this count in November 2012.	233	Mersey Narrows & North Wirral Foreshore pSPA (passage) Proposed additional feature of the Liverpool Bay SPA	70 km 17 km	No. Low densities during the passage period, the passage front involving birds from the pSPA is considerably to the south of the Project Site and connectivity is considered unlikely.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Black-headed gull	Aerial surveys of the Project Site recorded black-headed gulls in just three of the 22 surveys undertaken. Numbers were extremely low in all cases and a peak count occurred in May 2012 when 11 birds were estimated to be present (a density of 0.02 birds / km²). Boat-based survey results were similar in that the peak population was of 16 birds (0.04 birds / km²)	25.5	Noteworthy species for Morecambe Bay Ramsar (breeding).	20 km	No. Black-headed gull were recorded in very low densities within baseline survey work and the species is not included as a full qualifying species of any SPA or Ramsar site within foraging range.
Lesser Black-backed Gull	Aerial surveys of the Project Site recorded Lesser Black-backed Gulls in twelve of the 22 surveys undertaken. A peak count occurred in November 2011 when 154 birds were estimated to be present (a density of 0.33 birds / km²). Boat-based survey results for Lesser Black-backed Gulls involved a dramatic peak in numbers in March 2012 of a population estimated at 2223 birds at a density of 4.80 individuals / km²	141	Ribble and Alt Estuaries SPA (breeding) Morecambe Bay SPA and Ramsar Bowland Fells SPA Ailsa Craig SPA	34 km 20 km 54 km 143 km	Yes. Project site located within foraging range of 4 SPAs (noting that the Project Site is on the boundary of the Ailsa Craig foraging range) and birds are present at the Project Site throughout the year.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Common tern	Arctic and common tern are often impossible to distinguish at range during surveys, and are often recorded as 'commic' terns. However, positive identification of Arctic tern was made during the aerial surveys. No common tern were specifically identified in either the aerial or boat-based surveys. Arctic tern were recorded in negligible numbers during both aerial and boat-based surveys of Walney Extension	15.2	Ribble and Alt Estuaries SPA Proposed additional feature of the Liverpool Bay SPA	34 km 17 km	No. Sites located beyond foraging range for birds originating from Ribble and Alt SPA, and numbers within the Project Site too low to be considered significant.
Sandwich tern	Sandwich tern were recorded in negligible numbers during both aerial and boat-based surveys of the Project Site. A peak population of 4 birds from aerial surveys (0.01 ind / km²) and 6 birds from boat-based surveys (0.01 ind / km²)	49	Morecambe Bay SPA and Ramsar Duddon Estuary SPA Proposed additional feature of the Liverpool Bay SPA	20 km 20 km 17 km	No. Although Morecambe Bay and Duddon Estuary SPA are within range of this species recorded densities were too low for a likely significant effect to occur. Both the Dee Estuary SPA (71 km away) and Cemlyn Bay and the Skerries SPA (87 km) fall outside the mean maximum foraging range for this species.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Cormorant	Aerial surveys of the Project Site recorded cormorant in only four of the 22 surveys undertaken. Numbers were low in all cases and a peak count occurred in April 2012 when 10 birds were estimated to be present (a density of 0.02 birds / km²). Boat-based survey results were similar in that the peak population was of 29 birds (0.06 birds / km²) in August 2012.	25	Ribble and Alt Estuary SPA (Wintering assemblage feature) Morecambe Bay SPA (Wintering assemblage feature)	34 km 20 km	No. Densities low during summer months and only one record in winter months (November 2012).
Fulmar	Present in low numbers in aerial surveys with a peak count of 20 birds (0.04 individuals/km²) in July 2011. Numbers in boat based surveys were similar to those recorded in aerial surveys with a peak of 12 birds in May 2012.	400	Lambay Island SPA (Republic of Ireland) Rathlin Island SPA (Northern Ireland) Saltee Islands SPA (Republic of Ireland)	170 km 215 km >300 km	No. Densities low throughout the Project Site surveys

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Gannet	Aerial surveys of the Project Site recorded Gannet in all but three surveys (January – March 2012). Numbers were variable and a peak count occurred in October 2012 when 592 birds were estimated to be present (a density of 1.28 birds / km²).	229	Ailsa Craig	170 km	Yes. Project Site within foraging range and species present throughout the Site in summer months. The Grassholm SPA is outside of the mean maximum foraging range for this species and therefore not considered further (287 km distant).
Great skua	Uncommon passage migrant; recorded in just 2 surveys with a peak population of 20 birds.	N/A	None	N/A	No. Present in low densities in only 2 surveys and no designated SPAs within the study area. Passage flux and collision of great skua has been analysed in line with appropriate Collision Risk Modelling methods and the results reported in Annex 1.
Kittiwake	Common in most aerial surveys with a peak in March 2012 (3.17 individuals / km²). Boat based surveys showed similar results although the peak count occurred in November 2012 of 1431 birds (3.93 individuals / km²).	60	None	N/A	No. There are no SPAs within foraging range for this species. Large densities in spring and autumn indicate dispersal from local breeding colonies.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Common Gull	Present in 13 aerial survey, population estimates were <25 birds with the exception of November 2011 and March 2012.	50	None	N/A	No. Population estimates low for this species and no SPAs within foraging range.
Herring Gull	Present throughout the winter and common in early spring; rare or absent during the breeding season.	61.1	Morecambe Bay SPA (breeding)	20 km	Yes. Although species predominantly present throughout winter and densities low within the Project Site during the breeding season, this species maybe be at risk from collision related mortality and SPA is within foraging range.
Great Black-backed Gull	Present on occasion during aerial surveys with a peak count occurring in November 2011 (236 birds, 0.51 individuals / km²).	N/A	None	N/A	No. Generally present in low-moderate numbers in autumn to spring and no SPAs designated for this species within the study area.
Guillemot	Most abundant species recorded present in all 22 aerial surveys, peak population in July 2012 when population of 6580 birds present (14.31 individuals / km²).	84.2	None	N/A	No. There are no SPAs designated for this species within foraging range, the large numbers present are likely to originate from local colonies.

Table 5.4: Potential LSE on offshore ornithological features

Species present during site surveys	Site usage (all densities refer to the Project Site plus 4km buffer)	Mean maximum foraging range (km) taken from Thaxter et al (2012)	SPA sites within foraging range	Distance from SPA to Project Site	Potential for LSE?
Razorbill	Common throughout the year, specifically identified in nine of the 22 aerial surveys. A peak population occurred in November 2011 when 6624 (14.21 individuals / km²). Boat-based survey results show a peak population (calculated by Distance Analysis) of 4265 birds in March 2012.	48.5	None	N/A	No. There are no SPAs designated for this species within foraging range, the relatively large numbers present are likely to originate from local colonies.
Puffin	Scarce, recorded in 10 of the 22 aerial surveys with a peak population of 191 (0.4 individuals / km²).	105.4	None	N/A	No. Low densities recorded and no SPAs within foraging range.



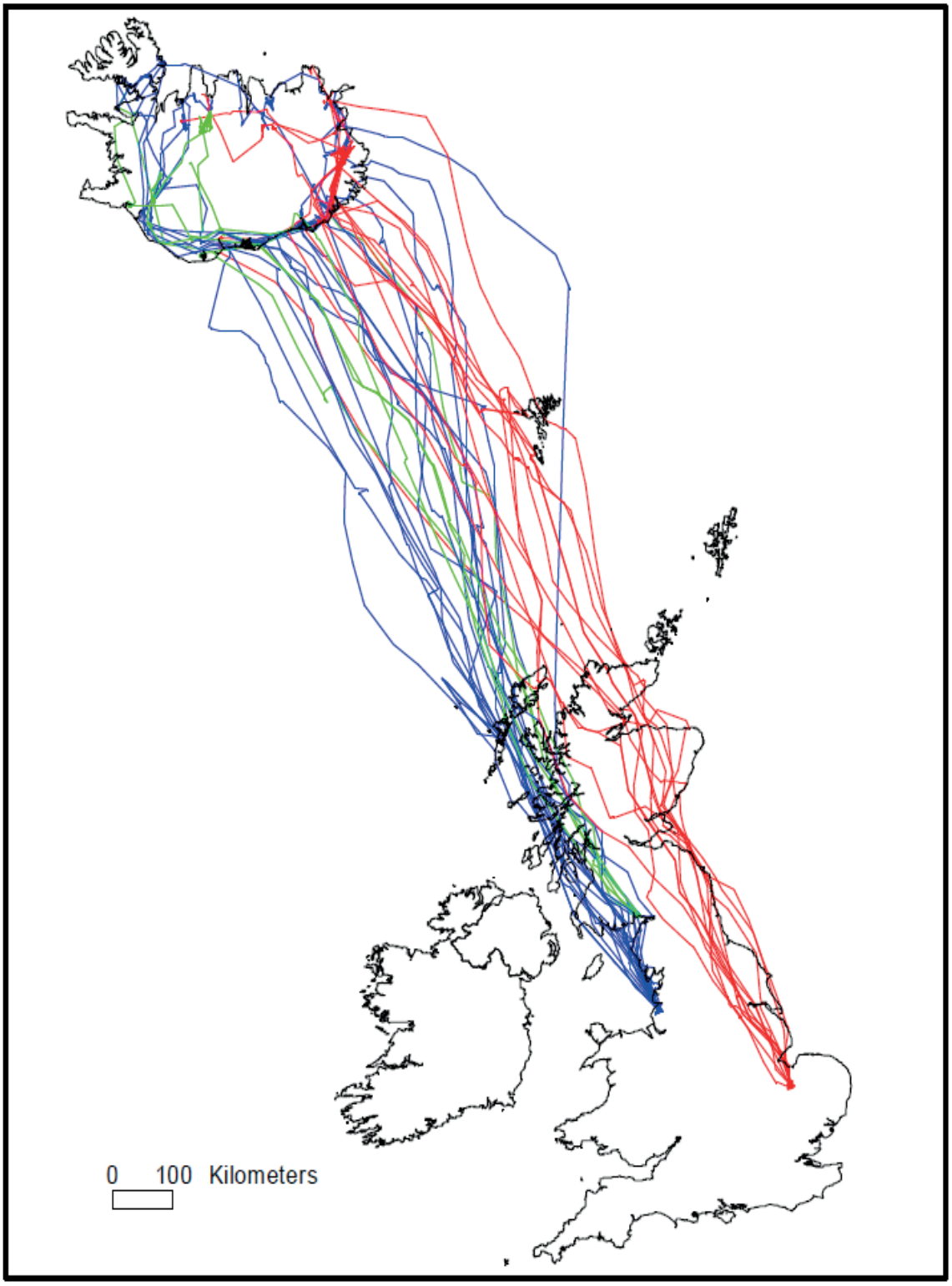


Figure 5.1: Whooper Swan telemetry data from Griffin et al. (2010)

ASSESSMENT – MIGRATORY SWANS AND GEESE

Whooper Swan

5.9.5 Twenty sites in the UK are internationally important for Whooper Swan, including three in Northern Ireland and twelve in Scotland. Autumn migration, triggered by the freezing over of the breeding grounds, begins in mid-September to early October, and peaks in late October to early November. The journey between Iceland and the UK means that there are no migratory staging posts separate from the breeding and wintering ranges. Whooper Swans gather at staging grounds around Iceland and depart directly from these. Birds make the 800-kilometre sea crossing non-stop by day and night (Griffin et al., 2011), although birds will land on the sea to rest or to sit out periods of adverse weather.

5.9.6 There is very limited movement between the major wintering areas throughout the winter (Wernham et al., 2002), the main return journey occurs in March and April and is timed so that birds arrive on the breeding grounds just before the ice clears (Walney Bird Observatory, 2006). Due to the migratory and within winter flight behaviour recorded in the literature, it is therefore considered that there is no evidence that suggests that SPAs away from Lancashire (Martin Mere, Ribble and Alt Estuaries) require consideration in this assessment.

5.9.7 The satellite tracking study of Whooper Swans reported in Griffin et al. (2010) found that swans migrating from east England (Welney) generally migrated north along the east coast of Britain, whereas those from northwest England and southwest Scotland (Martin Mere and Caerlaverock) followed the western coastline as shown in Figure 5.1. The tracking data show migration routes passing directly through the Project area. As a result there is potential for Whooper Swan to fly through the wind farm site and therefore potential for a likely significant effect on the following SPAs:

- Martin Mere SPA; and
- Ribble and Alt Estuaries SPA.

5.9.8 Although it has been suggested that Whooper Swans show a high degree of winter site fidelity (JNCC, 2009a), it has also been noted that some individuals undertake within winter movements across the Irish Sea (Wernham et al., 2002). This within winter movement from Ireland to Britain is apparently more frequent than those to Britain from Ireland (Wernham et al., 2002). Birds moving between England and Ireland may have the potential to fly through the Project Site and there is therefore potential for a LSE on the following SPAs:

- Lough Neagh and Lough Beg SPA;
- Upper Lough Erne SPA;
- Lough Foyle SPA; and
- Lough Swilly SPA.

Pink-footed Goose

5.9.9 Twenty-four sites in the UK are internationally important for Pink-footed Goose, with the majority found in south and east Scotland (18 sites). There are strong seasonal movements within Britain, with birds moving south during autumn from north Scottish arrival areas. In spring, birds move north again, following the progression of spring grass growth. This means that pink-footed geese may use many separate sites in the course of one winter (JNCC, 2009).

5.9.10 Pink-footed geese generally start to arrive in Britain during early to mid-September, especially at major sites, with numbers building in early to mid-October. The arrival is pronounced at several well-defined

staging areas, especially in north-east and eastern parts of Scotland. Spring migration occurs from late March; arrival dates in Iceland have varied between 25 March and 11 April since 1998.

5.9.11 Whilst there is clearly interaction between SPAs by numbers of pink-footed geese in the UK, sites in Lancashire (e.g. Martin Mere SPA) indicate an early arrival from breeding grounds (from mid-September) indicating a direct migration flyway rather than staging in east Scotland (Budgey, 2010). Spring migration can therefore be assumed to take a similar pattern.

5.9.12 The majority of pink-footed geese recorded during the Walney Bird Observatory Study (2006) utilising the Eastern Irish Sea Flyway were found to use a migration route offshore from the Walney Island coast. A total of 67 flocks, comprising 4,843 birds, were recorded during the migration study. Although the majority of birds seen were beyond the 6



km mark, birds were found to move along the Eastern Irish Sea Flyway on a broad front.

5.9.13 However, as part of the Environmental Statement for the Walney I and II offshore wind farm Projects, the majority of the observed pink-footed geese (76%) were passing less than 4.2 km from Walney Island. About half of the birds (56%) were passing less than 2.5 km from the coastline. Some pink-footed geese were passing further offshore and 576 birds (12%) were observed passing at the same distance from Walney Island as from Barrow Offshore Wind Farm (BOWind, 2008).

5.9.14 Radar studies undertaken at Walney Island detected sixty-three migration flightlines for this species. The preferred migration route was considered to be close to land with approximately 88% of flightlines within 6 km of the shore or overland. No migration was detected over the Walney I and II turbine arrays although there was uncertainty of the extent at which the radar could detect bird movements (Budgey, 2010).

5.9.15 Budgey (2010) states that "if most flocks were detected at nearly 10 km along the coast, and all were detected at nearly 5 km, one would expect that, if they were present, a similar number of flocks would be detected at that distance out to sea. On the basis of this assumption, it follows that low numbers of detections at greater than 5km out to sea was caused by a real lack of flocks at that distance." Furthermore, a number of tracks were first detected at over 15 km distance, along the coast. No tracks were detected at this distance perpendicular to the coast (Budgey, 2010).

5.9.16 The radar was operated virtually continuously during a three week period in October 2010 with the temporal abundance of tracks observed at Walney Island corresponding well with the numbers of birds arriving at WWT Martin Mere, a good proxy for migration arrival numbers (Budgey 2010). The majority of Pink-footed Goose arrival in 2010 occurred between 13 and 17 October (Budgey 2010).

5.9.17 Visually estimating the range at which birds are moving offshore from a land based observation platform is subjective particularly beyond 5 km, even when comparison is made with buoys at known locations, as used by Walney Bird Observatory (2006). For this reason, the radar study is considered the most accurate and true representation of the distance out at sea at which migrating pink-footed geese pass Walney.

5.9.18 The eastern Irish sea coast migratory route for Pink-footed Goose can be said to be significant, although densities are seen to reduce significantly beyond 4km from shore. There is potential for LSE on the following SPAs designated for Pink-footed Goose:

- Martin Mere SPA and Ramsar;
- Morecambe Bay SPA and Ramsar; and
- Ribble and Alt Estuaries SPA and Ramsar.

Greenland white-fronted goose

5.9.19 After breeding in Greenland, family groups and flocks of Greenland White-fronted Goose migrate south to stage in Iceland where they rest and feed for about a month (Fox et al. 2006, Wernham et al. 2002). They then undertake the last leg of their journey to reach wintering grounds in Scotland, North England and Wales. The actual migration route from Iceland to the Dyfi Estuary is not known, but the sort of direct flight route that is undertaken by many geese and swans (see Griffin et al. 2011), would theoretically not cross the Project Site. There is considered to be no potential for likely significant effect on the Dyfi Estuary SPA.

5.10 Initial screening summary

5.10.1 Following the initial screening phase, this assessment identifies a potential for a likely significant effect on the sites and features listed in Table 5.5. The location of these sites is indicated on Chart 5.5.

Table 5.5: Sites and features screened into the assessment following the initial screening stage

Site	Feature
Morecambe Bay SAC	Mudflats and sandflats *Salicornia* and other annuals colonising mud and sand Atlantic salt meadow
Shell Flat and Lune Deep SAC	Sandbanks which are slightly covered by sea water all the time Reefs
Morecambe Bay SPA and Ramsar	Wintering birds in the intertidal: Shelduck, oystercatcher, golden plover, grey plover, ringed plover, curlew, bar-tailed godwit, redshank, knot, dunlin, sanderling, turnstone, cormorant, Lesser Black-backed Gull, and black-headed gull. Lesser Black-backed Gull (breeding) Herring Gull (breeding) Pink-footed Goose (wintering)
Liverpool Bay SPA	Red-throated diver (wintering) Common scoter (wintering)
Bowland Fells SPA	Lesser Black-backed Gull (breeding)
Ribble and Alt Estuaries SPA and Ramsar	Lesser Black-backed Gull (breeding) Whooper Swan (wintering), Pink-footed Goose (wintering)
Skokholm and Skomer SPA	Manx Shearwater (breeding)
Aberdaron Coast and Bardsey Island SPA	Manx Shearwater (breeding)
Copeland Islands SPA	Manx Shearwater (breeding)
Ailsa Craig SPA	Gannet (breeding)
Martin Mere SPA and Ramsar	Whooper Swan (wintering), Pink-footed Goose (wintering)
Lough Neagh and Lough Beg SPA and Ramsar	Whooper Swan (wintering)
Upper Lough Erne SPA and Ramsar	Whooper Swan (wintering)
Lough Foyle SPA and Ramsar	Whooper Swan (wintering)
Lough Swilly SPA	Whooper Swan (wintering)

5.10.2 Table 5.6 shows those sites and features screened out of the assessment and provides a justification for that conclusion.

Table 5.6: Sites and features screened out of the assessment following the initial screening stage

Site	Feature	Justification
Various SACs (see Section 5.4)	Bats	Distance from the Project Site (> 50 km) and the absence of a mechanism for an effect at that distance.
Various SACs (see Section 5.5)	Diadromous fish	Distance of the SACs with these qualifying features from the Project Site (> 75 km)
Drigg Coast SAC	Annex I habitats	SAC is outside of the Project boundary and is also considered too distant (29 km at closest point) for there to be a mechanism for any indirect effect.
Morecambe Bay SAC	Annex I habitat features: Estuaries Large shallow inlets and bays Perennial vegetation of stony banks Sandbanks which are slightly covered by seawater all the time Coastal lagoons Reefs	Habitats (or instead, where relevant, their sub-features) are not present within vicinity of the cable corridor so there is considered no mechanism for a direct effect.
Various (see Section 5.7)	Marine mammals	The distance from the offshore wind farm Project Site to SAC sites with marine mammal qualifying features (nearest 127 km)
Morecambe Bay SPA and Ramsar	Loss of prey species for Intertidal bird features: Shelduck, oystercatcher, golden plover, grey plover, ringed plover, curlew, bar-tailed godwit, redshank, knot, dunlin, sanderling and turnstone. Disturbance to SPA assemblage features: wigeon, eider, red-breasted merganser and lapwing.	Construction works in the intertidal zone will not have a likely significant effect on intertidal bird features as a result of loss of prey species due to the small extent and temporary nature of the impact on benthic fauna in the intertidal zone Scheduled maintenance (inspection and testing) works on the intertidal export cable will not have a significant effect on the use of the intertidal due to their occasional nature and small scale
Morecambe Bay SPA and Ramsar	Disturbance to breeding little tern and Sandwich tern Disturbance to breeding Lesser Black-backed Gull, Herring Gull Disturbance to breeding seabird assemblage	Construction work disturbance in the intertidal zone will not have a likely significant effect on breeding bird features due to the distance of the intertidal export cable corridor from the breeding bird colonies.

6.0 ASSESSMENT OF LIKELY SIGNIFICANT EFFECT

6.1 Introduction

6.1.1 Following the initial screening process, more detailed information is used to assess the potential effects from each project phase on the sites and features identified in Section 5 Table 5.5.

6.1.2 The assessment of likely significant effect from each project phase has been divided into specific receptor based sections as defined below:

- **Seabirds:** Assessment of designated seabird features screened into the assessment in Section 5.7 which have the potential to be affected by offshore Project activity, distinguishing where relevant between disturbance, displacement, and collision effects. This includes; Lesser Black-backed Gull, Herring Gull, Gannet, Manx Shearwater, red-throated diver and common scoter;
- **Wader and wildfowl:** Assessment of designated wader and waterfowl features screened into the assessment in Section 5.6, which have the potential to be affected by the installation and operation of the export cable. The includes the wader and wildfowl species of the Morecambe Bay SPA and Ramsar sites; and
- **Habitats:** Assessment of designated habitat features screened into the assessment in Section 5.4, which have the potential to be affected by the installation and operation of the export cable. This includes habitat features of the Morecambe Bay SAC and Shell Flat and Lune Deep SAC (Table 6.3 and Table 6.4).

6.1.3 Table 6.1 documents the assessment of likely significant effect from the Project alone on the seabird qualifying features of the following SPA and Ramsar sites; Morecambe Bay SPA and Ramsar, Bowland Fells SPA, Ribble and Alt Estuaries SPA and Ramsar, Ailsa Craig SPA, Aberdaron Coast and Bardsey Island SPA, Skokholm and Skomer SPA, Copeland Islands SPA, and Liverpool Bay SPA.

6.1.4 Table 6.2 docments the assessment of likely significant effect from the Project alone on the wader and wildfowl qualifying features of the Morecambe Bay SPA and Ramsar.

6.1.5 Table 6.3 documents the assessment of likely significant effect from the Project alone on the Annex I habitat features of the Morecambe Bay SAC.

6.1.6 Table 6.4 documents the assessment of likely significant effect from the Project alone on the Annex I habitat features of the Shell Flat and Lune Deep SAC.

6.1.7 Whooper Swan and Pink-footed Goose have the potential to interact with the Project during its operational phase via collision with turbine blades. In order to determine the potential for a likely significant effect on the sites screened into assessment (Ribble and Alt Estuaries SPA and Ramsar, Martin Mere SPA and Ramsar, Lough Neagh and Lough Beg SPA and Ramsar, Upper Lough Erne SPA and Ramsar, Lough Foyle SPA and Ramsar, and Lough Swilly SPA) theoretical collision risk modelling was carried out (See HRA Report, Annex 1).The assessment of LSE on these sites as a result of turbine collision is detailed in Section 6.2.

6.1.8 SNCBs have requested that an assessment is provided of the collision risk to birds using the suite of coastal and estuarine sites in the vicinity of the Project Site. This is provided at Section 6.3.

6.1.9 SNCB interim guidance on the assessment of SPA breeding birds present outside of the breeding season has been followed to produce the assessment of likely significant effect summarised at Section 6.4 and provided at Annex 3 to this Report.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
Construction	Displacement by construction activity (for example, as a result of construction noise and visual presence disturbance, and boat movements)	Lesser Black-backed Gull	Morecambe Bay Bowland Fells Ribble and Alt Estuaries Ailsa Craig	N	Lesser Black-backed Gull frequently associate with vessels and human activity (e.g. fishing activity) (Mitchell et al., 2004) and may exploit novel foraging opportunities created by construction activities that may make prey more available to them. In addition, Lesser Black-backed Gulls are highly mobile foragers that spend significant proportions of time in flight (Furness and Wade, 2012) and hence are not considered to be vulnerable to boat traffic or displacement by construction activities.
		Herring Gull	Morecambe Bay	N	Herring Gull are highly mobile foragers that spend significant proportions of time in flight (Furness and Wade, 2012) and hence are not considered to be especially vulnerable to boat traffic or construction activities.
		Manx Shearwater	Aberdaron Coast and Bardsey Island Skokholm and Skomer Copeland Islands	Y	Manx Shearwater are highly mobile foragers that spend significant proportions of time in flight (Furness and Wade, 2012) and are not considered to be vulnerable to disturbance from boat traffic. Peak numbers were observed in May 2012 and September 2012 with 29 % of birds recorded observed in foraging activity. However, due to the large numbers of birds recorded in Site surveys and the relative proximity of SPAs with Manx Shearwater as a breeding feature there is considered to be a likely significant effect on these SPAs as a result of displacement in response to construction activity

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
		Gannet	Ailsa Craig	N	Gannet are highly mobile foragers that spend a significant amount of time in flight (Furness and Wade, 2012). Peak numbers were observed in July 2012 during boat-based surveys with only 9 % of birds observed in foraging behaviour, although given the extent of this species' foraging range, this will form part of a much wider area of foraging habitat. Furness and Wade (2012) place the species in the second lowest category for vulnerability to disturbance by wind farm structures, a LSE from from displacement activity is not predicted for this species.
		Red-Throated diver	Liverpool Bay	Y	As red-throated diver are susceptible to displacement as a result of the installation of the export cable through the SPA, a likely significant effect on this SPA cannot be excluded at this stage.
		Common scoter	Liverpool Bay	Y	Common scoter are susceptible to displacement as a result of the installation of the export cable through the SPA, consequently a likely significant effect cannot be excluded at this stage.
	Indirect effects on bird species due to prey availability	Lesser Black-backed Gull	Morecambe Bay Bowland Fells Ribble and Alt Estuaries Ailsa Craig	N	Lesser black backed gull frequently associate with vessels and human activity (e.g. fishing activity) (Mitchell et al., 2004) and may exploit novel foraging opportunities created by construction activities that may make prey more available to them. In addition, the species shows flexibility with respect to foraging area and has a varied diet. Omnivorous species in particular that do not entirely rely on fish in their diet may be insensitive to the temporary displacement of fish even should this occur.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
		Herring Gull	Morecambe Bay	N	Herring Gull show flexibility with respect to foraging area and have a varied diet. Omnivorous species in particular that do not entirely rely on fish in their diet may be insensitive to the temporary displacement of fish, should this occur.
		Manx shearwater	Aberdaron Coast and Bardsey Island. kokholm and Skomer Copeland Islands	N	Manx Shearwater show flexibility with respect to foraging area and have a varied diet. As an omnivorous species, they do not entirely rely on fish in their diet and may be insensitive to the temporary displacement of fish.
		Gannet	Ailsa Craig	N	Gannet are highly mobile foragers that spend a significant amount of time in flight (Furness and Wade, 2012). Peak numbers were observed in July in boat-based surveys with 9 % of birds observed in foraging behaviour. The large foraging range of this species combined with their predation on a relatively wide spectrum of prey implies that Gannets are unlikely to be significantly affected by localised construction effects.
		Red-throated diver	Liverpool Bay	N	Indirect effects on prey are likely to be a result of turbine installation, given the project is located 17 km from the boundary of the SPA no LSE is predicted.
		Common scoter	Liverpool Bay	N	Indirect effects on prey are likely to be a result of turbine installation, given the project is located 17 km from the boundary of the SPA no LSE is predicted.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
Operation	Avoidance and displacement from the Project Site as a result of turbine presence	Lesser Black-backed Gull	Morecambe Bay Bowland Fells Ribble and Alt Estuaries Ailsa Craig	N	There is little indication that Lesser Black-backed Gull will be displaced from operational wind farms. These species are amongst the most flexible in their habitat use and may be observed to take advantage of new foraging opportunities created by human activity. Lesser Black-backed Gulls recorded within boat-based surveys were found to be, in the main, either resting or transiting in the Site with only 14% observed to be foraging
		Herring Gull	Morecambe Bay	N	There is little indication that Herring Gull will be displaced from operational wind farms. These species are amongst the most flexible in their habitat use and may be observed to take advantage of new foraging opportunities created by human activity. The Project site is not considered to represent particularly important foraging habitat for these species as evidenced in the low or only medium use of the site (relative to the entire area). To the extent that if any birds are displaced, it is considered that there are ample alternative foraging opportunities
		Manx Shearwater	Aberdaron Coast and Bardsey Island Skokholm and Skomer Copeland Islands	Y	Maximum numbers of Manx Shearwater were recorded in May and September 2012 during aerial surveys. Peak counts were observed in May 2012 during boat based surveys with 29 % of birds observed foraging in the area. Due to the large numbers observed in aerial surveys a likely significant effect on the 3 SPAs within foraging range of this species cannot be excluded at this stage.
		Gannet	Ailsa Craig	N	Gannet forage over very large areas and are widespread throughout Britain's coastal and offshore waters (in addition to being flexible foragers able to exploit a range of prey), only 9 % of birds recorded in site surveys were observed in foraging behaviour.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
		Red-throated diver	Liverpool Bay	N	As the Project site is located 17 km from the boundary of the SPA, no LSE is predicted as a result of turbine presence during the operational phase.
		Common scoter	Liverpool Bay	N	As the Project site is located 17 km from the boundary of the SPA, no LSE is predicted as a result of turbine presence during the operational phase.
	Mortality as a result of direct collision with turbine blades	Lesser Black-backed Gull	Morecambe Bay Bowland Fells Ribble and Alt Estuaries Ailsa Craig	N	A total of 50 collisions per annum are predicted at a 98% avoidance rate (see HRA Report, Annex 2). As a worst case scenario if we assume all birds originate from the SPA with the smallest population, the Ribble and Alt Estuaries SPA with a population of 8234 (SMP, 2011), then this equates to 0.78 % of the SPA population and a 7 % increase in background mortality . During the breeding season a total of 20 collisions were predicted at a 98 % avoidance (see HRA Report, Annex 2, Table 7). This equates to 0.24 % of the Ribble and Alt Estuaries SPA population and a 2.8 % increase in background mortality. The Ailsa Craig SPA is located 143km from the Project site, 2 km beyond the mean maximum foraging range for Lesser Black-backed Gull. Following apportioning of collisions to SPAs (see HRA Report, Annex 2) 0.01 collisions are predicted to be associated with the Ailsa Craig SPA, representing 0.002 % of the SPA population. No LSE is predicted for this SPA.
		Herring Gull	Morecambe Bay	Y	At 98% avoidance rate 111 collisions per annum were predicted and 70 during the breeding season, this equates to 1.7 % of the SPA population of 4188 individuals. This is assessed as constituting a likely significant effect on this SPA.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
		Manx Shearwater	Aberdaron Coast and Bardsey Island Skokholm and Skomer Copeland Islands	N	At a 98% avoidance rate no Manx Shearwater collisions were predicted (see HRA Report, Annex 1). No likely significant effect is predicted on these SPAs as a result of collision mortality for this species.
		Gannet	Ailsa Craig	N	At a 98% avoidance rate 25 Gannet collisions per annum were predicted (see Annex 1). This equates to 0.05 % of the SPA population (54,260 individuals SMP 2004), and a 0.57 % increase in background mortality . No likely significant effect is predicted.
	Barrier effects as result of turbine presence	Lesser Black-backed Gull	Morecambe Bay Bowland Fells Ribble and Alt Estuaries Ailsa Craig	N	Lesser Black-backed Gulls will continue to pass through the wind farm area during the operational phase and no barrier to movement is predicted. No likely significant effect is predicted.
		Herring Gull	Morecambe Bay	N	Herring Gulls will continue to pass through the wind farm area during the operational phase and no barrier to movement is predicted. No likely significant effect is predicted.
		Manx Shearwater	Aberdaron Coast and Bardsey Island Skokholm and Skomer Copeland Islands	N	It is assessed that Manx Shearwater will be displaced from the operational wind farm rather than experiencing barrier effects from the operational wind farm. Consequently no likely significant effect is predicted from this effect on this species.
		Gannet	Ailsa Craig	N	The wind farm is unlikely to form a barrier to Gannet movements. This species is at greater risk from collision during the operational phase of the Project. No likely significant effect is predicted from this effect on this species.
		Red-throated diver	Liverpool Bay	N	As the Project site is located 17 km from the boundary of the SPA, no LSE is predicted as a result of turbine collision during the operational phase.

Table 6.1: Assessment of likely significant effect of the Project alone on offshore seabirds

Project phase	Effect	Species	Relevant SPA/ Ramsar site	LSE?	Justification
		Common scoter	Liverpool Bay	N	As the Project site is located 17 km from the boundary of the SPA, no LSE is predicted as a result of turbine collision during the operational phase.

Table 6.2: Assessment of likely significant effect of the Project alone on waterfowl species of the Morecambe Bay SPA and Ramsar from the installation of the export cable

Project phase	Effect	LSE	Justification
Construction	Disturbance and displacement of birds resulting in loss of foraging/roosting areas due to intertidal installation and burial of the export cables	Y	There is the potential for internationally and nationally important numbers of wintering waterbirds to be disturbed and displaced as a result of construction activity in the intertidal areas. A likely significant effect cannot be excluded at this stage.



Table 6.2: Assessment of likely significant effect of the Project alone on waterfowl species of the Morecambe Bay SPA and Ramsar from the installation of the export cable

Project phase	Effect	LSE	Justification
	Indirect impact of installation and burial of the export cable on prey availability.	N	The construction activity associated with the installation and burial of export cables includes the excavation of intertidal sediments using open-cut trenching. The vehicles and vessels used in installation and burial of the export cables will be crossing and engaged in construction activities on/over intertidal areas. The study area is characterised by an upper shore, composed of a shallow bank of cobbles and small pebbles, and a mid and lower seashore classified as large expanses of rippled medium-fine sands with some shell fragments (CMACS 2012). The invertebrate communities associated with these habitats (CMACS 2012) are likely to be similarly widely distributed within the study site. There may be some mortality of intertidal prey fauna caused by cable-laying activity (ploughing and open-cut trenching), but the vast majority are likely to be simply disturbed and displaced (ES Chapter 10, "Benthic Ecology"). Assuming an indicative 3,500 m length of cable installation per trench across the intertidal zone (some of which will be from a vessel at high tide), a cable trench width of 1.4m (a plough will be narrower) and 5 cable systems then the total area impacted is 24,500 m^2 = 2.45 ha. = 0.41% of the nominal 600 ha of mudflat / sandflat of Middleton Sands. This calculations assumes that the mudflat / sandflat sediments driven over by trenching vehicles will not be adversely impacted. Sediments impacted by cable-laying trenching are predicted to return to original condition within approximately 3 months, and the majority of intertidal biotopes and fauna are similarly expected to re-colonise swiftly following the burial of export cables (Environmental Statement Chapter 10, "Benthic Ecology"). The biotope and fauna of the lower shore (a polychaete/bivalve dominated muddy sand shore) would however show a higher intolerance to this impact with a moderate recoverability and sensitivity (Environmental Statement Chapter 10, "Benthic Ecology"). As this habitat is extensive in distribution in and around the study area, re-colonisation from unaffected areas would be expected to occur, with no long term change in habitat structure within the cable corridor.
	Potential disturbance and displacement due to onshore construction activity	Y	There is the potential for internationally and nationally important numbers of waterbirds to be disturbed as a result of onshore construction activity. This applies to birds using the high tide roost on the upper foreshore immediately north of Potts Corner and the roost in the Middleton saltmarsh.

Table 6.2: Assessment of likely significant effect of the Project alone on waterfowl species of the Morecambe Bay SPA and Ramsar from the installation of the export cable

Project phase	Effect	LSE	Justification
Operation	The indirect impact of electromagnetic field (EMF) levels emanating from the buried export cable on prey availability.	N	The operational phase involves the conduction of electricity through the buried export cables which will generate an electromagnetic field (EMF) that has the potential to affect intertidal invertebrates. The reasonably rapid attenuation of both the magnetic fields and electric fields means the potential impact zone is predicted to only occur within close proximity of the cables (a few to a few tens of metres). Environmental Statememt Chapter 10 "Benthic Ecology" found no definitive evidence of intertidal invertebrates being sensitive to electric fields, and the relatively minimal strength of the expected electric fields, even at the cable surface, was predicted as unlikely to cause detrimental physiological effects to these taxa. On this basis the indirect effect from EMF of any disturbance and displacement on the survival or productivity of the waterbird populations using the study area is considered to be minimal.
Decommissioning	None identified – It is anticipated that onshore and offshore cables, including those crossing the intertidal zone will be left in situ (Environmental Statement Chapter 4, "Project Description"). On this assumption, it can be reasonably assumed that there will be no potential impact on birds using the intertidal zone.	N/A	N/A

Table 6.3: Assessment of likely significant effect of the Project alone on designated habitats of the Morecambe Bay SAC

Project phase	Effect	Habitat	LSE	Justification
Construction	Direct habitat loss and/or disturbance as a result of export cable installation	Mudflats and sandflats including key subfeatures (Sand communities, mud communities and eelgrass bed communities)	Y	Cables will be installed via open trenching to an average depth of 1.5 m to 2 m. This temporary disturbance is to an area where the biotopes and fauna can be expected to be adapted to the high energy / disturbance conditions that occur naturally (e.g. storms and strong wave action). Recovery of the faunal communities will start immediately by migration of animals from adjacent areas (Royal Haskoning and Bomel Ltd, 2008) and new settlement of larvae. Eelgrass bed communities are not recorded from the cable corridor landfall location.

Table 6.3: Assessment of likely significant effect of the Project alone on designated habitats of the Morecambe Bay SAC

Project phase	Effect	Habitat	LSE	Justification
		Salicornia and other annuals colonising mud and sand	N	HDD crossing of the flood defence and saltmarsh (from agricultural land to the north to the car park at Potts Corner) will avoid direct impacts on the saltmarsh. Any ducting required as part of the HDD operation will be prepared away from the saltmarsh and will not require vehicular access across the marsh to transport it to the HDD site. In addition HDD works at the landfall will not involve the placing or transportation of any plant, apparatus, cables, cable ducts or any other materials required for the carrying out of the connection works on or over the saltmarsh, unless otherwise approved in writing by the relevant planning authority.
		Atlantic salt meadow	N	HDD crossing of the flood defence and saltmarsh (from agricultural land to the north to beyond the car park at Potts Corner) will avoid direct impacts on the saltmarsh. Any ducting required as part of the HDD operation will be prepared away from the saltmarsh and will not require vehicular access across the marsh to transport it to the HDD site. In addition HDD works at the landfall will not involve the placing or transportation of any plant, apparatus, cables, cable ducts or any other materials required for the carrying out of the connection works on or over the saltmarsh, unless otherwise approved in writing by the relevant planning authority.



Table 6.3: Assessment of likely significant effect of the Project alone on designated habitats of the Morecambe Bay SAC

Project phase	Effect	Habitat	LSE	Justification
	Increases in SSC, bed level change and seabed textural change following redeposition of suspended sediments (export cable burial)	Mudflats and sandflats	N	Open trenching in and above the intertidal zone will be undertaken using mechanical excavators during a suitable low water period. Excavated sediment will be temporarily relocated nearby to the trench so there will be no net removal or addition of sediment from the beach as a result of the operation. The cables will be laid into the trench which will then be backfilled, mechanically and/or by natural processes. Initial inundation by the tide will rapidly cause the majority of the displaced sediment to fluidise and collapse back into the trench under gravity and hydraulic action. Further, reworking by currents or waves will also rapidly redistribute and smooth any remaining local disturbances, returning the area of the works to a natural state (level, sediment type and consolidation) that will be in equilibrium with the baseline environment.
		Salicornia and other annuals colonising mud and sand	N	N/A for this receptor habitat.
		Atlantic salt meadow	N	N/A for this receptor habitat.
Operation	Scour effects due to the exposure of export cables or the use of cable protection measures	Mudflats and sandflats including key subfeatures	N	Standard empirical approaches (Whitehouse, 1998) indicate that predicted scour dimensions are primarily dependent upon the cable diameter. Further, the cable must be almost entirely exposed on the seabed for local scour to occur at all and that an oblique orientation of the cable to the ambient tidal or wave forcing will also reduce the predicted effect. Whitehouse (1998) reports that for fully exposed cables at any orientation, the maximum scour depth will be between one and three times the cable diameter (i.e. in the range 0.1 m to 0.7 m) and the maximum horizontal extent of any scour effect will be up to fifty times the cable diameter (i.e. in the range 4.5 m to 12 m). As such, any depression created will not necessarily be steeply sided. In predominantly sandy areas, the surface of the scour pit will have a similar character to the surrounding seabed.

Table 6.3: Assessment of likely significant effect of the Project alone on designated habitats of the Morecambe Bay SAC

Project phase	Effect	Habitat	LSE	Justification
Decommissioning	None identified – It is anticipated that onshore and offshore cables, including those crossing the intertidal zone will be left in situ (Environmental Statement Chapter 4, "Project Description").	N/A	N/A	N/A

Table 6.4: Assessment of likely significant effect of the Project alone on habitat features of Shell Flat and Lune Deep SAC arising from the installation of the export cable

Project phase	Effect	Habitat	LSE	Justification
Construction	Direct habitat loss and/or disturbance as a result of export cable installation.	Reefs	N	Characterisation surveys of the export cable corridor did not reveal any cobble reef habitat and a review of geophysical data confirmed this (CMACS 2012). Further geophysical surveys in March 2013 and underwater camera suveys in May 2013 found the sea bed along the Offshore Cable Corridor to be predominantly soft sediments (sand and mud) from the Project Site to the coastal areas.
		Sandbanks slightly covered by seawater at all time	N	The Offshore Cable Corridor is located 1.5 km away from the boundary of the Shell Flat component of the SAC and as a result no direct habitat loss or disturbance is anticipated as a result of cable installation.
	Increases in SSC, bed level change and seabed textural change following re-deposition of suspended sediments (export cable burial).	Reefs	N	Areas of potential Annex I stony reef will be avoided. Sea bed disturbance from cable laying will therefore not be incurred by this habitat.

Table 6.4: Assessment of likely significant effect of the Project alone on habitat features of Shell Flat and Lune Deep SAC arising from the installation of the export cable

Project phase	Effect	Habitat	LSE	Justification
		Sandbanks slightly covered by seawater at all time	N	The Offshore Cable Corridor is located 1.5 km away from Shell Flat component of the SAC and as a result any increases in SSC as a result of cable installation will not impact the sandbank feature.
Operation	Scour Effects Due to the Exposure of Inter-Array and Export Cables or the use of Cable Protection Measures	Reefs	N	The Offshore Cable Corridor will be buried to a maximum depth of 3 m and should any Annex I habitat be present this will be avoided during installation as described above. No operational effects are anticipated.
		Sandbanks slightly covered by seawater at all time	N	Up to 10 % of the export cable and inter-array cables may be protected by cable scour protection. This may be put in place either at the point of cable installation or as a remedial measure during the operational phase. The cable will have no potential to cause scour once protected but the presence of the protection may directly cause some localised ('secondary') scour where it meets the adjacent seabed. The dimensions of secondary scour are dependent upon the details of the protection design in relation to the local hydrodynamic and sedimentary environments and so cannot be reliably quantified. Secondary scour dimensions will however be inherently minimised through the graded shape design of the protection. The Offshore Cable Corridor is, however, located 1.5 km away from Shell Flat and as a result any increases in changes to the hydrodynamic regime as a result of scour protection will not affect the sandbank feature.

Table 6.4: Assessment of likely significant effect of the Project alone on habitat features of Shell Flat and Lune Deep SAC arising from the installation of the export cable

Project phase	Effect	Habitat	LSE	Justification
Decommissioning	None identified – It is anticipated offshore cables, including those crossing the intertidal zone will be left in situ (Environmental Statement Chapter 4, "Project Description"). On this assumption, it can be reasonably assumed that decommissioning will not have a significant effect on the interest features of this SAC	Reefs	N	N/A
		Sandbanks slightly covered by seawater at all time	N	N/A

6.2 Whooper Swan and Pink-footed Goose

MIGRATORY MOVEMENTS OF WHOOPER SWAN AND PINK-FOOTED GOOSE

6.2.1 Whooper Swan and Pink-footed Goose over-winter in Britain, migrating to and from breeding grounds further north in the Spring and Autumn. Some of these migration routes occur within the vicinity of the Project Site.

6.2.2 Collision risk modelling has been carried out for Whooper Swan and Pink-footed Goose in relation to the Project Site using the methodology defined by Band et al. (2007). The updated Band model (2012) designed for use for offshore wind farms was not deemed appropriate to use in this case as this model is dependent on baseline species density information which is not available for these species at the Project Site. The Band et al. (2007) model, whilst designed for use for onshore wind farms provides an appropriate index of flight activity to match the aims of this work. Details of the modelling are shown in Annex 1 to this Report.

6.2.3 The collision risk modelling for the Project alone uses guidance on precautionary and worst case scenarios of Whooper Swan and Pink-footed Goose interacting with the Project. Using the established "default" parameters (HRA Report, Annex 1), collision estimates were low for both species, 1.89 birds / annum for Whooper Swan and 2.56 birds / annum for Pink-footed Goose.

6.2.4 Table 6.5 and Table 6.6 show the predicted number of collisions as a consequence of the operational Project wind farm Site as a proportion of the relevant SPA population.

Table 6.5: Predicted Whooper Swan collisions as proportions of corresponding SPA populations

SPA	SPA review population (Stroud et al., 2001)	Current population (Holt et al 2012)	Number of collisions per annum	Collisions as a % of the SPA population
Martin Mere	621	1,864 (treated as one population for both sites)	1.89	0.10
Ribble and Alt Estuaries	159			

Table 6.6: Pink-footed Goose collisions as proportions of corresponding SPA populations

SPA	SPA review population (Stroud et al., 2001)	Current population (Holt et al 2012)	Number of collisions per annum	Collisions as a % of the SPA population
Martin Mere	25,779	46,862 (treated as one population for both sites)	2.56	0.005
Ribble and Alt Estuaries	23,860			
Morecambe Bay	2,475	7,116		0.04

WITHIN-WINTER MOVEMENTS OF WHOOPER SWAN BETWEEN ENGLAND AND IRELAND

6.2.5 Within-winter movements of Whooper Swan have been estimated based on the proportion of colour-ringed Whooper Swans recorded in a given winter that were seen both in Britain and in Ireland, from WWT data for 1979/80 to 2011/12 (see HRA Report, Annex 1). Using a precautionary approach, it has been assumed that each bird completed two transits across the Irish Sea.

6.2.6 As stated above there are a number of assumptions relating to the calculation of Whooper Swan numbers moving across the Irish Sea between Britain and Ireland. The results contain no measure of the variability in re-sighting effort or the heterogeneity among re-sightings. The calculation and the collision risk model both assume that birds make two movements across the Irish Sea, returning to their site of origin. However, it is important that the movement of Whooper Swans across the Irish Sea has been calculated as it provides a level of context against which collision risk can be assessed.

6.2.7 At an avoidance rate of 98%, 6.63 Whooper Swans are predicted to collide with the Project offshore wind farm site during within-winter movements per annum (See HRA Report Annex 1, Table 26). Whilst this measure is seen as overly precautionary it can be combined with the migratory collision estimate to give a total collision risk of 8.52 birds per annum. Table 6.7 shows the total collision risk as a proportion of the relevant SPA populations including within winter movements.



Table 6.7: Predicted total number of Whooper Swan collisions as a result of within winter movements and migratory movements as proportions of corresponding SPA populations

SPA	SPA review population (Stroud et al., 2001)	Current population (Holt et al 2012)	Total number of collisions per annum	Collisions as a % of the SPA population
Martin Mere	621	1,864 (treated as one population for both sites)	8.52	0.45
Ribble and Alt Estuaries	159			
Lough Neagh and Lough Beg		1,584		0.16
Lough Foyle		1,198		
Lough Swilly		1,6731[7]		
Upper Lough Erne		742		

6.2.8 No likely significant effect on sites supporting Whooper Swan (seasonal migration to and from Martin Mere and Ribble and Alt Estuaries SPAs) is predicted as a result of collision related mortality. Collision is predicted to affect only 0.10 % of the combined SPA population for these two sites (Table 6.5).

6.2.9 No likely significant effect is predicted as a result of within winter movements of Whooper Swan between England and Northern Ireland with less than 0.5 % of the SPA populations predicted to be affected by collision related mortality (Table 6.7). No LSE is predicted for Lough Neagh and Lough Beg SPA, Lough Foyle SPA, Lough Swilly SPA, and Upper Lough Erne SPA, with less than 0.2% of the SPA populations predicted to be affected by collision related mortality.

6.2.10 No likely significant effect on Pink-footed Goose is predicted as result of collision with turbine blades during their migratory passage to and from the UK with less than 0.06 % of the SPA populations predicted to be affected by collision related mortality (Table 6.6). No LSE is predicted for the Pink-footed Goose populations of Martin Mere SPA, Morecambe Bay SPA and the Ribble and Alt Estuaries SPA, with less than 0.2% of the SPA populations predicted to be affected by collision related mortality.

6.3 Collision risk to migratory bird populations

6.3.1 A suite of waterbird species found in the Morecambe Bay SPA / Ramsar intertidal zone have the potential to pass through or over the Project Site during passage periods and are potentially at collision risk from operational wind turbines. An assessment of the likely numbers of these species was undertaken using the Migration Assessment Tool ("MAT") detailed in Wright et al. (2012).

6.3.2 The first stage in the assessment was to determine the number of movements of waterbird species across the Project. The next stage of the MAT requires two pieces of information relating to the population estimated to interact with the wind farm site. The first piece of information is the UK population size of each considered species. The second piece of information is a population correction factor which estimates the percentage of the UK population that interacts with the Project footprint. The population of each species predicted to interact with the footprint of the Project

was estimated using the population of each species cited for SPAs deemed to be present within the east Irish Sea region (and potentially interacting with the Project site; Table 6.8) (Stroud et al., 2001). The proportion was calculated by comparing the total population of a species cited for connected SPAs and the UK population size.

6.3.3 The width of the migration corridor was then calculated using ArcGIS. The migration corridor was taken as the longest width of the Project Site running from east to west. This gave a value of 10.26 km. The number of flights of each species predicted to interact with the Project Site was calculated using this information (Table 6.9).

6.3.4 The precautionary estimate of the number of flights by waterbird species interacting with the Project indicates that the annual number is relatively low with the highest being dunlin (12,915 birds per annum out of a total regional population of over 159,000 birds making two migratory flights each year).

6.3.5 Due to its location some distance offshore any barrier provided by the Project Site to migratory paths of waterbird does not provide any restrictions to foraging or roosting site movement and it is predicted that there would be no energetic costs associated with any minor shifts in flight path route.

6.3.6 The waterbird assemblage from the adjacent SPA network[8] analysed by the Migration Assessment Tool (Wright et al., 2012) was subjected to collision risk modelling (HRA Report, Annex 1). Table 6.10 presents the results of this modelling.

6.3.7 At an avoidance rate of 98%, collision rates for all species of waterbird are low and will not result in a likely significant effect on the Morecambe Bay SPA and Ramsar sites.

Table 6.8: Species, SPA populations and the proportion of the GB population interacting with the Project site (does not include buffer) used for Migratory Assessment Analysis

Species	SPA populations								Proportion of UK population potentially interacting east Irish Sea region (%)
	Duddon Estuary SPA	Martin Mere SPA	Mersey Estuary SPA	Mersey Narrows and North Wirral Foreshore SPA	Morecambe Bay SPA	Ribble and Alt Estuaries SPA	The Dee Estuary SPA	Total	
Shelduck			5,039		6,372	4,103	6,827	22,341	36.62
Wigeon						84,699		84,699	19.25
Teal			11,667			7,641	5918	25,226	12.01
Pintail	1,636	978	2744		2,804	3,333	6,498	17,993	62.04
Oystercatcher					47,572	16,159	28,434	92,165	28.8
Ringed plover	628		1,453		693	995		3,769	11.09
Golden plover			3,070		4,097			7,167	1.79
Grey plover					1,813	6,073	2,193	10,079	23.44

Table 6.8: Species, SPA populations and the proportion of the GB population interacting with the Project site (does not include buffer) used for Migratory Assessment Analysis

Species	SPA populations								Proportion of UK population potentially interacting east Irish Sea region (%)
	Duddon Estuary SPA	Martin Mere SPA	Mersey Estuary SPA	Mersey Narrows and North Wirral Foreshore SPA	Morecambe Bay SPA	Ribble and Alt Estuaries SPA	The Dee Estuary SPA	Total	
Knot	4,495			10,655	29,426	57,865	21,553	123,994	38.75
Sanderling	1,055				2,466	6,172		9,693	60.58
Dunlin			44,300		52,671	39,952	22,479	159,402	45.54
Black-tailed godwit						819	1,739	2,558	5.95
Bar-tailed godwit				3,344	2,611	18,958	1,013	25,926	68.23
Curlew					13,620		4,028	17,648	12.61
Redshank	2,289		4,689		6,336	2,708	8,451	24,473	20.39
Turnstone					1,583			1,583	3.30

Table 6.9: Number of flights per annum of waterbird species potentially interacting with Project Site (does not include buffer)

Species	Number of movements across wind farm footprint
Shelduck	1,243
Wigeon	4,711
Teal	1,403
Pintail	1,000
Oystercatcher	5,126
Ringed plover	210
Golden plover	398
Grey plover	561
Knot	6,897
Sanderling	539
Dunlin	12,915
Black-tailed godwit	142
Bar-tailed godwit	1,903
Curlew	982
Redshank	1,361
Turnstone	88

Table 6.10: Collision risk model outputs for waterbird species assessment by the Migration Assessment Tool – number of collisions per annum

Species	Assuming no avoidance	Assuming 98% avoidance
Shelduck	31	1
Wigeon	98	2
Teal	27	1
Pintail	22	0
Oystercatcher	194	4
Ringed plover	6	0
Golden plover	13	0
Grey plover	18	0
Knot	211	4
Sanderling	16	0
Dunlin	384	8
Black-tailed godwit	5	0
Bar-tailed godwit	64	1
Curlew	38	1
Redshank	46	1
Turnstone	3	0

6.4 Assessment of impact on SPA breeding birds present outside the breeding season

INTRODUCTION

6.4.1 JNCC and Natural England have issued interim guidance on the approach to assessing the impacts on seabird species from breeding colony SPAs present at the Project Site outside of the breeding season (JNCC / NE, 2013). This relates to true seabird species only (all Annex I and regularly occurring migrant breeding species of gulls, terns, Gannets, auks, skuas, shearwaters, and petrels). It does not apply to migratory wildfowl and wader species.

6.4.2 An initial review of the information gathered by boat-based and aerial surveys at the Project Site and 4 km buffer suggests that the following bird species recorded on the Project Site may be relevant to this assessment; fulmar, Manx Shearwater, Gannet, Arctic skua, great skua, kittiwake, black-headed gull, little gull, common gull, Lesser Black-backed Gull, Herring Gull, great black-backed gull, Arctic tern, common tern, Sandwich tern, guillemot, razorbill and Puffin (Table 4.11).

ASSESSMENT

6.4.3 There are two stages in the assessment of SPA breeding birds outside the breeding season (see HRA Report Annex 3). Stage 1 involves the definition of a Biologically Defined Minimum Population Scale (BDMPS) for breeding qualifying features of SPAs with predicted connectivity with the Project Site. The BDMPS is defined utilising species-specific information from the ornithological literature and project-specific baseline

surveys, relating to the spatial and temporal distribution of birds during the non-breeding season with respect to a species breeding origins. The BDMPS is refined to provide the smallest geographical range and population scale that can be supported by current evidence. The assessment utilises seabird colony census data from the most recent national census, Seabird 2000 (Mitchell et al., 2004) to define the BDMPS and SPA populations. This is used throughout the assessment, unless stated otherwise, to provide a consistent metric for analysis.

6.4.4 The second stage of the assessment investigates the potential for a LSE on each SPA screened in during the first stage. For each species, this stage uses the contribution that each SPA makes to the BDMPS to determine the likely SPA contribution to project-specific mean-peak population estimates. If an LSE is predicted for a species the population estimates for that species are corrected to account for non-breeding and pre-breeding individuals. Published values for demographic parameters were used to derive the total number of breeding individuals in Project-specific population estimates. If, after correction, an LSE was predicted for an SPA the population estimate of a species would be further refined using results from collision risk and displacement analysis.

6.4.5 Evidence suggested connectivity between the Project and 67 UK SPAs during the non-breeding season (see Annex 3). Of those SPAs, an LSE was predicted for those for which razorbill was a qualifying feature. Upon further assessment these SPAs were also scoped out of the assessment when no LSE was predicted using population estimates of razorbill corrected for non-breeding and pre-breeding individuals.

6.4.6 For those SPAs which have no predicted connectivity with the Project Site during the breeding season, based on foraging ranges of qualifying species, the results for the non-breeding season stand alone. However, for those SPAs within foraging range of the Project Site an additional stage in the assessment is undertaken to predict the impact on the relevant qualifying features of these SPAs for a complete annual cycle. This further assessment involved eight SPAs. The assessment used proportions calculated for the non-breeding breeding season to determine the potential for LSE on the relevant SPA populations. No LSE was predicted in the breeding season for any of the eight SPAs (see Annex 3).



6.5 Summary of assessment of likely significant effect

6.5.1 Table 6.11 summarises the sites and features for which a likely significant effect may occur as a result of the Project alone, or for which a likely significant effect cannot at this stage be excluded.

Table 6.11: European Sites and features for which a likely significant effect may occur as a result of the Project

Site	Feature	Project phase	Effect
Morecambe Bay SAC	Mudflats and sandflats not covered by seawater at low tide	Construction	Habitat loss and disturbance as a result of export cable installation
Morecambe Bay SPA and Ramsar	Wintering: Bar-tailed godwit; golden plover; curlew; dunlin; grey plover; knot; oystercatcher;; pintail; redshank; shelduck; turnstone; Ringed plover; sanderling Lesser Black-backed Gull Herring Gull	Construction Operation	Disturbance and displacement of wintering birds resulting in loss of foraging / roosting areas due to intertidal installation and burial of the export cables and nearshore construction activity. Mortality as a result of turbine collision
Liverpool Bay SPA	Red-throated diver Common scoter	Construction	Displacement as a result of cable laying
Bowland Fells SPA	Lesser Black-backed Gull	Operation	Mortality as a result of turbine collision
Ribble and Alt Estuaries SPA and Ramsar	Lesser Black-backed Gull	Operation	Mortality as a result of turbine collision
Skokholm and Skomer SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence
Aberdaron Coast and Bardsey Island SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence
Copeland Islands SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence

6.5.2 Table 6.12 summarises the sites a features for which a likely significant will not occur. Where that conclusion relies on the provision of mitigation the nature of the required mitigation is identified.

Table 6.12: European Sites and features for which a likely significant effect will not occur

Site	Feature	Effect	Justification for conclusion of no LSE	Mitigation proposed?
Shell Flat and Lune Deep SAC	Sandbanks Reefs	Direct habitat loss and/or disturbance as a result of export cable installation.	The export cable corridor lies on the boundary of the SAC	None
Morecambe Bay SAC	Mudflats and sandflats Salicornia and other annuals colonising mud and sand Atlantic salt meadow (Glauco-puccinellietalia maritimae)	Increases in SSC, bed level change and seabed textural change following redeposition of suspended sediments (export cable burial) Direct habitat loss and / or disturbance as a result of export cable installation	Excavated sediments will be backfilled into the cable trench and the surface layers reformed by the incoming tide.	None Horizontal Directional Drilling (HDD) will be used to avoid impacts on saltmarsh features of the SAC. A detailed method statement will be prepared and agreed with Natural England, and other relevant stakeholders, for HDD activities close to the saltmarsh habitat.
Morecambe Bay SPA and Ramsar	Pink-footed Goose (wintering)	Collision risk	Following collision risk modelling the impact on Pink-footed Goose population is considered to be not significant (0.02 % of SPA population).	None
Ribble and Alt Estuaries SPA and Ramsar	Pink-footed Goose (wintering) Whooper Swan (wintering),	Collision risk	Following collision risk modelling the impact on Pink-footed Goose population is considered to be not significant (0.001 % of the combined SPA population with Martin Mere SPA). Following collision risk modelling the impact on Whooper Swan population is considered to be not significant (0.3 % of the combined SPA population with Martin Mere SPA).	None

Table 6.12: European Sites and features for which a likely significant effect will not occur

Site	Feature	Effect	Justification for conclusion of no LSE	Mitigation proposed?
Ailsa Craig SPA	Gannet (breeding)	Collision risk	At a 98% avoidance rate 25 Gannet collisions per annum were predicted (see HRA Report, Annex 1). This equates to 0.05 % of the SPA population (54,260 individuals SMP2 2004), and a 0.57 % increase in background mortality3.	None
Martin Mere SPA and Ramsar	Pink-footed Goose (wintering) Whooper Swan (wintering),	Collision risk	Following collision risk modelling the impact on Pink-footed Goose population is considered to be not significant (0.001 % of the combined SPA population with Ribble and Alt Estuaries SPA). Following collision risk modelling the impact on Whooper Swan population is considered to be not significant (0.3 % of the combined SPA population with Ribble and Alt Estuaries SPA).	None
Lough Negh and Lough Beg SPA and Ramsar	Whooper Swan (wintering)	Collision risk	Following collision risk modelling the impact on Whooper Swan population during within winter movement is considered to be not significant (0.16 % of the combined SPA population).	None
Upper Lough Erne SPA and Ramsar	Whooper Swan (wintering)	Collision risk		None
Lough Foyle SPA and Ramsar	Whooper Swan (wintering)	Collision risk		None
Lough Swilly SPA	Whooper Swan (wintering)	Collision risk		None



7.0 Assessment of adverse effect from the Project alone

7.1 Introduction

7.1.1 Following the screening and scoping stages of the assessment (Sections 5 & 6) the next step is to determine the potential for the Project to have an adverse effect on the sites and features scoped into further assessment. Table 6.11 lists the effects, sites and features scoped into the assessment and considered further within this Section of the Report.

7.2 Approach to assessment of potential adverse effects

7.2.1 Determining whether, in view of the European site's conservation objectives, the plan or project 'either alone or in-combination with other plans or projects' would have an adverse effect (or risk of this) on the integrity of the site has been assessed in the light of:

- Site specific information obtained from project surveys;
- The advice of the SNCBs, MMO, Environment Agency and other statutory bodies;
- The potential effects on European Sites screened into the assessment;
- Evidence provided for the EIA; and
- Professional judgement and lessons learned from other UK offshore wind farm development projects.

7.2.2 The following definitions and approach have been used to determine whether the Project would result in an adverse effect on any European Sites and their features, screened into the HRA.

SITE INTEGRITY

7.2.3 The assessment of adverse effect on the integrity of a site is addressed in light of the conservation objectives for each site. The integrity of a site is defined as 'the coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and / or populations of species for which the site has been designated' (ODPM Circular 06/2005).

7.2.4 EC guidance, "Managing Natura 2000 sites" (2000), emphasises that site integrity involves its ecological functions and that the assessment of adverse effect should focus on and be limited to the site's conservation objectives.

ADVERSE EFFECT

7.2.5 The possible impacts of the development at construction, operation and decommissioning stages, have been considered in the context of their effect on the species-specific population levels of the site in question.

7.2.6 An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation. In addition, an adverse effect would be one which caused a detectable reduction in the species and / or habitats for which a site was designated, at the scale of the site rather than at the scale of the location of the impact. Article 1 of the Habitats Directive defines the conservation status of a natural habitat as 'favourable' when "the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future".
An adverse effect on site integrity will not occur if it can be shown that in the long term, the population of the species as a viable component of the site will be maintained

despite potential impacts. Long term is considered to be a period of at least five years. This is considered to be an appropriate timescale for the assessment of adverse effect on integrity for the following reasons:

- SPAs are usually designated in the UK on the basis of a five year population estimates. A five year rolling mean is used because it is considered to take account of sufficient data to demonstrate that birds use sites regularly, smoothing out any short term peaks and troughs in numbers. Using the same argument, it is therefore logical to continue to review populations over the same time scale to demonstrate that observed use or 'non-use' of habitat is typical, and not a chance event. In addition, bird breeding performance and productivity varies between species and between years, and many species have long life spans. Population dynamics data therefore need to take into account the possible short term fluctuations in the numbers of any species; and
- EC Guidance, "Managing Natura 2000 sites" (2000) also recommends that, when considering the 'integrity of the site', it is important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.

7.3 Assessment of potential effect on the integrity of Morecambe Bay SPA and Ramsar

INTRODUCTION AND SITE DESCRIPTION

7.3.1 Morecambe Bay is one of the largest estuarine systems in the UK and is fed by five main river channels which drain through the intertidal flats of sand and mud. These habitats support a rich invertebrate fauna which in turn supports large numbers of waterbirds during both wintering and passage periods. Associated habitats also important for birds include freshwater wetlands, fringing saltmarshes and saline lagoons. Shingle banks and dock structures provide important and secure roost sites at high tide. In summer, areas of sand and shingle support breeding colonies of terns.

7.3.2 During the breeding season Morecambe Bay supports populations of European Importance of two Annex 1 species, little tern and Sandwich tern. Annex 1 species that occur in populations of European importance in the winter months are bar-tailed godwit and golden plover.

7.3.3 A number of migratory species occur in numbers of European importance. During the breeding season such species are Herring Gull and Lesser Black-backed Gull while on passage ringed plover and sanderling qualify. Over winter periods such interest features are curlew, dunlin, grey plover, knot, oystercatcher, Pink-footed Goose, pintail, redshank, shelduck and turnstone. In addition, the site supports an assemblage of over 20,000 waterbirds (210,688 birds 1991/92-1995/96).

7.3.4 Morecambe Bay SPA consists of five component SSSI's:

- Lune Estuary SSSI
- Morecambe Bay SSSI
- Roudsea Wood SSSI
- South Walney and Piel Channel Flats SSSI
- Wyre Estuary SSSI

7.3.5 The Offshore Cable Corridor lies within the Lune Estuary SSSI.

EFFECTS AND FEATURES SCREENED INTO ASSESSMENT

7.3.6 Section 6 of this Report determined there was a LSE on the following features:

- Wintering waterfowl species, as a result of the Export Cable installation in the intertidal zone;
- Breeding Lesser Black-backed Gull, as result of turbine collision; and
- Breeding Herring Gull, as a result of turbine collision.

CONSERVATION OBJECTIVES

7.3.7 Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive.

7.3.8 Subject to natural change, to maintain or restore:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The populations of the qualifying features; and
- The distribution of the qualifying features within the site.

7.3.9 For the species screened into assessment the population numbers from the SPA review and Natura 2000 data form are detailed in Table 7.1. The Ramsar criterion are detailed in Table 7.2.

Table 7.1: SPA population numbers for Morecambe Bay SPA

Species	SPA Review site account (5 year peak mean for 1991/92 to 1995/96 unless otherwise stated)	SPA Natura 2000 Standard Data Form (5 year peak mean for 1991/92 to 1995/96 unless otherwise stated)
Over-winter under Article 4.1 of the Directive		
Bar-tailed godwit	2,611 individuals representing at least 4.9% of the British wintering population	2,611 individuals representing at least 2.6% of the East Atlantic Flyway population
Golden plover	4,097 individuals representing at least 1.6% of the British wintering population	
During the breeding season under Article 4.2 of the Directive		
Lesser Black-backed Gull	22,000 pairs representing at least 17.7% of the breeding Western Europe/Mediterranean/Western Africa population (5 year mean 1992 to 1996)	
On passage under Article 4.2 of the Directive		
Ringed plover	693 individuals representing at least 1.4% of the Europe/Northern Africa wintering population	693 individuals representing at least 1.5% of the international population (unspecified)
Sanderling	2,466 individuals representing at least 2.5% of the Eastern Atlantic/Western & Southern Africa - wintering population (Count as at May 1995)	

Table 7.1: SPA population numbers for Morecambe Bay SPA

Species	SPA Review site account (5 year peak mean for 1991/92 to 1995/96 unless otherwise stated)	SPA Natura 2000 Standard Data Form (5 year peak mean for 1991/92 to 1995/96 unless otherwise stated)
Migratory species under Article 4.2 of the Directive		
Pintail	2,804 individuals representing at least 4.7% of the wintering NW Europe population	2,804 individuals representing at least 4.7% of the NW European population.
Curlew	13,620 individuals representing at least 3.9% of the wintering Europe – breeding population	13,620 individuals representing at least 3.9% of the East Atlantic Flyway population
Dunlin (Calidris alpina alpina)	52,671 individuals representing at least 3.8% of the wintering Northern Siberia/ Europe/Western Africa population	52,671 individuals representing at least 3.8% of the East Atlantic Flyway population
Grey plover	1,813 individuals representing at least 1.1% of the wintering Eastern Atlantic – wintering population	1,813 individuals representing at least 1.1% of the East Atlantic Flyway population
Knot	29,426 individuals representing at least 8.4% of the wintering North-eastern Canada/Greenland/Iceland/North-western Europe population	29,426 individuals representing at least 8.5% of the East Atlantic Flyway population
Oystercatcher	47,572 individuals representing at least 5.3% of the wintering Europe & Northern/Western Africa population	47,572 individuals representing at least 5.4% of the East Atlantic Flyway population
Redshank	6,336 individuals representing at least 3.6% of the wintering Eastern Atlantic - wintering population (5 year peak mean for 1989/90 to 1993/94)	6,336 individuals representing at least 3.6% of the East Atlantic Flyway population (5 year peak mean for 1989/90 to 1993/94)
Shelduck	6,372 individuals representing at least 2.1% of the wintering North-western Europe population	6,372 individuals representing at least 2.1% of the NW European population
Turnstone	1,583 individuals representing at least 2.3% of the wintering Western Palearctic - wintering population	1,583 individuals representing at least 2.4% of the East Atlantic Flyway population
Article 4.2 of the Directive –Internationally important assemblage of birds		
Regularly supports over 20,000 seabirds	During the breeding season, the area regularly supports 61,858 individual seabirds (5 year peak mean for 1991/92 to 1995/96)	
Regularly supports over 20,000 waterbirds	Over winter, the area regularly supports 210,668 waterbirds (5 year peak mean for 1991/92 to 1995/96)	210,668 waterbirds (5 year peak mean 28/09/1999)
Diverse assemblage of wintering species (not otherwise listed)	great crested grebe, golden plover, black-tailed godwit, cormorant, wigeon, teal, mallard, eider, goldeneye, red-breasted merganser, lapwing, sanderling, and whimbrel	

Table 7.2: Ramsar Criterion for Morecambe Bay Ramsar

Cited species and reasons for qualifying	
Ramsar criterion 4. Staging site for migratory waterbirds including internationally important numbers of passage: Ringed Plover	
Ramsar criterion 5. Assemblage of international importance – species with peak counts in winter: 223,709 waterbirds (5 year peak mean 1998/99 – 2002/2003)	
Cited species and reasons for qualifying	
Ramsar criterion 6. Species/populations occurring at levels of international importance (as identified at designation).	% of biogeographical population (5 year peak mean 1998/9-2002/3)
Species regularly supported during the breeding season:	
Lesser Black-backed Gull (W Europe/ Mediterranean/W Africa)	19,666 apparently occupied nests, representing an average of 13.3% of the breeding population (Seabird 2000 Census)
Herring Gull (NW Europe and Iceland/W Europe)	10,431 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census)
Sandwich tern (W Europe)	290 pairs, representing an average of 2.8% of the Great Britain population (5 year mean for 1992 to 1996)
Species (population) with peak counts in autumn/autumn:	
Cormorant (NW Europe)	967 individuals, representing an average of 4.2% of the Great Britain population
Shelduck (Europe)	7,032 individuals, representing an average of 2.3% of the population
Pintail (NW Europe)	3,743 individuals, representing an average of 6.2% of the population
Eider (NW Europe)	5,657 individuals, representing an average of 7.7% of the Great Britain population
Oystercatcher (Europe & NW Africa -wintering)	66,577 individuals, representing an average of 6.5% of the population
Ringed plover (Europe/Northwest Africa)	1,041 individuals, representing an average of 1.4% of the population
Grey plover (E Atlantic/W Africa -wintering)	1,655 individuals, representing an average of 3.1% of the Great Britain population
Sanderling (Eastern Atlantic)	703 individuals, representing an average of 3.4% of the Great Britain population
Curlew (Europe)	20,018 individuals, representing an average of 4.7% of the population
Redshank Tringa totanus totanus	8816 individuals, representing an average of 3.5% of the population
Turnstone (NE Canada, Greenland/W Europe & NW Africa)	1,371 individuals, representing an average of 1.4% of the population
Lesser Black-backed Gull Larus fuscus graellsii	40,393 individuals, representing an average of 7.6% of the population

Table 7.2: Ramsar Criterion for Morecambe Bay Ramsar

Cited species and reasons for qualifying	
Species with peak counts in winter:	
Great crested grebe (NW Europe)	217 individuals, representing an average of 1.3% of the Great Britain population
Pink-footed Goose (Greenland, Iceland/UK)	3,665 individuals, representing an average of 1.5% of the population
Wigeon (NW Europe)	6,133 individuals, representing an average of1.5% of the Great Britain population
Goldeneye (NW & C Europe)	285 individuals, representing an average of 1.1% f the Great Britain population
Red-breasted merganser (NW & C Europe)	327 individuals, representing an average of 3.3% of the Great Britain population
Golden plover (Iceland & Faeroes/E Atlantic)	4,073 individuals, representing an average of 1.6% of the Great Britain population
Lapwing	16,492 individuals, representing an average of 1% of the Great Britain population
Knot (W & Southern Africa)	66,335 individuals, representing an average of 14.7% of the population
Dunlin (W Siberia / W Europe)	26,416 individuals, representing an average of 1.9% of the population
Bar-tailed godwit	4,579 individuals, representing an average of 3.8% of the population
Noteworthy fauna birds - species currently occurring at levels of national importance:	% of biogeographical population (5 year peak mean 1991/2-1995/6)
Species regularly supported during the breeding season:	
Black-headed gull (N & C Europe)	1,620 apparently occupied nests, representing an average of 1.2% of the GB population (Seabird 2000 Census)
Species (population) with peak counts in spring/autumn:	
Ruff (Europe/W Africa)	33 individuals, representing an average of 4.7% of the Great Britain population
Whimbrel (Europe/Western Africa)	226 individuals, representing an average of 7.5% of the Great Britain population
Spotted redshank (Europe/W Africa)	8 individuals, representing an average of 5.8% of the Great Britain population
Greenshank (Europe/W Africa)	79 individuals, representing an average of 13.2% of the Great Britain population
Black-headed gull (N & C Europe)	19,907 individuals, representing an average of 1.1% of the Great Britain population
Species with peak counts in winter:	
Teal (NW Europe)	2,363 individuals, representing an average of 1.2% of the Great Britain population
Black-tailed godwit (Iceland/W Europe)	218 individuals, representing an average of 1.4% of the Great Britain population

7.3.10 Table 7.3 summarises the peak winter counts in the Offshore Cable Corridor study area of Middleton Sands recorded for the key species which are cited as part of Morecambe Bay SPA and the latest Morecambe Bay SPA 5 year peak means listed by Holt et al. (2012).

7.3.11 The waterbird data presented in the Morecambe Bay SPA citation originates from the Wetland Bird Survey (WeBS) monthly coordinated "core" counts made during high tide periods, principally from September to March. WeBS is a joint scheme run by the British Trust for Ornithology (BTO), Royal Society for the Protection of Birds (RSPB) and Joint Nature Conservation Committee (JNCC), in association with the Wildfowl & Wetlands Trust (WWT), to monitor non-breeding waterfowl in the UK. The scheme aims to identify population sizes, to determine trends in numbers and distribution, and to identify important sites for waterbirds (Holt et al. 2012).

Table 7.3: Comparison of peak waterbird counts in the intertidal study area (November 2011 - March 2012 (Marsh, 2012)) with the latest SPA population estimates

Species	Peak count during November 2011 - March 2012 in the study area		5yr peak mean for Morecambe Bay SPA (2006/7 – 2010/11)
	Number of birds	% of SPA population	
Shelduck	148	2.0	7,508
Wigeon	15	0.2	7,624
Eider	35	0.7	4,827
Red-breasted merganser	2	1.0	194
Cormorant	6	0.7	822
Oystercatcher	418	0.7	64,270
Ringed plover	22	3.0	727
Golden plover	1	0.03	3,216
Grey plover	475	52.8	899
Lapwing	23	0.1	17,081
Knot	19,139	39.7	48,195
Dunlin	5,210	19.5	26,794
Bar-tailed godwit	3,379	167.6	2,016
Curlew	451	3.7	12,213
Redshank	68	0.6	10,698
Turnstone	7	0.6	1,150
Lesser Black-backed Gull	74	0.3	25,723
Herring Gull	37	0.3	11,031
Total waterbird assemblage	30,073	14.4	
Total SPA waterbird assemblage			209,498

7.3.12 The 5 year peak mean (2006/7 - 2010/11) are considered the most up to date population numbers for the SPA and Ramsar citations and have been used for the basis of this assessment. The 5yr peak mean for Morecambe Bay SPA is based on the annual maxima derived from any month in the appropriate 12 month period (the WeBS year, July - June). The month of occurrence of the annual peak is, for most species, during the winter period.

7.3.13 Table 7.4 summarises the peak autumn counts recorded for SPA species in the cable corridor study area and the latest SPA 5 year peak means listed by Holt et al. (2012).

Table 7.4: Comparison of peak waterbird counts in September – October 2012 (Marsh, 2012) with the latest SPA wide population estimates

Species	Peak count during September-October 2012 in the study area		5yr peak mean for Morecambe Bay SPA (2006/7 – 2010/11)
	Number of birds	% of SPA population	
Shelduck	51	0.7	7,508
Oystercatcher	3,100	4.8	64,270
Ringed plover	37	5.1	727
Grey plover	525	58.4	899
Knot	12,100	25.1	48,195
Sanderling	6	1.1	548
Dunlin	6,808	25.4	26,794
Bar-tailed godwit	2,180	108.1	2,016
Curlew	1,267	10.4	12,213
Redshank	87	0.8	10,698
Total SPA waterbird assemblage			209,498

POTENTIAL DISTURBANCE TO, AND DISPLACEMENT OF, BIRD SPECIES USING THE INTERTIDAL DURING EXPORT CABLE INSTALLATION

7.3.14 Trench excavation, installation and burial of the export power cables across the intertidal zone involves the physical, visible and audible presence of trenching machinery, installation vessels and personnel. This is likely to result in the displacement from the construction area of most, if not all, species that would feed, loaf, or roost in the intertidal and supratidal zone during the period of construction activity. However, the sources of disturbance will be localised and will not, at any one time, be distributed throughout the length of the intertidal working corridor of the cable being installed and buried.

7.3.15 Disturbance or displacement may be a response to the physical (incluing visual) presence of construction equipment, or a response to the associated construction noise. A disturbance event may cause birds to take flight (either returning to the same area or departing entirely), or to cease feeding or roosting. A single instance of taking flight or ceasing to feed does not have an immediate effect on the survival or productivity of an individual bird. Repeated disturbance, or disturbance over an extended period, can affect the survival and productivity of a bird.

7.3.16 Noise created by the operation of machines and vehicles during the construction phase has the potential to cause birds to cease feeding, or to fly away from the area of influence. Disturbance depends on the nature or type of noise and the strength of the noise on reaching birds using intertidal habitat around the site. It is recognised that very loud and short, sharp 'percussive' noises, most familiar as gunshot but also produced during construction activity, for example the hammering in of metal piles, have the greatest potential to cause disturbance to birds (e.g. Madsen & Fox 1995, Mahaulpatha et al. 2000, Riddington et al. 1996), however there is no piling associated with the installation and burial of export cable installation.

7.3.17 Loud but discontinuous noises, such as those produced by machinery during construction processes, have been shown to cause disturbance when that noise is above certain recorded levels (e.g. Conomy et al. 1998a , Fleming et al. 2000, Goudie & Jones 2004, Ward et al. 2000, West et al. 2007). Such studies provide a strong evidence base for a threshold of 80 dB(A)[9] to be set, above which disturbance of waterbirds may occur. Based upon a literature review of waterbird response to construction disturbance, IECS (2009) recommend ambient construction noise levels should be restricted to below 70dB(A), and where possible, sudden irregular noise above 50dB(A) should be avoided as this causes maximum disturbance to birds.

7.3.18 The typical LAmax level[10] associated with intertidal construction activity (including cranes and dumper trucks) is 55 - 60dB(A) (IECS 2009). This noise level is considered to be the level associated with installation and burial of the Project export cables in the intertidal area (based on information in Environmental Statement Chapter 4, "Project Description").

7.3.19 In addition to noise the potential disturbance effects during the construction phase also include physical presence disturbance associated with the operational earthworks vehicles and installation vessels. The assessment has considered flight distance thresholds (the distance at which birds take flight in response to a disturbance) as reviewed by Goss-Custard (2007) and IECS (2009), which are based on a human intruder as the source of disturbance.

7.3.20 Bar-tailed godwit, knot, grey plover and dunlin were present in the greatest numbers during surveys of the Project intertidal cable corridor and have the potential to be disturbed and displaced during construction activity. These species often form large mixed-species flocks that frequently relocated within the study area and to adjacent mudflats when foraging, usually to elsewhere along the tide edge (Marsh 2012).

7.3.21 Monthly peak counts of knot in the study area exceeded 2,000 birds throughout the winter, a total of 17,500 knot were recorded in November and 19,130 in March. WeBS Core Counts of the Middleton count sector recorded a peak of 450 knot during spring passage (April and May), and no birds in August. Numbers of birds using the study area increased from 662 birds in early September to a seasonal peak of 12,100 birds in late October.

7.3.22 The wintering population of bar-tailed godwits using the study area was over 700 birds by early November. Baseline survey peak counts fluctuated, markedly so in early winter, with numbers not exceeding 1,000 birds until mid-January. Numbers remained above 1,000 until the latter half of March. During September and October, numbers of birds using the study area steadily rose from 390 to 2,180.

7.3.23 Numbers of grey plover peaked in the autumn with 525 birds during the September and in winter at 475 birds during January. Dunlin were recorded using the study area throughout the survey period and at all tidal states. Numbers increased from over 1,000 birds in the study area in early November, to a mid-November peak of 4,920 birds.

7.3.24 A precautionary potential disturbance zone of up to 450m has been assumed for bar-tailed godwit, knot, grey plover and dunlin for the purposes of the assessment. Goss-Custard (2007) provides flight distance maxima for knot, grey plover, dunlin and bar-tailed godwit of respectively 120m, 124m, 163m and 219m. Though in winter and autumn some preference was shown by these species for the northern half of the study site, the highly mobile flocks of internationally and nationally important numbers were wide ranging across the entire study site when foraging. Such numbers would therefore be subject to disturbance during the period of construction activity and within the vicinity of the Offshore Cable Corridor.

7.3.25 The peak number of curlew recorded in the study area during September and October 2012 represents 10.4% of the Morecambe Bay SPA population (based on the five year mean peak population). In winter 2011 / 12, the proportion of curlew occurring within the study area was less than 5% of the five year winter peak mean for Morecambe Bay. Curlew is probably one of the most sensitive of all waterbirds to disturbance. A precautionary potential disturbance zone of up to 500 m has been assumed for this species. The IECS (2009) study reported a flight distance of 275 m, whilst the literature review by Goss-Custard (2007) provides a range from an outlying lower limit of 38 m to an upper limit of 339 m. Curlew are widely and comparatively evenly distributed in the study area.

7.3.26 Shelduck were recorded throughout the baseline survey period and tidal cycle, with winter peak monthly counts fluctuating between 52 and 148, peaking in February. With the exception of a peak count of 51 birds, only small numbers were counted in autumn. Between April and August 2012, WeBS Core Counts recorded a peak count of 70 birds in April, at the Middleton count sector.
Maximum flight distances of 250 m have been recorded for this species (IECS 2009, Goss-Custard 2007).

7.3.27 Oystercatcher, were recorded in the baseline surveys, foraging and roosting in moderate to high numbers during the non-breeding seasons, although their populations did not attain a level of national importance. Maximum flight distances of 250 m have been reported (IECS 2009, Goss-Custard 2007) for either roosting or foraging birds.

7.3.28 Redshank were recorded in the baseline surveys, foraging and roosting in moderate numbers during the non-breeding seasons, although the population size did not attain a level of national importance. For this species, the maximum flight distances of 250 m have been reported (IECS 2009). For the purposes of assessment, a precautionary potential disturbance zone of up to 500 m has been assumed for shelduck, oystercatcher and redshank..

7.3.29 Small numbers of ringed plover were recorded in the baseline surveys using the study site at times during the non-breeding seasons. Usage was confined to the upper tidal flats, a foraging habitat type that also exists elsewhere within Morecambe Bay. The IECS (2009) and Goss-Custard (2007) studies reported a flight distance of 120 m for ringed plover, the distance at which birds take flight in response to a disturbance. For the purposes of this assessment, a precautionary potential

disturbance zone of up to 250 m has been assumed for this species.

7.3.30 Fourteen SPA waterbird species (Whooper Swan, greylag goose, wigeon, teal, mallard, eider, red-breasted merganser, cormorant, little egret, golden plover, lapwing, sanderling, snipe and turnstone) were recorded infrequently during baseline surveys and in very low numbers. For most species that may have been foraging in the study site, much greater expanses of more preferred foraging habitat exists elsewhere within Morecambe Bay and/or the adjacent farmland. This, combined with low abundance and frequency of birds in the study site, implies that these species are unlikely to be significantly affected by localised construction effects.

CONCLUSION

7.3.31 Given the number of SPA qualifying bird species recorded using the intertidal zone in the vicinity of the export cable corridor during the winter period and the predicted duration of the installation works - up to 3 months per cable system and therefore 15 months overall - an adverse effect on site integrity cannot be excluded.

POTENTIAL DISTURBANCE TO, AND DISPLACEMENT OF, INTERTIDAL BIRDS AS A RESULT OF ONSHORE CONSTRUCTION ACTIVITY

7.3.32 The construction phase involves the visible and audible presence of operational earthworks vehicles and other associated machinery and operatives during onshore construction of the jointing bays, excavation of the onshore cable trenches, and the installation of onshore cables. Construction work on the Onshore Substation (north of Middleton) at approximately 2 km inland of the Middleton Sands, is considered too distant to have a disturbance effect on bird species using the intertidal zone. Similarly, construction works on the onshore export cable trenches, beyond the trenches connecting to the jointing bay behind the sea defences, are considered too distant from the intertidal zone to disturb bird use of that zone including roosting birds in the Middleton saltmarsh.

7.3.33 Typical LAmax levels associated with construction site activity (cranes, dumper trucks, no hammer piling) is 55-60 dB(A) (IECS 2009). These noise levels are, in the absence of noise modelling, considered to result from installation and burial of the export cables in the onshore areas described in Environmental Statement Chapter 4, "Project Description". Noise from construction site activity onshore is not considered to reach a threshold for disturbance of waterbirds using the intertidal that will result in an adverse impact upon them as the receptors.

7.3.34 Numbers of curlew recorded by the baseline surveys using the upper most tidal flats of the study site peaked during winter 2011/12 at 450 birds, 3.7% of the Morecambe Bay SPA population, and all roosting within the southern half. Few birds were recorded using these upper tidal flats in September – October 2012. Curlew is one of the most sensitive of all waterbirds to disturbance. A precautionary potential disturbance zone of up to 500 m has been assumed for this species for the purposes of this assessment. The IECS (2009) study reported a flight distance of 275 m whilst the literature review by Goss-Custard (2007) provides a range from an out-lying lower limit of 38 m to an upper limit of 339 m. Much the uppermost tidal flats are within 500 m of the shoreline. The possibility exists for substantial numbers of roosting curlew to be subject to visual disturbance from on-shore construction activity within a 15 month period. Though this disturbance may be intermittent, it will include one or, in part, two winter seasons. Alternative roost sites are used by the existing study site

population, with the main roost for this species being the adjacent Middleton saltmarsh (Marsh, 2012).

7.3.35 The upper tidal flats were found by the baseline surveys to be the area of greatest usage by redshank during the low water period. This corresponds to the distribution of some of the species main prey, Corophium species, Hydrobia ulvae and small annelids worms (Cramp & Simmons 1983). However the greatest bird abundance in the upper tidal flats of birds was over high tide when up to 61 birds were recorded in winter. A precautionary potential disturbance zone of up to 500 m has been assumed for these species for the purposes of this assessment. The IECS (2009) and Goss-Custard (2007) studies reported maxima flight distance of 250 m and 110 m respectively. The baseline surveys suggest that most birds using the upper tidal flats may at times be within the disturbance zone and risk being displaced by on-shore construction activity. Though the visual disturbance from on-shore construction activity may be intermittent, it's maximum duration of fifteen months will include one or parts of two non-breeding seasons. The feeding technique and wide variety of prey taken by redshank, is likely to make this species well suited to adapting to changes in sediments and invertebrate communities of intertidal flats. Though locally the availability of a particular invertebrate prey species may have a strong influence on redshank numbers, from a whole site perspective the birds comparatively broad diet may allow it to re-distribute and maintain numbers in response to intermittent disturbance over twelve months. Furthermore, alternative roost sites do exist nearby and are routinely used by the study site population e.g. Middleton saltmarsh and Red Nab roosts (Marsh, 2012).

7.3.36 In winter, shelduck chiefly foraged across the higher mudflats during the low water period numbering up to 122 birds (1.5% of the Morecambe Bay SPA population), some of which remained to roost over high water along the upper shore. The upper most tidal flats is where one of the shelduck's main prey is distributed, the mud snail Hydrobia ulvae (CMACS 2012). This can provide up to 90% of the species' intake (Cramp & Simmons, 1983). A precautionary potential disturbance zone of up to 500 m has been assumed for these species for the purposes of this assessment. The IECS (2009) and Goss-Custard (2007) studies reported maxima flight distance of 199 m and 250 m respectively. The baseline surveys suggest that most birds using the upper tidal flats may at times be within the disturbance zone and risk being displaced by on-shore construction activity. Regular instances of human disturbance occurred during the baseline surveys and the birds flew south towards the Lune estuary, joining the main population on which the study site is on the peripheral, or north to join the small numbers on and around Red Nab (Marsh 2012).

7.3.37 Small numbers of ringed plover were recorded by the baseline surveys using the study site at times during the non-breeding seasons. Over 85% of records were from the uppermost tidal flats with a peak count of 37 in September, equating to 5% of the Morecambe Bay SPA population. A precautionary potential disturbance zone of up to 250 m has been assumed for this species for the purposes of this assessment. The IECS (2009) and Goss-Custard (2007) studies both reported a flight distance of 120 m. Though less than half of the upper most tidal flats are within 250 m of the shoreline, the possibility exists that a

roost of all birds using the area falls within the disturbance zone and risks being displaced by on-shore construction activity. Though the visual disturbance from on-shore construction activity may be intermittent, it's maximum duration of fifteen (non-consecutive) months will include one, or parts of two, non-breeding seasons. Alternative roost sites do exist and are used by the study site population e.g. the nearby Red Nab rocks at the northern end of Middleton Sands (Pete Marsh, pers comms.). There is thought to be no regular pattern of field use/roost by waterbirds in the vicinity of the study area (Pete Marsh pers comms).

7.3.38 Whooper Swan, wigeon, teal and eider were not recorded using the upper tidal flats. Greylag goose, mallard, red-breasted merganser, cormorant, little egret, golden plover, lapwing, sanderling, snipe and turnstone may have been foraging or roost in the study site but were not recorded during site surveys. Roost sites and much greater expanses of more preferred foraging habitat exists elsewhere within Morecambe Bay and/or the adjacent farmland for these species.

CONCLUSION

7.3.39 The onshore construction works are largely sufficiently distant from the intertidal and supra-tidal zones to allow a conclusion of no significant effect on the Morecambe Bay SPA and Ramsar sites. However, certain aspects of the onshore construction - such as excavations adjacent to the sea wall (for example, jointing bays) - will contribute to noise and visual presence disturbance and so add to the disturbance predicted from the intertidal works as described further above, and therefore contribute to the potential for a LSE on the Morecambe Bay SPA and Ramsar sites.

MORTALITY AS A RESULT OF COLLISION WITH TURBINE BLADES

7.3.40 The effect of collision related mortality on lesser black-backed and Herring Gulls originating from the Morecambe Bay SPA and Ramsar was screened in for further assessment in Section 6 of this report.

7.3.41 The breeding populations of Lesser Black-backed Gull and Herring Gull are shown in Table 7.5.

Table 7.5: Breeding Lesser Black-backed Gull and Herring Gull populations of Morecambe Bay SPA

Species	SPA Review population	Seabird Monitoring Programme (year of count)
Lesser Black-backed Gull	44, 000	16274 (2011)
Herring Gull	22,000	4188 (2011)

Lesser Black-backed Gull

7.3.42 Annex 1 to this Report shows (at Table 13) the results of a collision risk assessment for Lesser Black-backed Gull at the Project Site. Modelling predicts a total of 50 collisions per year (at a 98% avoidance rate). Annex 2, Table 3, shows that during the breeding season 20 collisions per year are predicted at the Project Site (at a 98% avoidance rate) for birds associated with the wider regional population. To determine the effect of collision mortality on the Lesser Black-backed Gull population of Morecambe Bay SPA / Ramsar collision numbers were apportioned to those SPAs supporting breeding colonies within mean maximum foraging range of the Project Site, based on the potential biological removal (PBR) methodology described in Annex 2. It was calculated that 14 Lesser Black-backed Gull collisions per year are associated with the Morecambe Bay SPA / Ramsar site.

Herring Gull

7.3.43 Annex 1, Table 13, shows the total number of predicted Herring Gull collisions at the Project site to be 111 per year, assuming a 98% avoidance rate. Annex 2, Table 3, shows that during the breeding season 70 collisions are predicted, assuming a 98% avoidance rate. To determine the effect of collision mortality on the Herring Gull population of Morecambe Bay SPA / Ramsar collision numbers were apportioned based on the PBR methodology described in Annex 2. It was calculated that 29 collisions per annum were associated with Morecambe Bay SPA / Ramsar.

7.3.44 Table 7.6 shows the Lesser Black-backed Gull and Herring Gull collisions as a proportion of the SPA population (SMP 2011) and in relation to the calculated potential biological removal (PBR) values of 482 and 140 respectively (identified in Annex 2, Table 6).

Table 7.6: Number of Lesser Black-backed Gull and Herring Gull collisions associated with the breeding population of Morecambe Bay SPA / Ramsar

Species	Number of collisions	Proportion of SPA population	Increase in background mortality4	Calculated PBR	Proportion of PBR
Lesser Black-backed Gull	14	0.09 %	0.99 %	482	2.9 %
Herring Gull	29	0.7 %	5.78 %	140	20.7 %

CONCLUSION

7.3.45 The number of Lesser Black-backed Gull and Herring Gull collisions associated with the Morecambe Bay SPA is considered to be sustainable in the context of the site's conservation objective of maintaining the interest feature populations. Mortality as a result of collision with turbine blades will not give rise, from the Project alone, to an adverse effect on the integrity of the Morecambe Bay SPA / Ramsar site.

MITIGATION FOR INTERTIDAL DISTURBANCE

7.3.46 Installation and burial of the export cables in the intertidal zone will be taking place within the Morecambe Bay SPA / Ramsar sites. The onshore zone containing the works compound and transition jointing bays behind the sea defence is outside of the SPA / Ramsar sites but adjacent to it. It will be necessary to propose mitigation measures sufficient to avoid an adverse effect on the integrity of the designated sites. The SPA is designated for supporting over wintering assemblages of waterbirds, survey data have shown the intertidal study area to support internationally and nationally important numbers of waterbirds during the wintering period. Proposed mitigation is that construction works are conducted outside of the time period October to March to avoid an adverse effect on the internationally and nationally important numbers of waterbirds using the study area. Such timing of works will minimise any direct impact upon waterbirds using the study site. It will also provide a lead in time of up to several months for re-colonisation and recovery of invertebrate populations along the export cable route prior to late winter; this is the time of year when energetic constraints are greatest for waterbirds using the study site.

7.3.47 7.3.47 For details of how this mitigation will be secured refer to Section 9 of this Report. Natural England has proposed that this constitutes appropriate mitigation.

7.3.48 7.3.48 Application of the above mitigation proposal will reduce potential environmental effects on ornithological sensitive receptors using the intertidal area, from construction of the offshore export cable, sea wall breaching works, and jointing bay construction works.

CONCLUSION REGARDING THE MORECAMBE BAY SPA AND RAMSAR SITE

7.3.49 No adverse effect on site integrity from the Project alone is predicted on the wintering wader and wildfowl features of the Morecambe Bay SPA and Ramsar site provided that no intertidal, upper foreshore, or nearby terrestrial (within 500 m of the foreshore) Project construction works are undertaken between 1st October and 31st March.

7.3.50 The predicted mortality on the Morecambe Bay SPA and Ramsar sites' breeding population of Lesser Black-backed Gull and Herring Gull as a result of turbine collision is shown to be within sustainable limits. Consequently there will not be an adverse effect on the integrity of these sites as a result of the Project alone.

7.4 Assessment of potential effect on the integrity of Morecambe Bay SAC

Introduction and site description

7.4.1 Morecambe Bay is the second largest embayment in Britain after The Wash and, at over 310 km² , it contains the largest continuous area of intertidal mudflats and sandflats in the UK, and includes the best example of muddy sandflats on the west coast (Brown et al., 1997). Within the sediments are a wide range of communities with particularly high numbers of various polychaete worms, bivalve molluscs and crustaceans. At low water, large areas of intertidal sandflats are exposed, with small areas of mudflat, particularly in the upper reaches of the adjoining estuaries. The sediments of the Bay are mobile and support a range of habitat and community types, from those typical of open coasts, where the sand is constantly on the move, to more sheltered areas where the sediment is less disturbed allowing more stable communities to develop. The diversity and composition of biological communities that occur in or on the sediments of Morecambe Bay are influenced by a number of key ecological factors.

FEATURES AND EFFECTS SCREENED INTO FURTHER ASSESSMENT

7.4.2 Section 6.1, Table 6.3 of this Report determined that there was potential for an effect on the following habitat features:

- Mudflats and sandflats

CONSERVATION OBJECTIVES

7.4.3 With regard to the natural habitats and / or species for which the site has been designated ("the Qualifying Features" listed below):

- Avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving Favourable Conservation Status of each of the qualifying features.

7.4.4 Subject to natural change, to maintain or restore:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;
- The populations of qualifying species;
- The distribution of qualifying species within the site.

HABITAT LOSS AND DISTURBANCE AS A RESULT OF THE INSTALLATION OF THE EXPORT CABLE

Mudflats and sandflats not covered by seawater at low tide

7.4.5 The process of cable installation in the intertidal zone is described in Section 2.4 of this report and Section 4.9 of ES Chapter 4 "Project Description".

7.4.6 In the intertidal zone the five export cable systems will be installed via trenching. All five trenches will be within the 500 m wide working corridor, as will all operating plant. The proposed width of a trench, if created by open cut, will be 1.4 m at the surface with an indicative length across the mudflat / sandflat of 3,500 m resulting in a disturbance area of 4,900 m² (0.49 ha) per cable trench. With a five cable installation the total area of mudflat / sandflat habitat impacted is 24,500 m² (= 5 x 4,900 m²), 2.45 ha, equivalent to 0.41 % of the estimated 600 ha of mudflat / sandflat in Middleton Sands.

7.4.7 Excavated sediment will be temporarily relocated nearby to the trench so there will be no net removal or addition of sediment from the beach as a result of the operation. The cables will be laid into the trench which will then be backfilled, mechanically and/or by natural processes. Initial inundation by the tide will rapidly cause the majority of the displaced sediment to fluidise and collapse back into the trench under gravity and hydraulic action. Further, reworking by currents or waves will also rapidly redistribute and smooth any remaining local disturbances, returning the area of the works to a natural state (level, sediment type and consolidation) that will be in equilibrium with the baseline environment. The intertidal sediments are mobile sands and the main intertidal biotopes recorded at Middleton Sands tend to be reasonably resilient following physical disturbance (see; http://www.marlin.ac.uk/). The area impacted is a dynamic sandy beach environment that will recover rapidly (within a few tidal cycles) from the works.

7.4.8 If marine drilling takes place (HDD from a vessel on the intertidal rather than from land, see Section 2.4 of this report), an excavation pit up to 4 m deep and approximately 30 m wide and 30 m long (to allow for sloped pit banks) will be dug. A maximum of 18,000m³ of material will be excavated (maximum number of 5 export cables) and a total area 0.45 ha of mudflats will be disturbed, equivalent to 0.075 % of the estimated 600 ha of the mudflats in Middleton Sands . The intertidal biotopes present in the area are mobile sands with low species numbers and are considered to be reasonably resilient to this type of disturbance. Few studies exist regarding the re-colonisation of intertidal areas by invertebrates following cable burial. Re-colonisation of intertidal areas dominated by Hediste diversicolor, Scrobicularia plana and Tubifex spp. following open-cut trenching in Clonakilty Bay, Ireland was found to be dependent on the species and its abundance within the surrounding area (Lewis 2002; 2003). Whereas the polychaetae Hediste diversicolor showed a good recovery six months following the impact in May-July, the bivalve Scrobicularia plana did not show signs of recovery until sampled a further six months later. The sheltered tidal flats of Clonakilty Bay are most likely in a lower energy environment than those at the exposed study site in Morecambe Bay. Owing to winter storms, and therefore a periodically high energy environment, intertidal sediments in the study area are liable to be mobile and therefore the main intertidal biotopes recorded in this area tend to be reasonably resilient following physical disturbance (Chapter 10 Benthic ecology, 10.9.2.3.)

CONCLUSION

7.4.9 Due to the total (maximum) area affected being relatively small, coupled with rapid recovery of physical and biological conditions and with no change in habitat structures expected to occur, no adverse effect is predicted on the mud and sandflats feature, and therefore the integrity, of Morecambe Bay SAC.

7.5 Assessment of the potential effects on Liverpool Bay SPA

Introduction and site description

7.5.1 The Liverpool Bay SPA is located in the south-eastern region of the northern part of the Irish Sea, bordering northern England and north Wales, and running as a broad arc from Morecambe Bay in the north to the east coast of Anglesey in the south, divided between England and Wales at the border running through the Dee Estuary.

7.5.2 The seabed of Liverpool Bay consists of a wide range of mobile sediments. Sand is the predominate substrate with a concentrated area of gravelly sand off the Mersey estuary. The tidal currents throughout the Bay are

generally weak and do not exceed 2 m / sec. This combined with a relatively extended tidal range of 6 m to 8 m along the Lancashire coastline facilities the deposition of sediments, encouraging mud and sand belts to accumulate.

7.5.3 Water temperature fluctuates between summer and winter, with the coldest temperatures in February and March of 5 to 6°C. In August the surface water temperatures range between 14 to 16°C. The salinity level varies from fully saline in the western seaward areas of Liverpool Bay and decreases eastwards to 33 to 31 parts per thousand with the increased fresh water river input.

Red-throated diver

7.5.4 Wintering red-throated diver occur throughout Liverpool Bay SPA with highest recorded densities off the Ribble Estuary, North Wales, and the North Wirral Foreshore (Webb et al., 2006.). Red-throated diver use the SPA in wintering numbers of European importance (922 individuals, 5.4% of the GB population, 2001/02 – 2006/07). The sandbanks of Liverpool Bay support the nursery and feeding grounds for many fish species. The distribution and concentrations of red-throated divers will at least partly be determined by the presence, abundance, and availability of their prey species.

Common scoter

7.5.5 Common scoters have a more clustered distribution within Liverpool Bay than red-throated divers, with highest concentrations recorded from three broad areas (Webb et al., 2006):

- Red Wharf Bay (Anglesey) and Conwy Bay;
- Great Orme's Head to the North Wirral Foreshore; and
- Formby Point to Skerries (off Blackpool).

7.5.6 Common scoters use the SPA in winter in numbers of European importance (54,675 individuals, 3.4% of the north-west European population of the nigra subspecies, 2001/02 – 2006/07). In the UK, wintering common scoters are associated with shallow (between 0 m to 20 m deep, less frequently in depths of around 30 m) offshore areas with sandy sea beds (Lack, 1986).

7.5.7 Liverpool Bay SPA supports at least 55,597 individual waterfowl in the non-breeding season. This assemblage is of European importance and includes the populations of both common scoter and red-throated diver regularly occurring in Liverpool Bay SPA. However, no other species have been identified as particularly important components of the assemblage of waterfowl that uses Liverpool Bay in the non-breeding season.

EFFECTS AND FEATURES SCREENED INTO THE ASSESSMENT

7.5.8 Section 6 Table 6.1 of this report determined there was potential for a likely significant effect on red-throated diver and common scoter from the Liverpool Bay SPA as a result of the installation of the export cable which crosses approximately 6.3 km of the SPA.

CONSERVATION OBJECTIVES

7.5.9 With respect to red-throated divers, the conservation objectives for the SPA is to maintain the population and its supporting habitats in favourable condition whereby (Natural England and CCW, 2009):

- The 5 year peak mean population size for this species is no less than 922 individuals;
- The overall presence and abundance of prey species within the site is maintained; and
- Red-throated divers are not subject to significant human-induced mortality, and areas where they congregate in higher densities are not subject to significant disturbance.

7.5.10 With respect to common scoter, the conservation objectives for the SPA is to maintain the common scoter population and its supporting habitats in favourable condition (Natural England and CCW, 2009).

7.5.11 The interest feature common scoter will be considered to be in favourable condition only when all of the following conditions are met:

- The 5 year peak mean population size for the common scoter population is no less than 54,675 individuals (ie the five-year peak mean between 2001/02 – 2006/07);
- The overall presence and abundance of benthic prey species within the site is maintained, along with its associated features;
- Common scoters are not exposed to significant human-induced mortality, and their aggregations are not subject to significant disturbance;
- The movement of common scoters between feeding and resting areas is not significantly impeded;
- Displacement as result of export cable installation.

7.5.12 The proposed export cable route passes through the extreme northern extent of the Liverpool Bay SPA. This involves a portion of 6.3 km of the total length, with a assumed working width of 800m (an area totalling 5.04 km^2).

7.5.13 A substantial amount of data is available for the SPA that details distribution of the two qualifying features (common scoter and red-throated diver); most notably documents produced by JNCC to determine the boundary of the SPA (Webb et al., 2006).

7.5.14 Liverpool Bay supports a population of 54,765 common scoter and within the SPA, the most important areas are Shell Flat to Formby (off Blackpool), Colwyn Bay and Conwy Bay (NE & CCW, 2006). The area in which the Project Site Offshore Cable Corridor will pass through cannot therefore be considered to lie within an immediate region known to support important densities of scoters. This inference is supported by distribution figures presented in Webb et al., (2006) which indicate that the area within which the Project ECR will lie does not have significance for this species (see for example Figure 2 in Webb et al., 2006).

7.5.15 Red-throated divers occur sporadically through the SPA area with highest densities occurring off the Ribble Estuary, North Wales and the North Wirral Foreshore (Webb et al., 2006). A population of 922 individuals is detailed in the SPA citation, which accounts for 5.4% of the British population and is of European importance. The area in which the Project Offshore Cable Corridor will lie has not been known to support significant densities of this species (recording densities of between 0.0001 - 0.1049 ind / km^2), with a substantial portion of this area not recording this species at all (see for example Figure 3 in Webb et al., 2006).

CONCLUSION

7.5.16 The citation data for the Liverpool Bay SPA show low numbers of both qualifying features recorded along the route of the export cable where it crosses the northern limit of this SPA. The two qualifying features occur only seasonly in the SPA; red-throated diver are absent during Spring to early Autumn (Webb et al., 2006), while common scoters are present from August to May with the most significant numbers present from August to March (NE and CCW, 2009). The cable installation operation will result in only temporary disturbance over an expected short duration (worst case 21 days at 1.5km of cable per day multiplied by 5 cables) within the SPA and will be restricted to slow moving boat

traffic that is not considered to represent a level of disturbance beyond the background levels that the species are currently exposed to. Consequently it is assessed that the Project's cable laying operation will not have an adverse effect on the integrity of the Liverpool Bay SPA.

7.6 Assessment of potential effects on the Ribble and Alt Estuaries SPA and Ramsar

Introduction and site description

7.6.1 The Ribble and Alt Estuaries (of which the Ribble is by far the larger) together with an extensive area of sandy foreshore along the Sefton Coast, form this SPA and Ramsar site. The SPA's intertidal mudflats, saltmarshes and coastal grazing marshes support important populations of wintering and migrating waterbirds. The areas of saltmarsh also support large concentrations of breeding gulls and terns. The SPA includes the component SSSI's of Ribble Estuary and Sefton Coast, with the former site's designation noting the internationally important numbers of waterfowl that it supports.

7.6.2 During the breeding season the Ribble and Alt Estuaries support populations of European importance of two Annex 1 listed species; ruff and common tern. The site also supports populations of European importance of four further Annex 1 listed species: Bewick's swan, Whooper Swan, golden plover and bar-tailed godwit. The site supports a suite of further species that occur during winter in populations of European importance, including pintail, teal, wigeon, Pink-footed Goose, scaup, sanderling, dunlin, knot, oystercatcher, black-tailed godwit, common scoter, curlew, cormorant, grey plover, shelduck and lapwing. During the breeding season, Lesser Black-backed Gull and black-headed gull are both present in numbers of European importance, while sanderling, ringed plover, whimbrel, and redshank also exceed this threshold during passage periods.

EFFECTS AND FEATURES SCREENED INTO ASSESSMENT

7.6.3 Section 6 Table 6.1 of this report identifies potential for a likely significant effect on breeding Lesser Black-backed Gulls originating from the Ribble and Alt Estuaries SPA as a result of turbine collision.

CONSERVATION OBJECTIVES

7.6.4 The conservation objectives for the SPA are to maintain in favourable condition:

- The habitats for the populations of regularly occurring Annex 1 species of European importance, in particular intertidal sand and mudflats and saltmarsh;
- The habitats for the populations of regularly occurring migratory bird species of European importance, in particular intertidal sand and mudflats and saltmarsh; and
- The habitats for the populations of waterfowl that contribute to the wintering waterfowl assemblage of European importance, with particular reference to intertidal sand and mudflats, marshy grassland and saltmarsh.

Table 7.7: Population numbers for Lesser Black-backed Gull from the Ribble and Alt Estuaries SPA and Ramsar

Species	Designated SPA population	Ramsar criterion	Current population
Lesser Black-backed Gull	3,600 individuals (Stroud et al 2001)	4,108 Apparently occupied nests	8,234 individuals (SMP 2011)

DIRECT COLLISION WITH TURBINE BLADES

7.6.5 The total number of Lesser Black-backed Gull collisions at the Project offshore wind farm site predicted during the breeding season totalled 20 birds, at a 98 % avoidance rate (HRA Report Annex 2, Table 3). To determine the effect of collision mortality on the Lesser Black-backed Gull population of the Ribble and Alt Estuaries SPA, collision numbers were apportioned based on the PBR methodology described in Annex 2. It was calculated that 2 collisions were associated with the Ribble and Alt Estuaries SPA, equating to just 0.82 % of the calculated PBR value of 244 (HRA Report Annex 2, Table 5).

7.6.6 Table 7.8 shows these collisions as a proportion of the SPA population (SMP 2011) and in relation to the calculate PBR of 244 (HRA Report Annex 2, Table 6).

Table 7.8: Number of Lesser Black-backed Gull collisions associated with the Ribble and Alt Estuaries SPA.

Number of collisions	Proportion of SPA population	Increase in background mortality5	Calculated PBR	Proportion of PBR
2	0.02%	0.28%	244	0.82%

CONCLUSION

7.6.7 The number of Lesser Black-backed Gull collisions associated with the Ribble and Alt Estuaries SPA is considered to be sustainable in the context of the site's conservation objectives and the population will be maintained.

7.6.8 Consequently the Project alone will not have an adverse effect on the Ribble and Alt Estuaries SPA and Ramsar sites.

7.7 Assessment of potential effects on the Bowland Fells SPA

INTRODUCTION AND SITE DESCRIPTION

7.7.1 The Bowland Fells are dominated by blanket bog and heather moorland with areas of upland pasture, especially on lower slopes below the fell wall. They are incised by rapid flowing rivers giving rise to steep cloughs with occasional trees and lush wooded valleys on lower slopes. The valleys and cloughs provide a transition between the exposed moorland fells and the rural lowlands and include an attractive mosaic of woodland, unimproved meadows, rush dominated pastures, and flushed grassland slopes, with marshes and streams at lower levels. The major habitats are heather-dominated moorland and blanket mire. It is important for its upland breeding birds, especially breeding merlin and hen harrier. The site is also designated for its breeding population of Lesser Black-backed Gull, 13,900 pairs representing up to 11.2% of the breeding Western Europe / Mediterranean / Western Africa population.

EFFECTS AND FEATURES SCREENED INTO THE ASSESSMENT

7.7.2 The effect of collision related mortality on Lesser Black-backed Gulls originating from the Bowland Fells SPA was screened in for further assessment in section 6 Table 6.1 of this Report. Population values for Lesser Black-backed Gull at Bowland Fells SPA are shown at Table 7.9.

CONSERVATION OBJECTIVES

7.7.3 The conservation objectives for Bowland Fells SPA are:

- Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive.

7.7.4 Subject to natural change, to maintain or restore:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The populations of the qualifying features;
- The distribution of the qualifying features within the site.

Table 7.9: Population of Lesser Black-backed Gull at the Bowland Fells SPA

Species	Designated population	Current population
Lesser Black-backed Gull	27,800 (Stroud et al 2001)	10,937 (SMP, 2011)

DIRECT COLLISION WITH TURBINE BLADES

7.7.5 The total number of lesser black backed gull collisions at the Project offshore wind farm site predicted during the breeding season totalled 20 birds at a 98 % avoidance rate (HRA Report Annex 2, Table 3). To determine the effect of collision mortality on the breeding Lesser Black-backed Gull population of the Bowland Fells SPA collision numbers were apportioned based on the PBR methodology described in Annex 2. It was calculated that 1 collision was associated with the Bowland Fells SPA representing 0.31 % of the calculated PBR value of 324 (HRA Report Annex 2, Table 5).

7.7.6 Table 7-10 shows these collisions as a proportion of the Bowland Fells SPA population (SMP 2011) and in relation to the calculated PBR value of 324 (HRA Report Annex 2, Table 6).

Table 7.10: Number of Lesser Black-backed Gull collisions associated with the Bowland Fells SPA.

Number of collisions	Proportion of SPA population	Increase in background mortality6	Calculated PBR	Proportion of PBR
1	0.009%	0.11%	324	0.31%

CONCLUSION

7.7.7 The number of breeding Lesser Black-backed Gull collisions for birds associated with the SPA is considered to be sustainable in the context of the site's conservation objectives and the population will be maintained. Consequently the Project alone will not have an adverse effect on the Bowland Fells SPA.

7.8 Assessment of potential effects on the Aberdaron Coast and Bardsey Island SPA

INTRODUCTION AND SITE DESCRIPTION

7.8.1 The Aberdaron Coast and Bardsey Island SPA is located at the end of the Lleyn Peninsula in north-west Wales. The SPA coastline is rocky with frequent crags, screes and low cliffs. The site is designated for its resident population of chough and for breeding Manx Shearwater. The former species has a restricted distribution in Britain, tied to coastal areas of low intensity agriculture and short-grass (Cramp & Simmons, 1977) which, within the region, is found only in north-west Wales and the Isle of Man; the SPA supports 12 breeding pairs. Choughs are noted to be essentially sedentary in the UK (Cramp and Perrins, 1994) and have not been recorded in the Project Site.

7.8.2 The Manx Shearwater colony on Bardsey is large and the SPA designation cites a population of European Importance of 6930 pairs which represents at least 2.6% of the species breeding population (Stroud et al., 2001).

EFFECTS AND FEATURES SCREENED INTO ASSESSMENT

7.8.3 Section 6 Table 6.1 determined that there was potential for a likely significant effect on Manx Shearwater from the Aberdaron Coast and Bardsey Island SPA as result of displacement by construction activity and turbine presence.

CONSERVATION OBJECTIVES

7.8.4 The conservation objectives for breeding Manx Shearwater are to maintain the population in favourable conservation status, where all of the following conditions are satisfied:

- Breeding population of Manx Shearwater (confined to Bardsey) is stable or increasing (lower limit 10,000 pairs);
- Reproductive rates remain stable (lowest tolerable limit of >0.5 fledged chicks per pair for 3 consecutive years);
- Deaths from lighthouse attractions, fencing and other infrastructure are minimal (upper limit of 35 fatalities per year);
- No ground predators are introduced;
- Nesting birds are not disturbed by restoration works on boundary walls or recreational activities; and
- All factors affecting the achievement of these conditions are under control.

Table 7.11: Population of Manx Shearwater at the Aberdaron Coast and Bardsey Island SPA

Species	Population at time of designation	Current population
Manx Shearwater	13,860 (Count as at 1996)	16,183 (SMP, 2001)

AVOIDANCE AND DISPLACEMENT AS A RESULT OF CONSTRUCTION ACTIVITY

7.8.5 Manx Shearwater were present within the study area during the May 2012 boat-based surveys in internationally important numbers. Aerial survey data shows that the species was present in higher numbers during May and September, with lower numbers present during mid-summer. This suggests that the Project Site was most utilised during migratory periods by Manx Shearwater, with a lower number of birds using the study area for foraging excursions from colonies in the breeding season. Over one quarter of Manx Shearwaters (29%) were observed foraging during boat-based surveys, with the majority of birds recorded (44%) resting on the sea surface. This implies that the study area provides some value to the species when present.

7.8.6 Manx Shearwater are highly mobile foragers with a high degree of habitat flexibility (Furness and Wade, 2012). There is little evidence available on the response of Manx Shearwaters to construction period boat traffic although all monitoring work that has investigated construction period effects including at Walney I and II (NIRAS, 2012) and at Robin Rigg (eon / Natural Power, 2012) have not recorded any significant changes in numbers or distribution of this species.

AVOIDANCE AND DISPLACEMENT AS A RESULT OF TURBINE PRESENCE

7.8.7 Manx Shearwater is considered to be one of the seabird species least likely to be susceptible to displacement from offshore wind farms (Furness & Wade, 2012; Maclean et al., 2009). The lower numbers of Manx Shearwaters present during the breeding period (compared to the peak number in spring and early autumn) suggests that the study area does not provide key foraging opportunities for birds originating from breeding sites during egg-laying or chick-rearing periods. The peak numbers occurring in May and September represent periods of dispersal from breeding sites.

7.8.8 Table 7-12 and Table 7-13 present the potential displacement scenarios of Manx Shearwater at the Project site and 4 km buffer in terms of numbers of birds potentially at risk of being lost as a result of displacement.

7.8.9 Table 7-12 shows displacement during the breeding period, where red cells represent > 1% of the SPA population, orange cells 0.5 % - 0.99 % of the population and green cells 0 – 0.49 % of the SPA population.

Table 7.12: Displacement risk matrix for Manx Shearwater from the Aberdaron Coast and Bardsey Island SPA

Manx Shearwater (breeding)	Mortality (%)										
Displacement level (%)	0	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0
10	0	9	19	28	37	46	56	65	74	83	93
20	0	19	37	56	74	93	111	130	148	167	185
30	0	28	56	83	111	139	167	194	222	250	278
40	0	37	74	111	148	185	222	259	296	333	370
50	0	46	93	139	185	231	278	324	370	416	463
60	0	56	111	167	222	278	333	389	444	500	555
70	0	65	130	194	259	324	389	453	518	583	648
80	0	74	148	222	296	370	444	518	592	666	740
90	0	83	167	250	333	416	500	583	666	750	833
100	0	93	185	278	370	463	555	648	740	833	926
Input data – Mean peak population estimates for Walney Extension + 4 km buffer, aerial surveys May – Aug											
Reference population 1 - Aberdaron Coast and Bardsey Island / Glannau Aberdaron and Ynys Enlli SPA – 16183 individuals											

7.8.10 A level of 30 % displacement, 60 % mortality is required to affect 1 % of the Aberdaron Coast and Bardsey Island SPA population. As guidance, a level of 30 % displacement is predicted as the likely impact of the Project based on the species lack of sensitivity to disturbance (Furness and Wade, 2012) and preliminary results of monitoring work at Walney I and II (NIRAS, 2012a). It is considered unlikely that 60 % mortality level will occur as a result of displacement given the foraging habitat available to this species and that birds present within the Project site will not all originate from the Aberdaron Coast and Bardsey Island SPA. Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Taken together with monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) which suggest that distribution and population estimates were similar in pre-construction and construction periods no adverse effect on the SPA population is predicted.

7.8.11 Table 7.13 shows displacement within the post-breeding period (September – October) where a regional population derived from Mitchell et al. (2004) is relevant. During the post-breeding period the number of Manx Shearwater at risk does not surpass a 1% threshold of the regional population at any chosen level of displacement or mortality.

Table 7.13: Displacement of Manx Shearwater during the post-breeding period (September-October)

Manx Shearwater (Post-breeding)	Mortality (%)										
Displacement level (%)	0	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0
10	0	5	10	15	20	26	31	36	41	46	51
20	0	10	20	31	41	51	61	71	82	92	102
30	0	15	31	46	61	77	92	107	123	138	153
40	0	20	41	61	82	102	123	143	163	184	204
50	0	26	51	77	102	128	153	179	204	230	255
60	0	31	61	92	123	153	184	214	245	276	306
70	0	36	71	107	143	179	214	250	286	322	357
80	0	41	82	123	163	204	245	286	327	368	408
90	0	46	92	138	184	230	276	322	368	414	459
100	0	51	102	153	204	255	306	357	408	459	511
Input data – Mean peak population estimates for Walney Extension + 4 km buffer, aerial surveys Sept – Oct											
Reference population 1 – Regional population – 448,502 individuals											

CONCLUSION

7.8.12 Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Additionally, the monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) suggest that distribution and population estimates are similar in pre-construction and construction periods. Consequently it is considered that displacement effects on Manx Shearwater, as a result of either construction activity or the presence of operational turbines, will not result in an adverse effect on the integrity of the Aberdaron Coast and Bardsey Island SPA.

7.9 Assessment of potential effects on the Skokholm and Skomer SPA

INTRODUCTION AND SITE DESCRIPTION

7.9.1 Skomer, Skokholm and Middleholm are three islands lying off the extreme south-west tip of Pembrokeshire in south-west Wales. They are bounded by cliffs that reach 70 m on Skomer and plateau vegetation is affected by salt spray and nutrient enrichment from seabirds. The islands support a large number of breeding seabirds, especially petrels, gulls and auks. The SPA is over 280 km distant from the Project offshore wind farm site and the Manx Shearwater interest feature alone is relevant, due to its extensive foraging range (Thaxter et al., 2012). The 2001 SPA review cites 150,968 pairs of Manx Shearwaters which represents at least 56.9% of the breeding population of the species. The current population values for this site are shown in Table 7.14.

CONSERVATION OBJECTIVES

7.9.2 The vision for the Manx Shearwater feature of the SPA is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- During the breeding season the population of Manx Shearwater will be at least 150,000 pairs within the SPA (this represents around half of the current breeding population at this site);
- Breeding success will be at least 0.5 chicks per egg laid; and
- The factors affecting the feature are under control.

Table 7.14: Population of Manx Shearwater from Skokholm and Skomer SPA

Species	Population at time of designation	Current population
Manx Shearwater	301,936 individuals (JNCC, count as at late 1990s)	632,140 individuals (Perrins et al 2011).

DISPLACEMENT AS A RESULT OF CONSTRUCTION ACTIVITY AND TURBINE INSTALLATION

7.9.3 Manx Shearwater were present at the Projct offshore wind farm site during the May 2012 boat-based surveys in internationally important numbers, although aerial survey numbers did not breach the threshold for regional importance. Aerial survey data shows that the species was present in higher numbers during May and September, with lower numbers present during mid-summer. This suggests that the site was most utilised during migratory periods by Manx Shearwater, with a lower number of birds using the study area for foraging excursions from colonies in the breeding season.

7.9.4 A proportion of 29% Manx Shearwaters were observed foraging during boat-based surveys, with 44% resting on the sea surface. This implies that the study area provides some value to the species when present. Manx Shearwaters are known are known to be a highly mobile species when foraging with a high degree of habitat flexibility (Furness and Wade, 2012). There is little evidence available on the response of Manx Shearwaters to construction period boat traffic although all monitoring work that has investigated construction period effects including at Walney I and II (NIRAS, 2012) and at Robin Rigg (eon / Natural Power, 2012) have not recorded any significant changes in numbers or distribution of this species.

DISPLACEMENT AS A RESULT OF TURBINE PRESENCE

7.9.5 Manx Shearwater has been considered one of the seabird species least susceptible to displacement from offshore wind farms (Furness & Wade, 2012; Maclean et al., 2009). The lower numbers of Manx Shearwaters during the breeding period (compared to the peak number in spring and early autumn) suggests that the study area does not provide key foraging opportunities for birds originating from these sites during egg-laying or chick-rearing periods. The peak numbers occurred in May and September represent periods of dispersal from breeding sites.

7.9.6 Table 7.15 and Table 7.16 present the potential displacement scenario of Manx Shearwater at the Project site and 4 km buffer in terms of numbers of birds potentially at risk of being lost to the relevant populations.

7.9.7 Table 7.15 shows breeding period displacement for the SPA where red cells represent > 1 % of the SPA population, orange cells 0.5 % - 0.99 % of the population and green cells 0 % – 0.49 % of the SPA population. Table 7.16 shows displacement within the post-breeding period (September – October) where a regional population derived from Mitchell et al. (2004) is relevant. A level of 30% displacement is predicted as the likely impact of the Project based on the species lack of sensitivity to disturbance (Furness and Wade, 2012) and preliminary results of monitoring work at Walney I and II (NIRAS, 2012a).

Table 7.15: Displacement risk matrix for Manx Shearwater from the Skokholm and Skomer SPA

Manx Shearwater (Breeding)	Mortality (%)										
Displacement level (%)	0	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0
10	0	9	19	28	37	46	56	65	74	83	93
20	0	19	37	56	74	93	111	130	148	167	185
30	0	28	56	83	111	139	167	194	222	250	278
40	0	37	74	111	148	185	222	259	296	333	370
50	0	46	93	139	185	231	278	324	370	416	463
60	0	56	111	167	222	278	333	389	444	500	555
70	0	65	130	194	259	324	389	453	518	583	648
80	0	74	148	222	296	370	444	518	592	666	740
90	0	83	167	250	333	416	500	583	666	750	833
100	0	93	185	278	370	463	555	648	740	833	926
Input data – Mean peak population estimates for Walney Extension + 4 km buffer, aerial surveys May – Aug											
Skokholm and Skomer SPA – 632,140 individuals											

7.9.8 As a level of 100% displacement and 100 % mortality would not affect 1% of the Skokholm and Skomer SPA population, no adverse effect on the SPA population is predicted as a result of operational displacement.

7.9.9 Table 7.16 shows displacement within the post-breeding period (September – October) where a regional population derived from Mitchell et al. (2004) is relevant. During the post-breeding period the number of Manx Shearwater at risk does not surpass a 1% threshold of the regional population at any given level of displacement or mortality.

Table 7.16: Displacement of Manx Shearwater during the post-breeding period (September-October)

Manx Shearwater (Post-breeding)	Mortality (%)										
Displacement level (%)	0	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0
10	0	5	10	15	20	26	31	36	41	46	51
20	0	10	20	31	41	51	61	71	82	92	102
30	0	15	31	46	61	77	92	107	123	138	153
40	0	20	41	61	82	102	123	143	163	184	204
50	0	26	51	77	102	128	153	179	204	230	255
60	0	31	61	92	123	153	184	214	245	276	306
70	0	36	71	107	143	179	214	250	286	322	357
80	0	41	82	123	163	204	245	286	327	368	408
90	0	46	92	138	184	230	276	322	368	414	459
100	0	51	102	153	204	255	306	357	408	459	511
Input data – Mean peak population estimates for Walney Extension + 4 km buffer, aerial surveys Sept – Oct											
Reference population 1 – Regional population – 448,502 individuals											

CONCLUSION

7.9.10 Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Taken together with monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) which suggest that distribution and population estimates were similar in pre-construction and construction periods, it is considered that displacement effects on Manx Shearwater from either Project construction or Project operational activity will not result in an adverse effect on the integrity of the Skokholm and Skomer SPA.

7.10 Assessment of potential effects on the Copeland Islands SPA

INTRODUCTION AND SITE DESCRIPTION

7.10.1 The Copeland Islands SPA is located off the north-east coast of County Down, Northern Ireland and covers an area of 201.52 ha. The SPA comprises three islands (Big Copeland, Light House Island and Mew Island) together with a number of associated islets. The site includes rocky shores together with small areas of sand/mud and cobble/boulder beaches. Terrestrially, the site is composed of saltmarsh, freshwater marsh, maritime grassland and a limited extent of inland cliff and semi-improved agricultural grassland.

7.10.2 The site is designated under Article 4.1 of the Birds Directive for supporting nationally important numbers of Arctic tern (566 pairs representing 22.6% of the Irish population) and under Article 4.2 of the Birds Directive for supporting internationally important numbers of Manx Shearwater (4800 pairs representing 1.7% of the world population, Table 7.17). The islands also support a number of non-qualifying species including a nationally important breeding population of Eider (200 individuals representing 10% of the Irish population), a nationally important population of common gull (250 pairs representing 7% of the Irish population) and Northern Ireland's first breeding pair of Mediterranean gull.

CONSERVATION OBJECTIVES

7.10.3 Conservation objectives for this site have not been identified but in their absence it is assumed that the objective is to maintain the breeding population of Arctic tern and Manx Shearwater.

Table 7.17: Population of Manx Shearwater from Copeland Islands SPA

Species	Population at time of designation	Current population
Manx Shearwater	9,600 (Seabird 2000)	Most up to date population data at time of designation

DISPLACEMENT AS A RESULT OF CONSTRUCTION ACTIVITY AND TURBINE INSTALLATION

7.10.4 Manx Shearwater were present during the May 2012 boat-based surveys in internationally important numbers, although aerial survey numbers did not breach the threshold for regional importance. Aerial survey data shows that the species was present in higher numbers during May and September, with lower numbers present during mid-summer. This suggests that the site was most utilised during migratory periods by Manx Shearwater, with a lower number of birds using the study area for foraging excursions from colonies in the breeding season.

7.10.5 A proportion of 29% Manx Shearwaters were observed foraging during boat-based surveys, with 44% resting on the sea surface. This implies that the study area provides some value to the species when present. Manx Shearwaters are known are known to be a highly mobile species when foraging with a high degree of habitat flexibility (Furness and Wade, 2012). There is little evidence available on the response of Manx Shearwaters to construction period boat traffic although all monitoring work that has investigated construction period effects including at Walney I and II (NIRAS, 2012) and at Robin Rigg (eon / Natural Power, 2012) have not recorded any significant changes in numbers or distribution of this species.

DISPLACEMENT AS A RESULT OF TURBINE PRESENCE

7.10.6 Manx Shearwater has been considered one of the least likely seabird species susceptible to displacement from offshore wind farms (Furness & Wade, 2012; Maclean et al., 2009. The lower numbers of Manx Shearwaters during the breeding period (compared to the peak number in spring and early autumn) suggests that the study area does not provide key foraging opportunities for birds originating from these sites during egg-laying or chick-rearing periods. The peak numbers occurred in May and September represent periods of dispersal from breeding sites.

7.10.7 Table 7.18 and Table 7.19 present the potential displacement scenario of Manx Shearwater at the Project in terms of numbers of birds potentially at risk of being lost to the relevant populations. Table 7.18 shows breeding period displacement for the SPA where red cells represent >1% of the SPA population, orange cells 0.5 -0.99 % of the population and green cells 0 – 0.49% of the SPA population. Table 7.19 shows displacement within the post-breeding period (September – October) where a regional population derived from Mitchell et al. (2004) is relevant.

Table 7.18: Displacement risk matrix for Manx Shearwater from the Copeland Islands SPA

Manx Shearwater (Breeding)	Mortality (%)											
Displacement level (%)		0	10	20	30	40	50	60	70	80	90	100
	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	9	19	28	37	46	56	65	74	83	93
	20	0	19	37	56	74	93	111	130	148	167	185
	30	0	28	56	83	111	139	167	194	222	250	278
	40	0	37	74	111	148	185	222	259	296	333	370
	50	0	46	93	139	185	231	278	324	370	416	463
	60	0	56	111	167	222	278	333	389	444	500	555
	70	0	65	130	194	259	324	389	453	518	583	648
	80	0	74	148	222	296	370	444	518	592	666	740
	90	0	83	167	250	333	416	500	583	666	750	833
	100	0	93	185	278	370	463	555	648	740	833	926
Input data – Mean peak population estimates for Walney Extension + 4 km buffer, aerial surveys May – Aug												
Copeland Islands SPA – 9,600 individuals												

7.10.8 A level of 30% displacement, 30 % mortality is required to affect 1 % of the Copeland Islands SPA population. A level of 30% of displacement is predicted as the likely impact of the Project based on the species lack of sensitivity to disturbance (Furness and Wade, 2012) and preliminary results of monitoring work at Walney I and II (NIRAS, 2012a).

7.10.9 It is considered unlikely that 30 % mortality level will occur as a result of displacement given the foraging habitat available to this species. Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Birds present within the Project site are likely to originate from both the Copeland Islands, Aberdaron Coast and Bardsey Island SPAs and the super colony at Skokholm and Skomer as well as local breeding colonies such as; Calf of Man, Lambay Island, Treshnish Isles and Sander.

7.10.10 Monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) which suggest that distribution and population estimates of Manx Shearwater were similar in pre-construction and construction periods, no adverse effect on the SPA population is predicted.

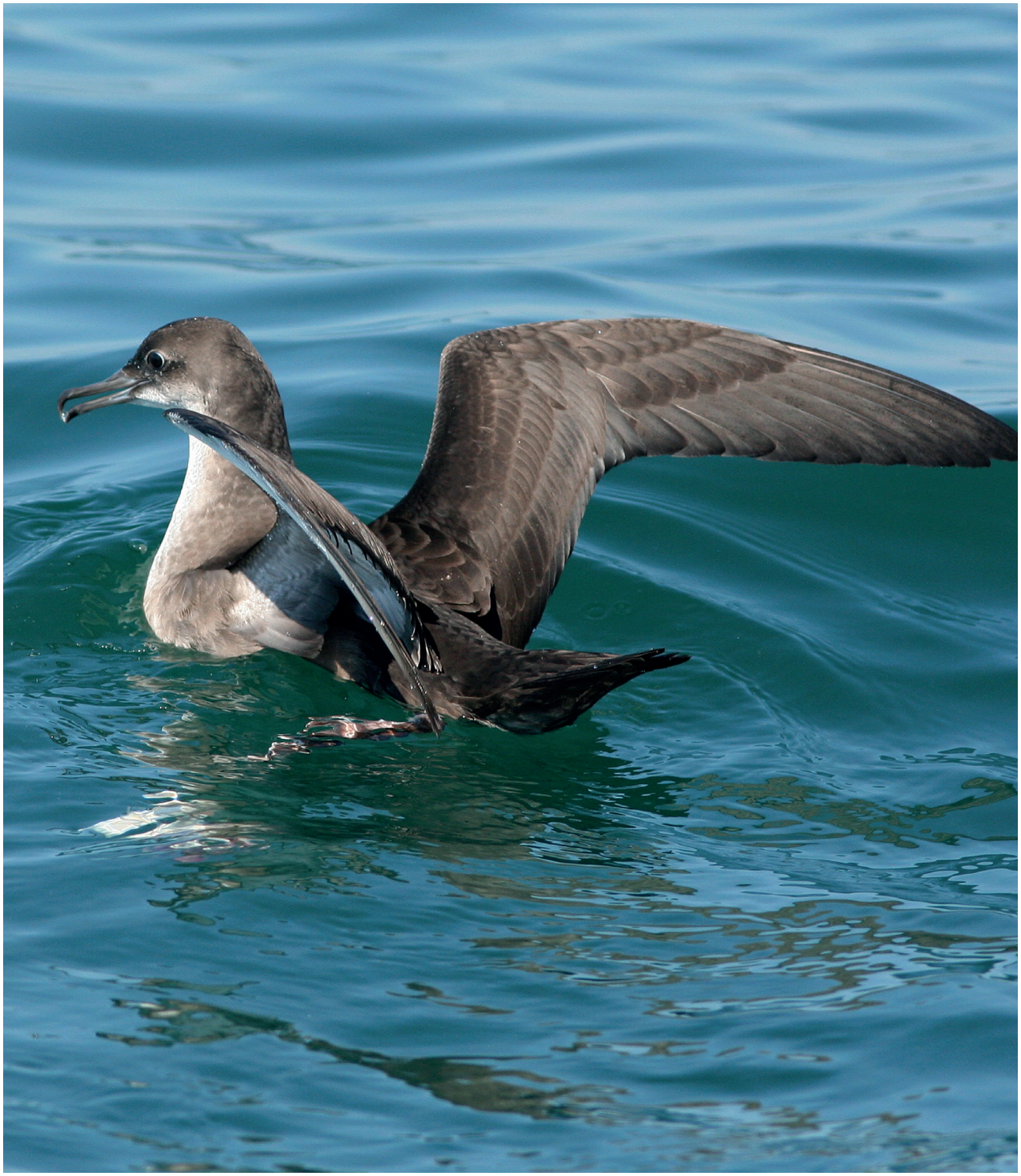
7.10.11 Table 7.19 shows displacement within the post-breeding period (September – October) where a regional population derived from Mitchell et al. (2004) is relevant. During the post-breeding period the number of Manx Shearwater at risk does not surpass a 1% threshold of the regional population at any given level of displacement or mortality.

Table 7.19: Displacement of Manx Shearwater during the post-breeding period (September-October)

Manx Shearwater (Post-breeding)	Mortality (%)											
Displacement level (%)		0	10	20	30	40	50	60	70	80	90	100
	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	5	10	15	20	26	31	36	41	46	51
	20	0	10	20	31	41	51	61	71	82	92	102
	30	0	15	31	46	61	77	92	107	123	138	153
	40	0	20	41	61	82	102	123	143	163	184	204
	50	0	26	51	77	102	128	153	179	204	230	255
	60	0	31	61	92	123	153	184	214	245	276	306
	70	0	36	71	107	143	179	214	250	286	322	357
	80	0	41	82	123	163	204	245	286	327	368	408
	90	0	46	92	138	184	230	276	322	368	414	459
	100	0	51	102	153	204	255	306	357	408	459	511
Input data – Mean peak population estimates for the Project + 4 km buffer, aerial surveys Sept – Oct												
Reference population 1 – Regional population – 448,502 individuals												

CONCLUSION

7.10.12 Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Taken together with monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) which suggest that distribution and population estimates were similar in pre-construction and construction periods it is considered that displacement effects on Manx Shearwater will not cause an adverse effect on the integrity of the Copeland Islands SPA.



8.0 Assessment of the effect of the Project in-combination with other plans and projects

8.1 Introduction

8.1.1 In-combination effects refer to effects on certain receptors from the Project together with other developments in the wider area (including non-wind farm developments). Other developments to be considered in any cumulative assessment should be those that are:

- Built and operational;
- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined, and if permitted would affect the proposed development in the scoping study; and
- Projects that are at the pre-application stage and are reasonably foreseeable.

8.1.2 The in-combination assessment will adopt a principle that in order for the Project to contribute to cumulative impacts upon any species, there must be sufficient cause to consider that a species is sensitive within the project site itself, i.e. as a result of particular sensitivity or presence in notable numbers on at least one survey occasion, rather than simply being recorded within the site. Therefore only where the project alone was screened as having the potential for LSE on Natura 2000 sites and features are the sites and features included in the in-combination screening process. If a site was not screened as having the potential for a LSE, there is no prospect of it having an in-combination effect with another development; the Project having an effectively 'neutral' impact and there being no mechanism by which an in-combination impact could result.

Table 8.1: Natura 2000 sites and features for which the project alone may result in LSE

Site	Feature
Morecambe Bay SAC	Mudflats and sandflats Salicornia and other annuals colonising mud and sand Atlantic salt meadow
Morecambe Bay SPA and Ramsar	Bar-tailed godwit; golden plover; curlew; dunlin; grey plover; knot; oystercatcher; Pink-footed Goose; pintail; redshank; shelduck; turnstone, ringed plover and sanderling Lesser Black-backed Gull Herring Gull Pink-footed Goose
Shell Flat and Lune Deep SAC	Sandbanks which are slightly covered by seawater all the time Reefs
Liverpool Bay SPA	Red-throated diver (wintering) Common scoter (wintering)
Bowland Fells SPA	Lesser Black-backed Gull (breeding)

Table 8.1: Natura 2000 sites and features for which the project alone may result in LSE

Site	Feature
Ribble and Alt Estuaries SPA	Lesser Black-backed Gull (breeding) Whooper Swan (wintering) Pink-footed Goose (wintering)
Skokholm and Skomer SPA	Manx Shearwater (breeding)
Aberdaron Coast and Bardsey Island SPA	Manx Shearwater (breeding)
Copeland Islands SPA	Manx Shearwater (breeding)
Ailsa Craig SPA	Gannet (breeding)
Martin Mere SPA	Whooper Swan (wintering) Pink-footed Goose (wintering)
Lough Negh and Lough Beg SPA	Whooper Swan (wintering)
Upper Lough Erne SPA and Ramsar	Whooper Swan (wintering)
Lough Foyle SPA and Ramsar	Whooper Swan (wintering)

8.2 Screening for in-combination effects on the Annex I habitat features of the Shell Flat and Lune Deep SAC

8.2.1 The export cable corridor does not cross the Shell Flat and Lune Deep SAC but does run adjacent to the southern boundary of the Lune Deep component of this SAC (see Chart 5.3). Up to 5 cable systems may be installed within the corridor during the indicative period Q2 2016 to Q4 2018.

8.2.2 The West of Duddon Sands Offshore Wind Farm export cable makes landfall on Middleton Sands but does not cross or run adjacent to the Shell Flat and Lune Deep SAC (see Chart 2.4). The export cable for that project is timetabled for installation in the period March - October 2013.

8.2.3 Consequently it is assessed that there is no potential for an in-combination effect on the Annex I habitat features of the Shell Flat and Lune Deep SAC and this Site and Annex I features are screened out from further assessment in this HRA.

8.3 Screening for in-combination effects on the intertidal habitat features of Morecambe Bay SAC

8.3.1 The installation of the export cable, including the offshore cable installation, is predicted to occur in the timeframe Q2 2016 to Q4 2018. The following plans and projects are due to take place during this construction period.

8.3.2 The West of Duddon Sands Offshore Wind Farm export cable makes landfall on Middleton Sands south of Heysham and approximately 1 km north of Pott's Corner. The burial techniques to be employed are similar to those of the Project. The West of Duddon Sands Offshore Wind Farm is timetabled for the period March-October 2013 (DONG Energy 2013). It is therefore considered that there is no potential for in-combination impacts to exists during the construction phase itself. Furthermore, the time interval between completion of cable burial of the West of Duddon Sands project and the start of the Project is expected to be two and half years. This is considered an adequate recovery period for intertidal invertebrate communities and the mudflat and sandflat habitat features of Morecambe Bay SAC.

8.3.3 8.3.3 The Project is not aware of other plans and projects which may have an in-combination effect on the intertidal habitat features of the Morecambe Bay SAC.

8.4 Screening for in-combination effects on wader and wildfowl interest features of Morecambe Bay SPA and Ramsar.

8.4.1 8.4.1 The potential for in-combination effects on wader and wildfowl species exists during the construction phase, should the activity overlap with any other activities that have the potential to affect the relevant SPA populations. As described in section 8.2 the only project in the area with the potential to act in-combination with the construction of the export cable is the installation of West of Duddon Sands Offshore Wind Farm export cable. The West of Duddon Sands Offshore Wind Farm export cable installation is timetabled for the period March-October 2013 (DONG Energy 2013). It is therefore considered that there is no potential for in-combination impacts to exists during the construction phase itself. Furthermore, the time interval between completion of cable burial of the first project and the start of the second is expected to be two and half years. This is considered an adequate recovery period for intertidal invertebrate communities following any indirect impacts of construction activity on prey availability to waterbirds.

8.5 Screening for in-combination effects on Whooper Swan and Pink-footed Goose

8.5.1 The potential for in-combination effects on Whooper Swan and Pink-footed Goose may occur during the operational phase of the Project during migration periods. The following wind farms lie in the migratory pathway (from Greenland and Iceland) for both species.

- Robin Rigg;
- Barrow;
- Ormonde;
- Walney I & II; and
- West of Duddon Sands.

8.5.2 The west coast population of both species was estimated as described in HRA Report Annex 1 giving population estimates of 3,015 birds for Whooper Swan and 53,388 birds for Pink-footed Goose.

8.5.3 These population estimates were assumed to represent the total population of each species across a migratory front between the Isle of Man and the Cumbrian coast, a migratory front with an approximate length of 48 km (Chart 8-1).

8.5.4 The proportion of flights at risk height for both species were kept constant (40% for Whooper Swan and 60% for Pink-footed Goose) in the modelling, in line with the values outlined in Section 6.2, along with the avoidance rates for each species (98% for Whooper Swan and 99% for Pink-footed Goose).

8.5.5 Parameters for collision risk modelling are shown in Table 8-2 with the features of each wind farm which were used to determine the total or mean values used in collision risk modelling.

8.5.6 The proportion of the British west coast population of each species likely to interact with each wind farm was calculated using the proportion of the migratory front occupied by the width of each wind farm, multiplied by the total population for each species.

8.5.7 The total collision risk to both species was calculated using two methods. The first approach totalled the collision risk estimates

obtained through individual collision risk modelling for each wind farm. The second approach used the total and mean parameters shown in 8.2 to calculate collision risk estimates. The most precautionary figures calculated using these two approaches (in this case the first approach) are presented, see Table 8.3.

Table 8.2: Parameters used for collision risk modelling of Whooper Swan and Pink-footed Goose for six wind farm sites

Migratory front	Migratory front length (km)[11]	Proportion of Irish Sea flyway (%)[12]	No. of turbines	Height of rotors	Rotor radius
Barrow	3.71	7.7	30	120	45
Ormonde	3.72	7.72	30	163	63
Robin Rigg	6.34	13.16	60	125	45
Walney I	6.69	13.89	51	137	53.5
Walney II	6.95	14.43	51	150.2	60
Walney Extension	15.24	31.64	207	142	60
West of Duddon Sands	9.45	19.62	108	183[13]	60
Total/Mean	52.1[14]	108.18	537	145.74	55.21

8.5.8 The migratory front of each wind farm is based on the constructed extent (or proposed extent as in the case of Walney Extension) and there is some potential for differences to that reported in any collision assessments within each relevant Environmental Statement. However, this theoretical modelling exercise provides results for the two species independent of any previous modelling exercise.

8.5.9 An estimated cumulative total of 36.71 collisions / annum (avoidance rate of 99%) are predicted to occur for Pink-footed Goose. For Whooper Swan, a cumulative total of 3.88 collisions / annum (avoidance rate of 98%) are estimated.

8.5.10 To account for differences in the distribution of birds across the migratory front, a range of population estimates were used, resulting in potential cumulative collision risk predictions ranging from 9.18 to 146.82 collisions / annum for Pink-footed Goose (99% avoidance), and from 0.97 to 15.54 collisions / annum for Whooper Swan (98% avoidance).

Table 8.3: In-combination collision risk modelling results for Whooper Swan and Pink-footed Goose populations interacting with six offshore wind farm sites in the Irish Sea.

Species	Population density	Avoidance rate (%)				
		0	95	98	99	99.9
Pink-footed Goose	0.25	917.65	45.88	18.35	9.18	0.92
	0.5	1835.29	91.76	36.71	18.35	1.84
	1	3670.61	183.53	73.41	36.71	3.67
	2	7341.21	367.06	146.82	73.41	7.34
	4	14682.42	734.12	293.65	146.82	14.68
Whooper Swan	0.25	48.55	2.43	0.97	0.49	0.05
	0.5	97.11	4.86	1.94	0.97	0.1
	1	194.22	9.71	3.88	1.94	0.19
	2	388.44	19.42	7.77	3.88	0.39
	4	776.88	38.84	15.54	7.77	0.78

8.5.11 Table 8.4 and Table 8.5 show the total number of predicted collisions for Whooper Swan and Pink-footed Goose respectively from all six wind farm sites and the collisions as a portion of the relevant SPA populations. For both Whooper Swan and Pink-footed Goose less the 1% of the SPA population is predicted to be at risk of collision.

Table 8.4: Whooper Swan collisions as a proportion of corresponding SPA populations

SPA	SPA review population	Current population (Holt et al 2012)	Collisions as a % of the SPA population
Martin Mere	621	1864 (treated as one population for both sites)	0.21
Ribble and Alt Estuaries	159		

Table 8.5: Pink-footed geese in-combination collisions as a proportion of corresponding SPA populations

SPA	SPA review population	Current population (Holt et al 2012)	Collisions as a % of the SPA population
Martin Mere	25779	46862 (treated as one population for both sites)	0.078
Ribble and Alt Estuaries	23860		
Morecambe Bay	2475	7116	0.52

8.5.12 The length of the migratory front has implications for the modelling process. Under the precautionary approach, it has been assumed that the migratory front is as narrow as possible whilst still passing through the Walney Extension site. To assume the migratory front passed through any of the other five wind farms in addition to, or instead of, Walney Extension would increase the width of the front and thereby reduce collision risk estimates.

OVERLAND MOVEMENTS OF PINK-FOOTED GOOSE

8.5.13 The most recent estimate of the global population of Pink-footed Goose was calculated by Fox et al. (2010) as 413,000 individuals. This population is divided into two predominantly separate geographic populations, the Icelandic and Greenland breeding population and the Svalbard breeding population. The entire winter population is distributed in a few European countries which border the North Sea. Individuals that breed in Greenland and Iceland migrate to Britain and Ireland, whereas those that breed in Svalbard migrate to the Netherlands, Denmark and Belgium (JNCC, 2009b). Data presented in the individual sections for Lancashire and Norfolk are taken from the Iceland Goose Censuses available on the WWT website.

8.5.14 Since the Second World War numbers of pink-footed geese in Lancashire have increased due, in part to the establishment of protected roost sites. Before 1973, numbers of the species in Lancashire did not exceed 15,000 birds (Mitchell and Hearn, 2004). The population of the species wintering in the UK has been extensively studied since 1978 with coordinated counts occurring at least once in each annual wintering period (November). These studies have been expanded until, in the most recent survey (2011) counts from four months were recorded (October, November, December and February). Between 1978 and 2011 the population size of Pink-footed Goose in Lancashire has increased from 5,280 individuals to 49,438 individuals. In recent years, the population in Lancashire in October has fluctuated with a low of 23,808 birds recorded in the most recent survey period (2011). This is a considerable decrease from the counts of over 50,000 birds in the three previous surveys (2008, 2009 and 2010). However, this decrease is not reflected in counts undertaken in November with counts of around 50,000 recorded in the last three survey periods (2009, 2010 and 2011). Counts throughout the wintering period presented in the Icelandic Goose Census suggest that the number of pink-footed geese in Lancashire remain at similar levels throughout the wintering period with no obvious peak month. There is therefore no evidence for any recent decline in the Lancashire population due to collision with onshore (or offshore) wind farms constructed and operating in recent years.

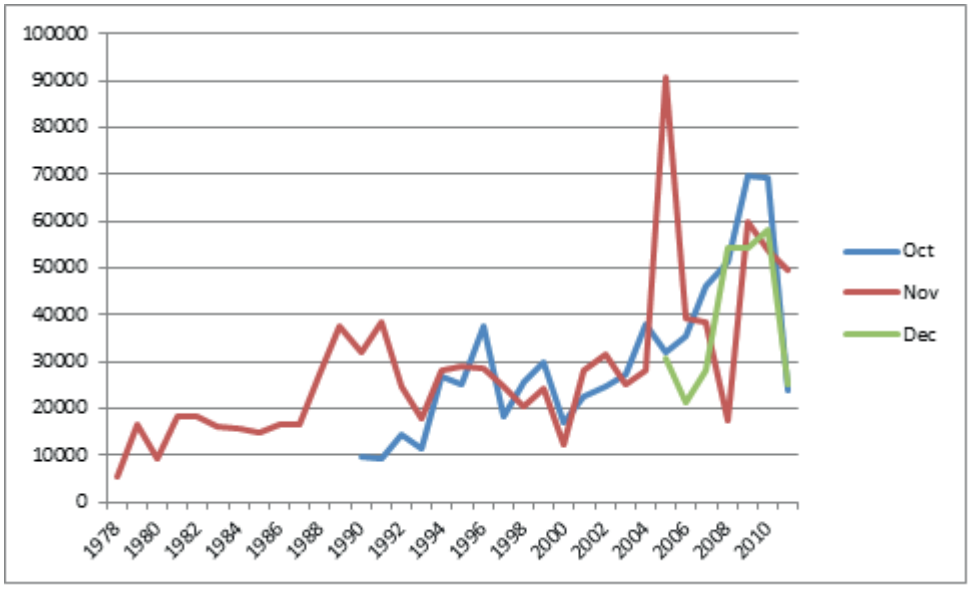


Figure 8.1: Population sizes of Pink-footed Goose recorded in Lancashire as part of the Icelandic goose census 1978-2011

8.5.15 Pink-footed geese are known to utilise a number of different sites throughout the course of one winter with a considerable southerly redistribution of geese from arrival areas in northern Scotland to areas in southern Scotland, Lancashire and Norfolk (Mitchell and Hearn, 2004; JNCC, 2009b). This distribution is reversed later in the wintering period with birds moving northwards through England and southern Scotland to staging areas in east and northeast Scotland (Fox et al., 1994; Mitchell and Hearn, 2004).

8.5.16 There is evidence for regular movements of pink-footed geese between Lancashire and Norfolk (Mitchell and Hearn, 2004), with over 1,000 pink-footed geese that were captured at Martin Mere between 1987 and 1993. Of these birds 66 were re-sighted in Norfolk with peak sightings in early December and January. Counts from Norfolk in February, although only reported for one year in Mitchell (2012), suggest that a large number of geese have already moved further north either to Lancashire or along the east coast of Britain to Scotland. This suggests that the majority of spring passage movements of pink-footed geese between Lancashire and Norfolk occur during the latter half of January and early February. The overland movement takes geese over a considerable number of inland sites which contain potentially suitable foraging and roosting habitat. As such, it is surprising that inland records of pink-footed geese are so infrequent (excluding fly over birds) with no inland site consistently hosting large numbers of the species. This implies that within-winter movement is generally without staging areas and is non-stop in nature. There are however some records of flocks of pink-footed geese clearly stopping temporarily during within-winter movements. For example, 880 were recorded at Drakelow Gravel Pit, Derbyshire in February 1991 and 396 were on the River Idle at Bawtry, Nottinghamshire in January 1995 (Mitchell and Hearn, 2004), there are however no sites which consistently hold large numbers of the species. The presence of the species at these sites is most likely due to weather conditions encountered by individuals as they undertake movements.

8.5.17 Mitchell and Hearn (2004) state that the migratory front within which the passage movements of pink-footed geese between Lancashire and Norfolk occur is highly

dependent on prevailing weather conditions, including wind direction, frontal activity and hill fog. There are numerous documented observations of Pink-footed Goose from the English Midlands, particularly over the southern Pennines between the Lancashire Mosses and the Wash, Norfolk in both spring and autumn. Mitchell and Hearn (2004) further suggest that these movements occur on favoured routes between the Aire Gap in Lancashire and Buxton, Derbyshire. Within this area notable movements have been recorded over Blackstone Edge, Lancashire, Rivington Moor, Lancashire, Todmorden Moor, West Yorkshire and Pendle Hill, Lancashire. However, there are other documented observations of movements outside of this migratory front in Derbyshire, Leicestershire, Northamptonshire, Nottinghamshire, Staffordshire and Warwickshire (Birdguides.com accessed May 2013) possibly due to the influence of prevailing weather conditions affecting the flight of these birds. The movements recorded in these counties are, generally, in a north-westerly or westerly direction suggesting that such movements are from Norfolk towards Lancashire.

8.5.18 There is limited information available on the flight heights of migrating pink-footed geese traversing onshore wind sites. They were recorded during bird surveys at the consented Chiplow wind farm in north-west Norfolk which has a turbine height of 100 m. A total of 348 pink-footed geese, in 12 flocks, were recorded at turbine height (Entec, 2010). The species was also recorded at collision height during bird surveys at Loch Urr wind farm located in Dumfries and Galloway. Of six flocks recorded at the site, one flock of 80 birds and another single bird were recorded at a maximum turbine height of 127.5 m (Eon, 2012). At Louth Canal wind farm one flock of 73 pink-footed geese was observed transiting the proposed wind farm site within a height band of 20-130 m (Partnership for Renewables, 2012a).

8.5.19 Baseline surveys at Carron Valley wind farm, located in Stirlingshire, recorded 55 pink-footed geese, none of which were recorded at PCH (Partnership for Renewables, 2012b).

8.5.20 Although it may appear that collision risk may be high for Pink-footed Goose, it is important to take account the actual levels of collision recorded at operational wind farm sites. Collision data collected from five wind farm sites in the USA and one in Europe indicate that the collision risk posed to geese by operational wind farms is very low (Fernley et al., 2006). In over nine years of surveys only four goose collisions were recorded, when corrected to take into account Corpse Search Completeness it was estimated that 10 collisions actually occurred. Using this data avoidance rates could be determined for four of the six wind farms. These avoidance rates ranged from 99.82% to 100% with an average rate of 99.93%.

8.5.21 These studies have been used to inform recently published Scottish Natural Heritage (SNH) guidance (SNH, 2013) relating to the avoidance rates of pink-footed geese at operational wind farms. SNH recommend that for collision risk modelling at wind farm sites an avoidance rate of 99.8% is used.

8.5.22 There is no current evidence that onshore wind sites contribute at any level to collision risk of pink-footed geese within the flyway between East Anglia and Norfolk, Flight height is likely to be over rotor height, with few birds stopping on route and increasing their risk of collision. Mortality and wide population trends of pink-footed geese is most likely to be influenced by hunting in both their breeding and wintering areas. There are numerous wildfowling groups throughout the UK with The Wash, a SPA for Pink-footed Goose, identified as one of the best sites for wildfowling in the UK (Shooting Gazette, 2013). Unlike in other countries, wildfowlers

in England are not legally required to report the number of wildfowl taken during shooting activities. As such, it is difficult to determine the annual losses of pink-footed geese as a result of wildfowling activities, although estimates using Icelandic bag statistics, ring recoveries and population models suggest that 25,000 birds are shot each year in Britain (Mitchell and Hearn, 2004). Therefore, there is no evidence to support a likely in-combination effect of pink-footed geese collision from the Project Site with onshore windfarms within the species migratory flyway.

8.6 Screening for in-combination effects on seabird features

8.6.1 Cumulative effects on ornithological receptors with schemes other than offshore wind farms are considered to be unlikely, as wind farms have the potential to generate specific impacts on birds, in particular the effect of collision. It is likely that collision is the most important long term effect of output from such developments.

8.6.2 The screening process for in-combination effects on ornithological features has been based on the species and their associated population designation (i.e., breeding species, over-wintering species and passage species) enabling a zone of influence to be defined in which in-combination effects may occur.

8.6.3 It was determined the Project had the potential for a likely significant effect on the following features:

- Ribble and Alt SPA – Lesser black-back gull (breeding);
- Morecambe Bay SPA – Lesser Black-backed Gull (breeding) and Herring Gull (breeding);
- Liverpool Bay SPA – Red-throated diver (wintering) and common scoter (wintering);
- Bowland Fells SPA – Lesser Black-backed Gull (breeding);
- Skomer and Skomer SPA – Manx Shearwater (breeding);
- Aberdaron Coast and Bardsey Island SPA - Manx Shearwater (breeding);
- Copeland Islands SPA – Manx Shearwater (breeding); and
- Ailsa Craig SPA – Gannet and lesser blacked gull (breeding).

8.6.4 Chart 8.2 shows the plans and projects within the study area that are likely to interact with the Project. Table 8.6 details the timeline for these projects, where plans and projects are on hold or no scoping information is publicly available they are not considered to be reasonably forseeable and therefore not considered within the in-combination assessment.

8.6.5 Currently the south-east project within the Round 3 Irish Sea Zone (Rhiannon) is the only offshore wind farm project within the Zone that is proposed or could be reasonably anticipated to happen. Although the other areas in the zone have been identified in the Zonal Appraisal Process (ZAP) and survey information is available they are yet to produce scoping or PEI information and as such have not been included in the in-combination assessment.

8.6.6 Table 8.6 shows the construction timescales for the projects considered within the in-combination assessment, the construction phase of the Project has the potential to overlap with the construction of and Atlantic Array OWF and Navitus Bay OWF only.

Table 8.6: Construction and operational timescales of offshore wind farm projects with the potential to act in-combination with the Project

Project	Construction Timeline		Operational year	Potential for Construction timeline overlap?
	Start*	Finish*		
Burbo Bank Extension	Q4 2014/ Q1 2015	Q1 2016	N/A	No
Burbo Bank Operational	N/A	N/A	2007	No
Ormonde	N/A	N/A	2012	No
Gwynt-Y-Môr	Q1 2012	Q4 2014	N/A	No
North Hoyle	N/A	N/A	2003	No
Rhyl Flats	N/A	N/A	2009	No
Robin Rigg	N/A	N/A	2010	No
Walney 1	N/A	N/A	2011	No
Walney 2	N/A	N/A	2012	No
Barrow	N/A	N/A	2006	No
West of Duddon Sands	Q1 2013	Q3 2014	N/A	No
Navitus Bay	2016	2019	N/A	Yes
Arklow Bank Phase 1	N/A	N/A	2004	No
Arklow Bank Phase 2	Project on hold	N/A	N/A	No
Codling Wind Park	Project on hold	N/A	N/A	No
Codling Wind Park Extension	Project on hold	N/A	N/A	No
Oriel	Project on hold	N/A	N/A	No
Dublin Array	Project on hold	N/A	N/A	No
Atlantic Array	2016	2020	N/A	Yes
Celtic Array (Rhiannon)	2017	2020	N/A	Yes

* publicised dates

8.6.7 A foraging range approach has been used to determine the potential for in-combination effects on the designated sites and features listed above. Any offshore wind farm sites that fall within the mean maximum foraging range for the species and are considered to be foreseeable have been included in the in-combination assessment.

8.6.8 Charts 8-3 to 8-6 show the foraging ranges of breeding seabirds (Thaxter et al, 2012) from the relevant SPA sites and the wind farm developments they are likely to interact with the Project. Table 8.7 summarises the plans and projects likely to interact with each species and the associated SPA sites, based on these foraging ranges.

8.6.9 Foraging range is not applicable for over-wintering species such as red-throated diver and common scoter. A likely significant effect on this species was predicted as a result of the installation of the export cable during the construction phase of the project; of the sites listed in Table 8.6 only 3 have the potential to overlap with the construction phase of the project. However, as none of these sites are located within the Liverpool Bay SPA, it is considered there is no potential for likely significant effect on red-throated diver and common scoter from Liverpool Bay SPA as a result of in-combination effects





Table 8.7: Offshore wind farm sites that have the potential to act in-combination with the Project on breeding seabirds; Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Species	SPA	Burbo Bank	Gwynt-Y-Môr	North Hoyle	Rhyl Flats	Walney I & II	Barrow	Robin Rigg	West of Duddon Sands	Ormonde	Burbo Bank Extension	Rhiannon	Atlantic Array	Navitus Bay	Arklow Bank
Manx Shearwater	Skokholm and Skomer	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
	Aberdaron Coast	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
	Copeland Islands	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Lesser Black-backed Gull	Morecambe Bay	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
	Ribble and Alt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
	Bowland Fells	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
	Ailsa Craig	N	N	N	N	Y	N	Y	Y	Y	N	Y	N	N	N
Herring Gull	Morecambe Bay	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N	N	N
Gannet	Ailsa Craig	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N

8.7 For many of the Round 1 and 2 sites present within Liverpool Bay and the Irish Sea limited data are available to inform the assessment, particularly in reference to bird densities and collision risk modelling. Table 8.8 shows the availability of data for the wind farm sites screened into the assessment.

Table 8.8: Information sources for Offshore wind farms used in the in-combination assessment

Project	CRM data available	Source
Burbo Bank Operational	N	Environmental Statement (Seascape Energy 2002)
Gwynt-Y-Môr	N	Environmental Statement (Npower renewables 2005)
North Hoyle	N	FEPA monitoring report (Npower 2008)
Rhyl Flats	N	Ornithology monitoring report (ESS 2007)
Burbo Bank Extension	Y	(DONG Energy, unpublished)
Walney 1 & 2	Y	Environmental Statement (Dong Energy 2006)
Barrow	N	Post-construction monitoring report 2006-07 (BOWind 2008)
West of Duddon Sands	Y	Environmental Statement (RSKENSR, 2006)
Ormonde	Y	Ecology Consulting (2006)
Navitus Bay	N	PEI (Eneco 2011)
Arklow Bank	N	No information available
Atlantic Array	N	Draft Environmental Statement (RWE, 2012)
Celtic Array (Rhiannon)	Y	Scoping report and ZAP (Centrica, 2012)

8.7.1 In-combination effects as a result of decommissioning activity have not been considered within this assessment due to the uncertainties in predicting decommissioning timescales for each project.

8.7.2 The results of screening for a likely significant effect as a result of in-combination effects on Manx Shearwater, lesser-black backed gull, Herring Gull and Gannet are detailed in Table 8.9 below.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
Construction	All construction effects	Skokholm and Skomer Aberdaron Coast and Bardsey Island Copeland Islands		Rhiannon Atlantic Array Navtius Bay	N	There is potential for periods of concurrent construction activity from the Project, Rhiannon, Atlantic Array and Navitus Bay offshore wind farms. Peak densities of Manx Shearwater at Atlantic Array reached 26 ind / km² (RWE, 2012), it is likely that these birds originate from the Skokholm and Skomer SPA rather than the 2 SPAs closest to the Project site. Given the available foraging habitat for this species the 3 projects cumulative construction displacement is unlikely to result in a LSE on the SPA populations listed.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
		Lesser Black-backed Gull	Ribble and Alt Estuaries Morecambe Bay Bowland Fells Ailsa Craig	Rhiannon Atlantic Array Navtius Bay	N	Lesser black backed gull frequently associate with vessels and human activity (e.g. fishing activity) (Mitchell et al., 2004) and may exploit novel foraging opportunities created by construction activities that may make prey more available to them. Monitoring surveys at Walney I and II found that populations of this species increased during the construction phase within the wind farm footprint (NIRAS, 2012a). There is potential for cumulative construction effects on Lesser Black-backed Gulls as a result of the simultaneous construction of the Project and Rhiannon offshore wind farm. Rhiannon lies over 41 km to the south-west of the Project site. However, considering the distance between the two projects and the intermittent nature of any boat traffic disturbance, the potential for a cumulative impact to arise from concurrent and/or sequential activity is not considered to provide any additive impact magnitude beyond those presented for the Project alone. The effect of disturbance and displacement arising from increased construction activity is likely to be localised and temporary (for the duration of the construction phase) Both Atlantic Array and Navitus Bay wind farms are beyond the mean maximum foraging range of birds originating from the SPAs listed.
		Herring Gull	Morecambe Bay	None	N	There is no potential for cumulative construction effects on Herring Gull as Atlantic Array, Rhiannon and Navitus Bay wind farms are beyond the mean maximum foraging range of birds originating from Morecambe Bay.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
		Gannet	Ailsa Craig	Rhiannon	N	Gannet are known to be highly mobile foragers spending a large proportion of their time in flight and thus are not considered particularly vulnerable to disturbance impacts (Furness and Wade, 2012).
Operation	Displacement as a result of turbine presence	Manx Shearwater	Skokholm and Skomer Aberdaron Coast Copeland Islands	See Table 8.7	Y	The peak density of Manx Shearwater recorded during boat-based surveys in the Irish Sea zone was 34 ind / km² (Centrica 2012) with peak densities of Manx Shearwater at Atlantic Array reaching 26 ind / km² (RWE, 2012). There is potential for a LSE significant effect on Manx Shearwater from the 3 SPAs listed as a result of in-combination operational displacement.
		Lesser Black-backed Gull	Ribble and Alt Estuaries Morecambe Bay Bowland Fells	See Table 8.7	N	There is little indication that Lesser Black-backed Gull will be displaced from operational wind farms. These species are amongst the most flexible in their habitat use and may be observed to take advantage of new foraging opportunities created by human activity. These species were not identified as sensitive receptors in either the Rhyl Flats, North Hoyle or Gwynt-Y-Môr Environmental statements (NWP 2002, RWE, ESS 2007 and RWE 2005). If any birds are displaced, it is considered that there are ample alternative foraging opportunities and consequently there is no potential for a LSE on the SPA populations.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
		Herring Gull	Morecambe Bay	See Table 8.7	N	There is little indication that Herring Gull will be displaced from operational wind farms. These species are amongst the most flexible in their habitat use and may be observed to take advantage of new foraging opportunities created by human activity. The Project site is not considered to represent a particularly important foraging habitat for these species as evidenced in the low use of the Project site. These species were not identified as sensitive receptors in either the Rhyl Flats, North Hoyle or Gwynt-Y-Môr Environmental Statements (NPower 2005 & 2008, , ESS 2007). If any birds are displaced, it is considered that there are ample alternative foraging opportunities and consequently there is no potential for a LSE on the SPA populations.
		Gannet	Ailsa Craig	See Table 8.7	N	Gannet forage over extensive areas and are widespread throughout Britain's coastal and offshore waters, in addition to being flexible foragers able to exploit a range of prey. This suggests that Gannet is not sensitive to displacement effects, as detailed by Furness and Wade (2012). If any birds are displaced, it is considered that there are ample alternative foraging opportunities and consequently there is no potential for a LSE on the SPA populations.
	Collision with turbine blades	Manx Shearwater	Skokholm and Skomer Aberdaron Coast Copeland Islands	See Table 8.7	N	No Manx Shearwater collisions were predicted for the Project or Burbo Bank extension (DONG Energy, 2013a). The number of collisions for this species associated with the Rhiannon offshore wind farm has not been identified in the ZAP document (Centrica 2012). However, the species does not fly at potential collision risk height and as a result there is considered to be no potential for a likely significant effect on the 3 SPAs listed.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
		Lesser Black-backed Gull	Ribble and Alt Estuaries Morecambe Bay Bowland Fells Ailsa Craig	See Table 8.7	Y	Although a number of offshore wind farm sites (see Table 8.7) have been identified to have the potential to act in-combination with the Project on Lesser Black-backed Gull from the SPAs listed, collision numbers are only available for the following sites: ▪ Walney 1 &2 ▪ West of Duddon Sands ▪ Ormonde ▪ Rhiannon ▪ Burbo Bank Extension There is potential for a LSE on the populations of Lesser Black-backed Gull from Ribble and Alt, Morecambe Bay, Bowland Fells and Ailsa Craig SPAs and so this issue is carried forward for further assessment.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
		Herring Gull	Morecambe Bay	See Table 8.7	Y	Although a number of offshore wind farm sites have been identified to have the potential to act in-combination with the Project on Herring Gull, collision risk estimates were only found in the available literature for one of the offshore wind farms being considered, Burbo Bank Extension. For two other neighbouring wind farms, Walney I and II and West of Duddon Sands, their respective Environmental Statements both stated that the "number of birds observed flying at rotor height within the proposed windfarm area was sufficiently low to conclude that the magnitude of collisions will be negligible" (RPS 2006a & b). Both documents implied that no collision risk modelling was conducted for Herring Gull. The number of collision associated with Morecambe Bay as a result of the Burbo Bank extension was 4 (DONG Energy 2013a).
		Gannet	Ailsa Craig	See Table 8.7	N	At a 98% avoidance rate 25 collisions per annum were associated with the Project. At Burbo Bank extension 35 collisions were predicted (DONG Energy 2013a) and at Rhiannon 350 (Centrica 2012). A total of 410 collisions (from sites where CRM has been completed for this species), representing 0.6 % of the SPA population of 64,920. At this level of predicted impact in combination effects are assessed as not likely to have a significant effect.

Table 8.9: Screening for LSE as a result of in-combination effects on Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet

Project phase	Effect	Species	Relevant SPAs	OWF sites with the potential to act in-combination with the Project	Potential for in-combination effects to have LSE	Justification
	Barrier effects	Manx Shearwater	Skokholm and Skomer Aberdaron Coast Copeland Islands	See Table 8.7	N	Manx Shearwater have an extensive foraging range and have been satellite tracked throughout the Irish Sea (Guilford et al., 2008) and the limited barriers to any post-breeding movement provided by the wind farm sites in the Irish Sea are considered not to result in a LSE on the SPAs listed.
		Lesser Black-backed Gull	Ribble and Alt Estuaries Morecambe Bay Bowland Fells Ailsa Craig	See Table 8.7	N	Lesser Black-backed Gulls are likely to pass through the wind farm during the operational phase and are more likely to be at risk of collision than barrier effects.
		Herring Gull	Morecambe Bay	See Table 8.7	N	Herring Gulls will continue to pass through the wind farm area during the operational phase and no barrier to movement is predicted.
		Gannet	Ailsa Craig	See Table 8.7	N	The Project site is at the edge of the mean maximum foraging range for this species. Gannet show high degree of flexibility in habitat use (Furness and Wade, 2012). Any barrier provided by the Project site and the wind farms listed in Table 8.7 are not expected to have any significant energetic costs to this species.

8.8 Screening conclusion

8.8.1 Table 8.10 summarises the sites and features with the potential for a likely significant effect as a result of in-combination effects.

Table 8.10: Sites and features for which there is potential for LSE as result of in-combination effects

Species	SPA	Projects	Effect
Lesser Black-backed Gull	Ribble and Alt Estuaries Morecambe Bay Bowland Fells Ailsa Craig	See Table 8.7	Collision mortality
Herring Gull	Morecambe Bay	See Table 8.7	Collision mortality
Manx Shearwater	Skokholm and Skomer Aberdaron Coast and Bardsey Island Copeland Islands	See Table 8.7	Displacement

8.9 Assessment of in-combination effects

8.9.1 The conservation objectives for the sites listed in Table 8.10 are detailed in Sections 7.4 to 7.10. The in-combination assessment is made against the most up to date population figures as detailed in these sections.

LESSER BLACK-BACKED GULL

8.9.2 In-combination collision mortality has the potential to impact upon Lesser Black-backed Gull populations originating from the Ribble and Alt Estuaries SPA amd Ramsar, Morecambe Bay SPA and Ramsar, and Bowland Fells SPA. Although a number of offshore wind farm sites (see Table 8.7) have been identified to have the potential to act in-combination with the Project on breeding Lesser Black-backed Gull populations, only five projects have completed collision risk modelling that can be used in the assessment, Walney I & II, West of Duddon Sands, Ormonde, Burbo Bank Extension, and Rhiannon.

8.9.3 Table 8.11 shows the predicted annual collision rates for breeding Lesser Black-backed Gull across six offshore wind farm sites.

Table 8.11: In-combination collision numbers for Lesser Black-backed Gull during the breeding season

Wind farm site	Collision at 98% avoidance rate	Source	Comments
Burbo Bank Extension	175	DONG Energy (2013a)	
Walney I & II	87	RPS (2006); DONG Energy (2006)	Based on proportion of birds recorded during the breeding season which is then applied to total collision
West of Duddon Sands	128	RSKENSR (2006)	

Table 8.11: In-combination collision numbers for Lesser Black-backed Gull during the breeding season

Wind farm site	Collision at 98% avoidance rate	Source	Comments
Ormonde	48	Ecology Consulting (2006)	Based on proportion of birds recorded during the breeding season which is then applied to total collision
Rhiannon	132	Centrica Energy 2012)	
The Project	20	DONG Energy (2013b)	

8.9.4 The methodology detailed in Annex 2 was used to apportion collisions from each site to each SPA. Table 8-12 details the collision numbers for each SPA arising from each wind farm and the total number of collisions for each SPA.

Table 8.12: In-combination SPA collision numbers for Lesser Black-backed Gull

Sites	Collision numbers							
	Burbo Bank Extension	Walney I & II	West of Duddon Sands	Ormonde	The Project	Rhiannon	Total	PBR
Ribble and Alt Estuaries SPA	164	7	13	2	2	37	225	244
Morecambe Bay SPA	6	74	107	45	14	71	317	482
Bowland Fells SPA	4	6	8	2	1	25	46	324
Ailsa Craig	0	0.02	0.02	0.01	0.01	0.2	0.3	11

8.9.5 The total number of cumulative Lesser Black-backed Gull collisions apportioned to the Ribble and Alt Estuaries SPA is 225, this equates to 2.7 % of the SPA population of 8,234 and 92 % of the calculated PBR value of 244.

8.9.6 The total number of in-combination Lesser Black-backed Gull collisions apportioned to the Morecambe Bay SPA is 317, this is equates to 1.9 % of the SPA population of 16,274 and 66 % of the calculate PBR of 482. The Project contributes to only 4.4 % of the total collisions.

8.9.7 The total number of in-combination Lesser Black-backed Gull collisions apportioned to the Bowland Fells SPA is 47, this is equates to 0.4 % of the SPA population of 10,937 and 15 % of the calculate PBR of 324. The Project contributes to only 2.1 % of the total collisions.

8.9.8 The total number of in-combination Lesser Black-backed Gull collisions apportioned to the Ailsa Craig SPA is 0.3, this is equates to 0.08 % of the SPA population of 366 and 2.7 % of the calculate PBR of 11 bird. The Project contributes to only 3% of the total collisions.

8.9.9 Collisions associated with the Project and Burbo Bank extension OWF site have been apportioned to all colonies, including both SPAs and local regional colonies not associated with SPAs (DONG Energy 2013a). Collision values for the other four wind farm sites have been apportioned to SPAs only due to the uncertainties in the data sets, resulting in an over precautionary number of collisions associated with each SPA.

HERRING GULL

8.9.10 In-combination collision mortality has the potential to impact upon the Herring Gull population originating from the Morecambe Bay SPA. Although a number of offshore wind farm sites (see Table 8.7) have been identified to have the potential to act in-combination with the project on breeding Herring Gull populations, only Burbo Bank Extension has completed collision risk modelling that can be used in the Project assessment. For Burbo Bank Extension 4 Herring Gull collisions were predicted to be associated with the Morecambe Bay SPA. The in-combination collision figure therefore totals 33, 0.79 % of the Morecambe Bay SPA population and 24 % of the calculated PBR value of 140 for the SPA (see Annex 2).

MANX SHEARWATER

8.9.11 Manx Shearwater were found to be periodically common at other sites in the region including Walney I and II (NIRAS, 2012a), the Irish Sea Zone (Centrica Energy, 2012), West of Duddon Sands (RPS, 2006) and Ormonde (Ecology Consulting, 2005) although little or no quantitative analysis has been undertaken on the levels of displacement predicted. The analysis at Walney I and II (NIRAS, 2012a) concludes that little displacement occurred during the construction phase although the analysis did not include a significant duration of post-construction data. Manx Shearwater were less abundant at Robin Rigg although there was some evidence of a decline in numbers during the operational phase (eon / npower, 2012).

8.9.12 Manx Shearwaters are known to be widespread and cover a large expanse of the Irish Sea during both the breeding period (Guilford et al., 2008) and during post-breeding periods (Brown and Grice, 2005). In the summer months, Manx Shearwater have been shown to favour western areas of the Irish Sea, close to the east coast of Ireland, and the west coast of Scotland (Stone et al., 2004). Most birds are found feeding in areas with stratified salty water from Dundalk Bay to the sea front south of Isle of Man. In particular, high densities of Manx Shearwater have been shown to be associated with stratified water including with the Western Irish Sea Front (Begg and Reid, 1997).

8.9.13 Peak monthly population estimates of Manx Shearwater are available for West of Duddon Sands and Burbo Bank Extension but not for the other sites listed in Table 8.7. The peak monthly population estimates for these sites has been used to assess the potential in-combination displacement scenario of Manx Shearwater in terms of numbers of birds potentially at risk of being lost as a result of displacement. Table 8.13 shows breeding period displacement from the cumulative SPA population, where red cells represent > 1% of the SPA population, orange cells 0.5 – 0.99 % of the population and green cells 0 – 0.49% of the SPA population.

Table 8.13: In-combination displacement matrix for Manx Shearwater for cumulative SPA population

Manx Shearwater (Breeding)	Mortality (%)											
Displacement level (%)		0	10	20	30	40	50	60	70	80	90	100
	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	75	150	225	300	375	450	524	599	674	749
	20	0	150	300	450	599	749	899	1049	1199	1349	1498
	30	0	225	450	674	899	1124	1349	1573	1798	2023	2248
	40	0	300	599	899	1199	1498	1798	2098	2397	2697	2997
	50	0	375	749	1124	1498	1873	2248	2622	2997	3371	3746
	60	0	450	899	1349	1798	2248	2697	3147	3596	4046	4495
	70	0	524	1049	1573	2098	2622	3147	3671	4196	4720	5244
	80	0	599	1199	1798	2397	2997	3596	4196	4795	5394	5994
	90	0	674	1349	2023	2697	3371	4046	4720	5394	6069	6743
	100	0	749	1498	2248	2997	3746	4495	5244	5994	6743	7492
Input data: Cumulative mean-peak monthly population estimates for the Project, Burbo Bank Extension and West of Duddon Sands for the breeding period May-Aug												
Reference population: Cumulative SPA population - Aberdaron Coast and Bardsey Island SPA (SMP, 2001), Copeland Islands SPA (SMP, 2002 and Skokholm and Skomer SPA (Perrins et al., 2012)												

8.9.14 Although this analysis does not include peak monthly estimates from Rhiannon or the other wind farms located within the Irish Sea, it does show that at the estimated displacement level of 30 % a 100 % mortality level would still not affect 1% of the cumulative SPA population. A 90 % displacement level and 100 % mortality level would be required to affect 1% of the cumulative SPA population. It is also like that birds present in each site will originate not just from SPAs but a wider regional population including local breeding colonies such as those in Argyll, Isle of Man and Co. Dublin (Mitchell et al., 2004).

8.10 Conclusion

8.10.1 The total number of Lesser Black-backed Gull in-combination collisions associated with the Ribble and Alt Estuaries SPA was 225, this equates to 92 % of the calculated PBR for this site (see Annex 2) of which the project contributes to only 0.89% of the 225 collisions.

8.10.2 The total number of in-combination Lesser Black-backed Gull collisions apportioned to the Morecambe Bay SPA is 317, this equates to 66 % of the calculate PBR of 482. The Project contributes to only 4.4 % of the total collisions.

8.10.3 The total number of in-combination Lesser Black-backed Gull collisions apportioned to the Bowland Fells SPA is 47, this is equates to 0.4 % of the SPA population of 10,937 and 15 % of the calculated PBR of 324. The Project contributes to only 2.1 % of the total collisions.

8.10.4 The in-combination collision numbers calculated are considered to be overly precautionary due to collision numbers for Walney I & II, West of Duddon Sands and Ormonde being apportioned to SPAs only and not taken account of birds from local breeding colonies. It is therefore considered that additional mortality as a result of in-combination turbine collisions is considered to be sustainable and the breeding populations of Lesser Black-backed Gull originating from the Ribble and Alt Estuaries, Morecambe Bay and Bowland Fells SPA will be maintained

8.10.5 The in-combination collision figure for Herring Gull totals 33, 0.79 % of the SPA population and 24 % of the calculated PBR of 140 for the SPA (see Annex 2). Additional mortality as a result of in-combination turbine collisions is considered to be sustainable and the breeding population of Herring Gull originating from the Morecambe Bay SPA will be maintained.

8.10.6 Manx Shearwater have an extensive foraging range (Thaxter et al. ,2012) and foraging excursions from colonies cover a wide extent within the Irish Sea (Guilford et al., 2008). Taken together with monitoring results from Walney I and II (NIRAS, 2012a) and Robin Rigg (eon / Natural Power, 2012) which suggest that distribution and population estimates were similar in pre-construction and construction periods it is considered that in-combination displacement effects on Manx Shearwater will not lead to a population decline in birds originating from the Aberdaron Coast and Bardsey Island SPA, Copeland Islands SPA and Skokholm and Skomer SPA and the conservation objectives for these sites will be maintained.

8.10.7 In conclusion this assessment identifies that the Project in-combination with the other relevant offshore wind farms idenitified in Table 8.7 will not have a likely significant effect on the following sites and features: the breeding Lesser Black-backed Gull populations of the Ribble and Alt Estuaries SPA and Ramsar, Morecambe Bay SPA and Ramsar, Bowland Fells SPA; the breeding Herring Gull population of the Morecambe Bay SPA and Ramsar; and the breeding Manx Shearwater populations of the Skokholm and Skomer SPA, the Aberdaron Coast and Bardsey Island SPA, the Copeland Islands SPA.

9.0 Consideration of mitigation and proposed monitoring

9.1 Mitigation

DIADROMOUS FISH

9.1.1 The Environmental Statement impact assessment on the fish and shellfish receptor (ES Chapter 11 "Fish and Shellfish Resource") takes account of the following mitigation measures adopted as part of the Project:

- The inter-array and export cables will be armoured and buried to a minimum target depth of 0.5 m to 2 m (max 8m). A worst case scenario of 10% of inter-array and export cabling is assumed to be protected by rock dumping/matressing where target burial depths cannot be achieved.
- During construction, overnight working practices will be employed so that construction activities are continuous for 24 hours, thus reducing the overall period of time for potential impacts to fish communities in the vicinity of the Project.
- Where pile driving activity is required, soft start procedures will be implemented. This involves reducing the piling hammer pressure and the subsequent sound level starting at a lower level, gradually increasing to full piling pressure. This enables fish in the area disturbed by the sound levels to move away from the piling before any adverse physiological impacts are caused. This method has been agreed with statutory consultees and implemented for other UK offshore wind farms.

Annex 1 habitats

9.1.2 A full description of mitigation measures adopted as part of the Project is provided in ES Chapter 4: "Project Description". Measures already incorporated into the Project design, which are relevant to benthic ecology and are expected to minimise some potential impacts, are: appropriate Project Environmental Management Plans (EMPs) and Pollution Control and Spillage Response Plans to minimise pollution, and cable burial, which will further prevent scouring and also prevent organisms encountering the strongest Electromagnetic Fields (EMF).

Marine Mammals

9.1.3 A number of mitigation measures, to manage / reduce and, where possible, remove the potential impacts to marine mammals, are incorporated into the Project design. These are outlined below.

- During pile driving operations throughout the construction phase of the project, standard JNCC mitigation measures will be adhered to as set out within The Statutory Nature Conservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals from Piling Noise (JNCC, 2010a). These measures include the monitoring of a 500 m mitigation area before and during piling activities by dedicated marine mammal observers and / or Passive Acoustic Monitoring (PAM) software; and the use of soft start procedure, for no less than 30 minutes, prior to the commencement of pile driving.

9.1.4 A detailed Marine Mammal Monitoring Protocol (MMMP) will be developed for the Project in close consultation with the JNCC and Natural England and this will feed into the Environmental Management Plan (EMP) for the site. This will follow best practice guidance and will incorporate standard mitigation including standard protocol and procedures during construction piling (as above).

9.1.5 All vessel operators will be required to follow appropriate codes of conduct and management procedures. Codes of conduct advise vessel operators on the appropriate

course of action if a marine mammal is encountered, such as avoiding abrupt changes to course or speed, and this will reduce the potential for collision risk with vessels.

9.1.6 Vessel operators will also be required to follow published guidelines and best practice with regards to safe handling of waste and potential pollutants on vessels. Strict control and mitigation measures will be implemented through the EMP, which will contain a pollution control and spillage response plan. This will be adhered to throughout the construction, operation and decommissioning phases of the Project to ensure the risk of accidental spillage from vessels is strictly controlled.

9.1.7 Decommissioning of the foundation structures will follow available guidance and good practice and will be determined in close consultation with regulators and advisors as part of the process of developing the separate decommissioning plan required prior to construction.

9.1.8 Those (mitigation) measures that are not incorporated into the project design are discussed in the relevant sections below where necessary to reduce the level of significance of a predicted impact.

Intertidal Ornithology

9.1.9 The installation and burial of the export cables in the intertidal will take place within an area of importance to birds, i.e. Morecambe Bay SPA and Ramsar. An assessment of the potential effects during the construction phase has identified that for seven species it will be necessary to propose mitigation measures sufficient to avoid an adverse effect on the integrity of the designated site (as a result of potential effects on the feature during the six months October to March). The SPA is designated for supporting over wintering assemblages of waterbirds, and this is when survey data have shown the intertidal study area to support internationally and nationally important numbers of waterbirds.

9.1.10 Recommendations for mitigation of this significant effect are that inter-tidal works are conducted outside of the time period October to March inclusive to avoid an adverse effect on the internationally and nationally important numbers of waterbirds using the study area. This recommendation concurs with the advice given by Natural England during consultation. Such timing of works will avoid any direct impact upon waterbirds using Middleton Sands. It will also provide a lead in time of up to several months for re-colonisation and recovery of invertebrate populations along the export cable route prior to winter; this is the time of year when energetic constraints are greatest for waterbirds when using this site.

Offshore Ornithology

9.1.11 Potential mitigation measures for impacts arising during the construction phase are outlined below:

- A code of conduct for vessel operators to help reduce disturbance of seabirds. Guidance on avoiding large rafts of birds and/or feeding aggregations during transits to the Project Site from port will be provided.

9.1.12 Table 9.1 summarises the mitigation measures relevant to the Habitats Regulations Assessment, and details the means by which those measures are to be secured and can therefore be considered certain to be implemented.

Table 9.1: Mitigation measures relevant to the HRA

Project phase	Mitigation description	Delivery mechanism	Reference
Construction	Piling "soft start" procedure Marine mammal monitoring zone Marine mammal observers	Marine Mammal Mitigation Protocol	Schedule H - Deemed Marine Licence - condition 9.1(f)
Construction	Vessel code of conduct - details of vessel transit corridors	Construction Method Statement	Schedule H - Deemed Marine Licence - condition 9.1(c)(vii)
Construction	Vessel code of conduct - details of vessel transit corridors	Construction Method Statement	Schedule I - Deemed Marine Licence - condition 7.1(c)(vi)
Construction	Cable burial risk assessment to inform burial depth	Cable Specification and Installation Plan	Schedule H - Deemed Marine Licence - condition 9.1(g)(iii)
Construction	Offshore connection works in the intertidal zone only during the period 1st April to 30th September	Marine Licence restriction	Schedule I - Deemed Marine Licence - condition 6.1
Construction	Offshore connection works (in the vicinity of the saltmarsh at Middleton Sands) shall only be undertaken by means of horizontal directional drilling	Marine Licence restriction	Schedule I - Deemed Marine Licence - condition 6.2(a)
Construction	No percussive piling activity during the period 15th February to 31st March (cod spawning period)	Marine Licence restriction	Schedule H - Deemed Marine Licence - condition 8.1
Construction	No percussive piling activity between 15th September and 31st October in a defined area covering the western corner of the Project Site	Marine Licence restriction	Schedule H - Deemed Marine Licence - condition 8.2
Construction	Plan for cable installation including cable protection and works at the landfall	Construction Method Statement	Schedule I - Deemed Marine Licence - condition 7.1(c)(iii)
Construction and operation	Marine pollution contingency plan - methods and procedures to deal with any spills and collision incidents during construction and operation	Project Environmental Management and Monitoring Plan	Schedule H - Deemed Marine Licence - condition 9.1(d)(i)

9.2 Monitoring measures

9.2.1 Monitoring measures are proposed in order to verify assumptions and validate key predictions made in the Habitats Regulations Assessment and to confirm the successful delivery of mitigation.

9.2.2 Table 9.2 lists the monitoring measures proposed and the delivery mechanism for these measures.

Table 9.2: Summary of monitoring measures

Monitoring	Delivery mechanism	Reference
Project environmental management and monitoring plan - to include the appointment and responsibilities of a fisheries liaison officer and an environmental liaison officer.	Marine Licence condition	Schedule H - Deemed Marine Licence - condition 9.1(d)(v)
Construction and monitoring program to include details of: proposed pre-construction surveys/monitoring, baseline reporting format and content, construction surveys/monitoring, post-construction surveys/ monitoring and related reporting in accordance with licence conditions 11 to 13.	Marline Licence condition	Schedule H - Deemed Marine Licence - condition 9.1(a)(iii)
Pre-construction surveys - A benthic survey a survey to determine the location, extent and composition of any benthic habitats of conservation, ecological and/or economic importance (including Annex 1 Habitat) inside the area(s) within the Order limits seaward of MHWS in which it is proposed to carry out construction works.	Marine Licence condition	Schedule H - Deemed Marine Licence - condition 12.2(a)
Pre-construction surveys - an ornithological survey covering the area(s) within the Order limits, and a further buffer distance, seaward of MHWS in which it is proposed to carry out construction works, which is required to test predictions in the Environmental Statement concerning impacts on key bird species (to be specified).	Marine Licence condition	Schedule H - Deemed Marine Licence - condition 12.2(c)
Construction monitoring noise monitoring and an ornithological survey covering the area(s) within the Order limits seaward of MHWS in which it is proposed to carry out construction works	Marine Licence condition	Schedule H - Deemed Marine Licence - condition 13.2
Post-construction monitoring to cover: (a) a survey of any benthic communities/benthos constituting Annex 1 Habitat inside the area(s) within the Order limits seaward of MHWS in which construction works were carried out; (b) an ornithological survey covering the area(s) within the Order limits seaward of MHWS in which construction works were carried out, and out to a buffer distance, which is required to test predictions in the Environmental Statement concerning impact on key species (to be specified); (c) one high resolution swath-bathymetric survey across the area(s) within the Order limits seaward of MHWS in which construction works were carried out to assess any changes to bed form morphology; and (d) after the first occurrence of a major storm event, a side scan sonar and bathymetry survey within the Order limits seaward of MHWS in which construction works were carried out.	Marine Licence condition	Schedule H - Deemed Marine Licence - condition 14.1

10.0 Consultation on the HRA

10.1 Introduction

10.1.1 Consultation is a key component of the pre-application stage for Nationally Significant Infrastructure Projects being considered by the Planning Inspectorate. The Applicant undertook consultation in relation to this HRA with various statutory authorities, including consultation on the EIA scoping report, PEI, HRA screening report and draft HRA report (attached as Annex 6 to this Report). The dates these documents were issued are detailed in Table 10.1. Key meeting dates associated with the HRA are listed in Table 10.2.

Table 10.1: Timeline of consultation activity relevant to the HRA

Date	Description
2010	Planning Inspectorate (IPC) notified of the Applicant's intention to submit an application for consent
September 2010	EIA Scoping Report issued
November 2010	IPC Scoping Opinion received
August 2012	PEI Report issued
October 2012	HRA Screening and Scoping Report issued for consultation by the Applicant to Natural England, CCW, JNCC, MMO, Environment Agency, Cumbria County Council, RSPB
March 2013	Consultation on draft ES chapters - including ornithology, marine mammals, fish and shellfish, benthic ecology
April 2013	Draft HRA Report circulated for comment to JNCC, Natural England, CCW, SNH, Northern Ireland Environment Agency, Republic of Ireland Department of Environment, Heritage and Local Government, Isle of Man Government, Marine Management Organisation, Natural Resources Wales, Environment Agency (England), Cumbria County Council (and other PPA), RSPB, WWT, Manx Wildlife Trust, Manx National Heritage, Whale and Dolphin Conservation Society, Lancashire Wildlife Trust, and the Planning Inspectorate

Table 10.2: Key meeting dates associated with the HRA

Date	Summary of meeting
14th November 2012	Key stakeholder workshop meeting with NE, JNCC, CEFAS, MMO to discuss Project progress and key issues for the EIA and HRA
15 November 2012	Meeting with representatives of MIEU (Defra Major Infrastructure and Environment Unit) to update on project progress.
25th February 2013	Meeting with representatives of Natural England, Environment Agency, Lancashire Moth Group, Butterfly Conservation to discuss landfall options at Pott's Corner
18th March 2013	Teleconference with representatives of Natural England to update on Project progress, development of the HRA, and cabling options at Pott's Corner
23rd May 2013	Meeting with the Environment Agency to discuss consultation responses regarding fisheries, biodiversity, and flood defence consents

10.2 Summary of response

10.2.1 The HRA Screening and Scoping Report (SSR) was issued for consultation in April 2012. The SSRcontains a brief description of all phases of the proposed development, details of the European Sites and the relevant interest features (diadromous fish, marine mammals, bird species, and habitats) potentially affected by the Project, together with a list of other plans and projects to be considered for potential in-combination effects with the Project. The SSR used the Project Scoping Report (DONG Energy, 2010) to identify activities and projects that should be considered for the HRA in-combination assessment and used The Crown Estate Round 3 Appropriate Assessment (Entec, 2009) to initially inform the screening for likely significant effects.

10.2.2 Table 10.3 summarises details of the HRA Screening and Scoping Report consultation. The full responses can be found in Annex 7.

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
JNCC / Natural England 26th November 2012	This development features aspects that bridge the 12 nautical mile threshold and as such is a joint response from the Joint Nature Conservation Committee (JNCC) and Natural England. JNCC has responsibility for the provision of nature conservation advice in the offshore area. 'Offshore' is defined as beyond 12 nautical miles (nm) from the coastline to the extent of the United Kingdom Continental Shelf (UKCS). Within territorial limits (<12 nm) nature conservation advice is the responsibility of the relevant country agencies in this case being Natural England. Overall we are of the opinion that the report represents a thorough and logical approach to the scoping of a habitats regulations assessment and we largely agree with the conclusions of the exercise. We feel, however, that some clarification is necessary for key areas outlined below:	Noted.
	As indicated in our response to the PEI consultation, the SNCBs advice is that a significant effect is likely on a number of designated European sites during construction, operation and decommissioning of the wind farm. We note that a map of study area showing the protected sites that can potentially be affected has not been included in the HRA screening report; a visual representation of the project and Natura 2000 sites within the study area is a useful way to convey information and provide an overview of range of possible effects.	Noted. The draft report includes Charts 5.1 and 5.2 showing the location of all sites considered in the Habitats Regulations Assessment.
	Some of the tables are lacking in the detail required to make an assessment of potential for LSE based on the data presented, these should be amended in order to allow a standalone assessment of LSE from their content. For example, Table 9 shows species present during site survey and potential for LSE, when referring to bird densities figures should be shown including the threshold required for densities to be too low to cause LSE. If more detail is referred to in a technical report references should be provided.	Noted. The applicant has undertaken an initial assessment of likely significant effect (Chapter 5) and provided a justification for screening out some sites and features at this stage - see Sections 5.1 to 5.7

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
	Diadromous fish features: Natural England agree with the conclusions of the screening report, that there are no SACs designated for diadromous fish features in proximity to the site, and so these features can be screened out from further assessment.	Noted. See Section 5.3
	Habitats: Natural England are satisfied that both Shell Flat and Lune Deep SAC and Drigg Coast SAC can be screened out. The reasons for this being that there is sufficient distance from these designated sites and the project site and that the footprint of changes to sediment transport regime as a result of the presence of the wind farm is confined to outside of their area.	Noted. See also the further consideration of the Shell Flat and Lune Deep SAC in Section 5.4
	Natural England suggests the addition of a more detailed map of the cable route to show its proximity to designated features. There was some recent work which CMACS undertook which assessed the potential for Annex 1 reef features along the cable route which could also provide evidence for the HRA assessment and should be referred to (this was undertaken to provide evidence for the impact of the geotechnical survey licence MLA_2012_00218). Additionally, it should be noted that the area for cable landfall, specifically Middleton Sands, is an important overwintering feeding area for bird species from the Morecambe Bay SPA. Disturbance at this area will need to be avoided from October to March. Natural England are happy to provide more information on this as required.	Noted. See Charts 5.3 and 5.4 for a consideration of the offshore cable route and Section 5.4 for a consideration of the impacts on intertidal habitats and species.
	Marine mammals: Natural England are satisfied that there are no impacts on marine mammals within SACs in our territorial waters due to the proximity of the site to designated sites in English Waters. JNCC would also agree that a significant effect on qualifying marine mammal species is unlikely in the area.	Noted. See Section 5.5
	However, although JNCC and NE are the two SNCBs with more direct nature conservation interests related to the project we'd like to make clear that it is the responsibility of the developer to seek the advice of other bodies, particularly the Countryside Council for Wales (CCW) and Department of the Environment Northern Ireland (DOENI) who are responsible for SACs containing mammal species that are closest to the development to ensure that they do not have any concerns of LSEs on these mobile species when it comes to foraging ranges or migratory routes.	Noted. DoENI, SNH, CCW, RoI DoEHLG included in this consultation on the draft HRA Report.
	JNCC observes that this chapter is relatively light on detail, i.e. only survey data have been used to look at densities in the area and this has not been put into any context of regional populations or movements of species from sites, e.g. any photo id evidence data or tagging data for how far seals/ cetaceans may move from areas. Some of this data are mentioned only very briefly, e.g. SCOS seal data, but don't display/map any of that evidence in the context of this document and just rely on stating a distance to site.	Noted. Further detail now provided in Sections 4.7 and 5.5

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
	Ornithology: We would like to reiterate the need for the developer to ask for advice from the bodies responsible for the SPAs out with England's territorial waters, specifically: SNH for Ailsa Craig SPA Gannets; DOENI for Lough Neagh and Lough Beg SPA Whooper Swans; and CCW for Skokholm and Skomer SPA and Aberdaron Coast and Bardsey Island SPA for Manx Shearwater.	Noted. These and other relevant organisations have been included in the consultation on this draft HRA Report.
	We feel that several species may have been screened out prematurely, and would advise that the situation with these SPA features is reconsidered and / or clarified. These are divided into three categories, as below:	Noted.
	Species excluded because of low densities: It is not clear from Table 40 in the PEI report whether this represents raw density data, or scaled up density data. If it is the former, it is too soon to screen these features out. This applies to red-throated divers, common scoters (accepting that Liverpool Bay SPA is some 21 km distant – probably no LSE, but perhaps worth taking forward), little gulls, fulmars, and possibly cormorants (as breeding features of Ribble-Alt or non-breeding assemblages).	Offshore bird data is discussed in Section 4.9, Table 4.11 identifies bird densities within the Project site and 4 km buffer. Table 5.4 provides a justification for screening out little gull, fulmar, and cormorant.
	Migrants: Several migrants appear to have been prematurely screened out. Although densities might be low on a given survey day, these densities may persist over a longer migratory window. It is relatively straightforward to assess the temporal aspect of this potential effect using Band (2012). This applies to common terns, great skuas, Gannets, potentially kittiwakes and common gulls. It is also not clear how tern spp. and grey gulls relates to individual species. Additionally, any migratory wildfowl and / or waders potentially passing through the wind farm en route to coastal SPAs should be assessed (e.g. using methods in the SOSS report of Wright et al. 2012, and potentially a collision risk assessment). This may apply to features of the Ribble-Alt SPA, Mersey Estuary SPA, Mersey Narrows and North Wirral Foreshore SPA, or Dee Estuary SPA for example. Additional migratory pintails associated with Martin Mere SPA may be relevant. This assessment does not need to be arduous or complex however it is important that the document provides a clear reasoning for screening these impacts out of the assessment.	Comments noted. Migratory bird population risks are considered in Section 6.3

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
	Wintering species: Although assigning wintering features to source breeding SPAs is likely to be inherently built upon large assumptions, it is also important to consider this for guillemots and razorbills in particular. Natural England would be pleased to discuss this further, to collectively assess what is known about provenance of wintering auks in the Irish Sea, and to advise on sensible assumptions in this element of HRA.	The Applicant notes the recent interim advice provided by Natural England on this matter. An assessment of the potential impact on SPA breeding features outside of the breeding season has been included in this HRA Report (Annex 3).
	Several species are highly likely to be considered for inclusion within the Irish Sea SPAs in the near future (Table 1).	Noted. Where appropriate these species have been incorporated into this assessment.
	Cumulative/ in combination assessment: Several onshore (coastal) windfarms, for example the Haverigg windfarm on the Cumbrian coast and the Heysham windfarm in Morecambe Bay, may have a direct impact on the bird species assessed as part of this project, specifically Pink-footed Goose and Whooper Swan. We advise that relevant onshore windfarms should be included within the cumulative assessment; Natural England can advise further on this as required. The MMO and relevant local authorities should also be consulted to determine any current or future developments that may apply.	Noted. Section 8.4 of this Report includes a consideration of the impact of onshore wind farms on Pink-footed Goose on cross-country migration.
	Burbo Bank Extension is likely to have completed an impact assessment. Therefore any potential cumulative effects to features relevant to this wind farm – such as the Manx Shearwater - should also be included.	Noted. The potential for an in-combination impact with other offshore wind farms including Burbo Bank Extension is included in Chapter 8. Data from the Burbo Bank Extension assessment (on, for example, collision risk) is used in this assessment

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
Countryside Council for Wales 10th December 2012 (via JNCC)	Thank you for e-mail dated 16th November 2012, providing CCW with the opportunity to comment on the Habitats Regulations Assessment (HRA) screening and scoping report for the proposed Walney Extension Offshore Windfarm (WEOW) off the Cumbrian coast. We must advise that whilst our comments are made to be helpful, they are necessarily brief, given that we have not had adequate time to consider the HRA in detail due to the exceptionally short turn-around time given, and because CCW has not had sight of any other relevant and necessary documentation for the proposed project and its potential impacts. In the future, CCW would welcome early engagement with the developer and JNCC on the project detail and its assessments. Our current comments and observations are, therefore, made without prejudice to any comments or advice that CCW may be required to give on the project (including further HRA reports & project documentation) should other information become available. It is worth noting that our advice relates only to the potential impacts on Welsh Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) and their associated features. You should however, refer to response(s) from Natural England for advice on potential effects of the project upon sites in England.	Noted.
	(1) CCW considers that the general approach taken by the screening report is appropriate, building upon the plan-level R3 HRA work.	Noted.
	(2) CCW agrees that marine mammals can be screened out as far as the Welsh sites are concerned, due to the foraging distances involved in relation to the proximity of the site to designated sites in Welsh waters (we note that the effects of piling on Bottlenose dolphin were considered in the HRA for the Gwynt-y-Mor scheme, and were concluded not to be adverse). However, we advise that as a European Protected Species, any potential injury and killing will need to be mitigated via the JNCC piling protocol.	Noted. Reference is now made in the HRA Report to a marine mammal mitigation protocol, this is also a condition of the Deemed Marine Licence.

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
	(3) CCW are concerned that, in relation to SPAs, a number of sites/species have been screened out or not considered at all. Welsh SPAs which have the potential to be affected must be fully considered. We advise therefore that the following sites should be 'screened in' and assessed further: (i) the Dyfi Estuary SPA - in order to consider the potential impacts on its migratory waterfowl (Greenland White fronted geese) site features, as currently we have no understanding of the risk to this feature and its migration path. (ii) Grassholm SPA and potential impacts on Gannet - in order to potentially later rule out on the basis of foraging distance. Whilst we note that Grassholm isn't within the mean max range for Gannet, it is within the maximum range of that species. (iii) Skokholm & Skomer SPA deand potential impacts on storm petrel - in order to potentially later rule out on the basis of foraging distance (iv) the Dee Estuary SPA and potential impacts on terns - in order to potentially later rule out on the basis of foraging distance (v) the Ynys Feurig, Cemlyn Bay and The Skerries SPA - in order to potentially later rule out on the basis of foraging distance	Noted. The Report includes a consideration (Section 5.7.2) of the Greenland white-fronted goose and the Dyfi Estuary SPA. Other Welsh SPA sites beyond the mean maximum foraging range for breeding birds are identified (Grassholm SPA, Table 5.4, with respect to Gannet; Ynys Feurig, Cemlyn Bay and The Skerries SPA, Table 5.4, with respect to Sandwich tern) but are not assessed further in this Report.
	(4) CCW considers that, as far as cumulative effects on Welsh interests go, WEOW should consider all oil & gas explorations in the Irish Sea (most notable because of the range and potential flight path of some SPA birds).	No information on the density of birds found within oil and gas sites is available to inform an incombination assessment. In addition, there is no concensus on the likely effects of these sites and thus, comparing them with offshore wind farms is not practicable. For any assessment to be carried out, a series of broad assumptions would have to be made that in the Applicants opinion would not provide any meaningful results.
	(5) CCW agrees that Salmon and Sea Lamprey can be screened out as there are no sites in the study area and given the distance from the Dee Estuary. However, CCW advise that clarity is needed in relation to potential in-combination effects on these species and advise that WEOW should at least identify the Dee so that it can be screened out at a later stage.	Noted. Table 4.2 now includes this SAC.

Table 10.3: Summary of consultation responses to the HRA Screening and Scoping Report

Consultee	Response	Applicant Response
	(6) Without seeing the physical process modelling assessments, it is difficult for CCW to comment on the potential far-afield effects of WEOW. It may be worth noting however that the Rhiannon Wind Farm Preliminary Environmental Information Document states that cumulative assessments undertaken within the ZAP report identified the potential for physical processes interaction between the Irish Sea Zone and Walney offshore wind farm, although it was concluded that predicted impacts were unlikely to be significant. It may be that the HRA report for WEOW already considers this in detail as we note that under Section 5 In-combination effects; 5. 1 Project to be considered (pg 39), the R3 Irish Sea Zone (Zone 9) has been considered as part of the screening process. CCW would welcome some further clarity that the point above has been considered in adequate detail.	Noted. The HRA Report uses the assessment provided in the MetOcean and Coastal Processes Chapter which identifies physical impacts will be restricted to one tidal excursion (approximately 8 km in this case) from the Project Site.

10.2.3 The draft HRA Report was issued for consultation in April 2013. The report uses information in various Project ES Technical Reports, Annexes and the draft Environmental Statement (ES) Chapters to identify those Natura 2000 sites and interest features where a likely significant effect is not predicted and those sites and features where a likely significant effect is predicted - or cannot be excluded.

10.2.4 These sites and features (considered in the draft HRA Report to be: Morecambe Bay SPA and Ramsar breeding Herring Gull and Lesser Black-backed Gull; Bowland Fells SPA breeding Lesser Black-backed Gull; Ribble and Alt Estuaries SPA and Ramsar breeding Lesser Black-backed Gull; Aberdaron Coast and Bardsey Island SPA, Skokholm and Skomer SPA, and Copeland Islands SPA breeding Manx Shearwater; and Morecambe Bay SAC saltmarsh habitat) are taken forward for further assessment. The Applicant acknowledges that this document is a draft document and some of that assessment is incomplete.

10.2.5 Table 10.4 summarises consultee responses to the draft HRA Report and the Applicant's response to these comments. The full consultee responses are held at Annex 7.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
Northern Ireland Environment Agency 3rd May 2013	NIEA Conservation Science is generally happy with the content, methodology and conclusions of the report regarding potential impacts on designated ornithological sites in Northern Ireland.	Comments noted.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Comments regarding movements of Whooper Swans between England and Ireland and vice versa: We acknowledge that all available evidence indicates that such movements are relatively rare but note that tracking studies and field observations have concentrated on the main Spring and Autumn migration periods, whereas the majority of trans-Irish Sea movements may occur during Winter in response to extreme cold weather in Great Britain. We recognise that the occurrence of hard weather episodes is inherently unpredictable and that little data exists on the scale of any swan movements initiated as a result but we believe that the possibility of additional collision risk arising from this source should be addressed in the report.	The assessment of Whooper Swan collision risk (HRA Report, Annex 1) includes scenarios investigating within-winter movements of this species. These are likely to be weather-related events and have been recorded by tracking marked birds between English sites and those in Northern Ireland and the Republic of Ireland (see Wernham et al., 2002). The theoretical modelling therefore builds in such scenarios in order to estimate the collsion risk to this species.
	There appears to be some inconsistency in the Northern Ireland Whooper Swan SPAs identified as being potentially affected by the project. The initial screening summary (Table 5.5) lists Lough Neagh/Beg, Upper Lough Erne and Lough Foyle, whereas Section 6.1 refers only to Lough Neagh/Beg. I cannot find any reference to the latter two sites being subsequently screened out.	This omission from the text at HRA section 6.1 has now been corrected.
	I would also suggest that, if an LSE is predicted for Lough Foyle then the analysis should also include the neighbouring Lough Swilly SPA in the Republic of Ireland.	The HRA Report now includes a consideration of this site (sections 5.7.2, and 6.2).
Wildfowl and Wetlands Trust 15th May 2013	I was pleased to see that the Report has addressed ornithological issues in some detail, and also that efforts were made to follow standard procedures, but I had some concerns regarding the parameterisation of the collision risk models in Appendix 3, as follows:	Noted.
	In Annex 1, Table 17 and subsequently, the proportion of flights at risk height is estimated at 40% on the basis that Griffin et al. 2010 recorded a median flight height of 9 m and a mean flight height of 31 m over water. However, Griffin et al. 2010 and 2011 also emphasised that the accuracy of the flight height data is ± 22 m. This should be mentioned, and linked to the range of potential collision heights included in the model illustrated in Table 20. For instance, by noting that the collision rate is 8.6 birds at 98% avoidance rates if all birds fly at turbine height. This also applies to the collision risk for within-winter movements between Britain and Ireland in Table 23. Although Whooper Swans do generally fly at relatively low altitudes, I do wonder whether they would actually fly beneath a moving object (i.e. the rotors). Are there any data from other constructed wind farms which could inform this matter?	The tables included within the theoretical collision modelling report present data showing variable proportions of birds at collision height and variable proportions of the population interacting with the Project Site. A figure of 40% (from Griffin et al., 2010) is used as the best estimate based on the evidence that could be sourced from the literature. Presentation of different flight height / population size scenarios is an attempt to address the limitations in this data.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The method used to calculate within-winter movements, for providing an estimate of the numbers flying across the wind farm footprint when moving between Britain and Ireland, is unclear. But presumably it is based on the number of ringed birds seen in both Britain and Ireland in a single season. On providing these data we emphasised that this approach would grossly underestimate the movement of birds between Britain and Ireland and, although that has rightly been stated in the text, it seems to me that these calculations are spurious in the absence both of better data and of some indication of the proportion moving across the site of the Walney Extension. It is unlikely that all movements will be across Walney, but the reason for taking half the estimated Britain-Ireland flights as coinciding with the site (2,004.5 birds per year, if I've understood correctly) is unclear. Given this uncertainty, more extensive use of radar studies should be used (to include monitoring night-time flights) to provide real information on swan (and goose) flights across the site.	It was agreed with Natural England that further monitoring data from the Project site would not aid this assessment and that effort would be better placed constructing a theoretical collision risk model for the two species. The 4009 figure represents all Whooper Swan movements across the Irish Sea per year. The collision risk model allows the user to insert the number of times a movement is carried out by a bird, in this case two. As the 4009 birds represented all movements across the Irish Sea, it was assumed, in the absence of better evidence, that half of these flights would occur from the UK to Ireland and half in the opposite direction.
	The number of Pink-footed Geese crossing the Walney Extension seems to be derived from radar trials at Walney Island (from Budgey 2010). But the frequency and timing of the radar observations are unclear, so it is difficult to assess whether the numbers recorded were observed over many days during the peak migration period, and thus whether the sampling time/duration was appropriate. Moreover, the mismatch between the observations from the Walney Bird Observatory (which found that most geese pass at >6km from the coast; pages 81 & 114) and Budgey (2010; which found minimal interaction of geese with Walney I & II, but noted concerns about detection rates at increasing distances from the radar) does not seem to be addressed /calculated for the Pink-footed Goose modelling in Appendix 3 (pages 262-263). The proportion of the west coast pink-footed geese which migrates over the Walney Extension therefore remains very speculative.	The relevant section of the HRA report has now been revised to provide the clarity requested (Section 5.7).
	On pages 135–137, the collision risk predictions for migration movements and within-winter movements should be summed in determining the LSE for Whooper Swans wintering at Martin Mere, as both could result in the Walney Extension affecting the Whoopers wintering at the Martin Mere SPA.	These assessments are now combined and shown at Table 6.7

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	I'm afraid that I found the information provided in Section 8.4 (pages 183–187) on "Screening for in-combination effects on Whooper Swans and Pink-footed Goose" difficult to follow. Firstly, the reason for including only the Barrow, Ormonde, Walney and West of Duddon Sands wind farms as likely to have in-combination effects is unclear, as Griffin et al. 2010, 2011 point out that Whooper Swans tracked from Martin Mere and across the Cumbrian offshore sites also coincide with offshore wind farms along the west coast of Scotland, most notably those in the Solway Firth (e.g. Robin Rigg). I think there is a plan to include there in the Final Report (from the note highlighted in yellow?), but in principle movements across terrestrial wind farms should also be considered (Griffin et al. 2011).	The HRA Report now includes the Robin Rigg offshore wind farm in the cumulative assessment.
	Secondly, I suggest providing further information on the use of "precautionary estimates of population size" (from Band 2012), and how these link to the proportion of Whooper Swans tracked across the wind farm footprints (Griffin et al. 2010, 2011) as I'm afraid that I don't follow the concept or the maths as written. Thirdly, the reason for using the migratory front illustrated in Chart 8.1 (page 184) seems rather odd; it's possibly OK for within-winter movements, but migration movements follow a more northwesterly trajectory across the site (as illustrated in Griffin et al. 2010). It's important to note that the collision rate estimates as a % of the Martin Mere SPA population given earlier in Tables 6.5 and 6.7 (total = 0.48; pages 135-1336) seem to differ quite markedly from the 0.04% cited for Martin Mere and the Ribble Estuary in Table 8.4 (on page 186). I may have missed something, but if so please clarify the reason for the differences. Overall, a summary of the % collisions for each of the SPA populations, separately and in-combination, would be helpful here.	This approach was taken from SOSS-05 (Wright et al., 2012) to help mitigate for the unlikely scenario that birds would be distributed evenly across the migratory front. The migratory front is now assessed as a more concentrated front between the Cumbrian coast and the Isle of Man. Tables 6.5 and 6.7 show the collision risk values for Whooper Swan from the Project alone, Table 8.3 shows the values for the Project in-combination with other wind farm sites.
	In Appendix 4, it's again not possible to interpret the information provided without knowing what the values the "Population" column refer to, and how they relate to the proportion of tracked birds seen to cross the Walney footprint. Also, are the numbers in the cells the proportion of the total population, the proportion of the numbers wintering at Martin Mere/Ribble, or the number of birds estimated to collide with the turbines? For cumulative assessment, it would be much clearer here to give the number of estimated collisions/annum for the different avoidance rates provided, along with the total (cumulative) collisions for all the Cumbrian offshore wind farms (plus those further north), and the % of the SPA numbers (i.e. the proportion of the swans that winter (a) on the Ribble and (b) at Martin Mere) these relate to.	The population figures represent the population multiplied by the number given, this is explained within the methodology and is taken from SOSS-05 guidance. The numbers in the cells are the number of collisions/ annum and for different avoidance rates.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	On page 74, regarding potential displacement of seabirds from Walney I and II wind farm areas, there's mention that monitoring surveys made during the construction of these sites are included in the report but that "no data are yet available for the operational period of the wind farm". Given that Walney Extension is considered to have a potential LSE for feeding Manx Shearwater, Lesser Black-backed Gull, Herring Gull and Gannet (Table 5.4), and that there's a risk of large numbers of Manx Shearwater being displaced from the site (Table 6.1), these post-construction monitoring data should be included to inform an appropriate assessment of the potential effects of the Walney Extension.	The Applicant notes that monitoring surveys are required for a three year period following construction but that post construction monitoring data are not yet published for year 1 for the Walney I and II wind farm sites. Results from these surveys will inform our understanding of the actual displacement effects occurring from these operational wind farms. As a precautionary approach the HRA Report for the proposed Walney Extension offshore wind farm presents a range of displacement values (from 0% to 100% and range of potential mortality outcomes (from 0% to 100%) in its assessment of the implication for sites where these species are qualifying features. (See section 7 of the HRA Report).
	On page 80, regarding the Whooper Swan numbers and population estimates, Hall et al. 2012 should now be used (as in Appendix 3 [in Annex 1]), rather than Worden et al. 2009, as Hall et al. provide results of the most recent (January 2010) census.	Hall et al., has now been used to report Whooper Swan population estimates.
	Page 80, last line. Need a reference here to confirm the source of the statement, relating to Pink-footed Goose migration, that "It is suggested that there are potentially three main routes through northern Britain: one east coast flyway and two on the west coast (eastern Irish Sea) involving an offshore route and an inshore route.	This section (Section 4.9.44) has been reworded to more accurately reflect the statements in Budgey (2010).
	Pages 135–136. The figures presented in Tables 6.5 and 6.7 should take into account comments on the flight height accuracy mentioned above.	The presentation of different migration population values is an attempt to mitigate this factor.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	On page 183 and Appendix 3, I can't work out how a "west coast population estimate" of 3,015 birds was calculated from Hall et al. (2012), so a bit more detail would be helpful.	The population of Whooper Swans likely to interact with Walney Extension was derived from the 2010 Swan Census totalling those birds observed in counties which would be expected to receive birds from the west coast flyway population. This gave a total population of 3,015 birds using the west coast flyway (Hall et al., 2012).
	Tables 4.11 (page 76 onwards) and 5.4 (page 105 onwards) are somewhat repetitive and difficult to interpret. It would be easier to assess the importance of the site for different species if one of two columns could be added to give just the max count and the density of birds, with additional information in a "Notes" column. Also note that numbers do not always match; for instance for the maximum Gannet count recorded (1,009 in Table 4.11; 592 in Table 5.4).	The Applicant acknowledges that Table 4.11 presents a lot of survey information on the species recorded at the proposed offshore wind farm site. The different values for Gannet (reported also in Table 4.11) refer to the difference between aerial survey estimates and boat-based survey estimates.
Natural Resources Wales 23rd May 2013	These comments are limited to those interventions and sites which lie wholly within Wales and do not cover the sites which lie partly or entirely within England, in particular potential effects on the Liverpool Bay SPA. They should, therefore, be read in conjunction with comments from Natural England (NE) and the Joint Nature Conservation Committee (JNCC), as the issues they raise may be relevant to the assessment as a whole. NRW welcomes this draft Habitats Regulations Assessment (HRA) of the Walney Extension offshore wind farm. However, we have a number of concerns over the monitoring evidence and methodology used to assess potential impacts on the Manx Shearwater features of the Aberdaron Coast and Bardsey Island SPA and the Skokholm and Skomer SPA and would welcome further clarification of the following points:	Noted (comments restricted to sites within Wales).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The assessment makes reference to the construction period effects assessed as part of Walney I and II (NIRAS, 2012) and at Robin Rigg (eon / Natural Power, 2012), and notes that none of the studies recorded any significant changes in numbers or distribution of Manx Shearwater. However, our understanding of the Robin Rigg scheme on the west coast of Scotland is that the number of individuals recorded pre-construction was 1,566 individuals with 0.26 individuals per unit sample effort, during construction the number of individuals recorded was 1,672, with 0.13 individuals per unit, whilst during operation in the first year only 160 individuals where recorded, with only 0.05 per unit sample effort (eon / Natural Power, 2012). This indicates an approximate reduction of 80% from post construction numbers to those present during operation. We accept that the work that has been done at Walney also shows no difference between pre-construction and construction but there appears to be a lack of information on displacement comparing pre-construction and operation. We would welcome clarification as to whether this information is available or why the evidence for post construction/operational displacement evidenced at Robin Rigg has not been adopted for the purposes of this assessment.	At Robin Rigg, Manx Shearwater were rarely seen on site, and those that were sighted were predominantly in August and much less so during the adjacent months (Walls et al. 2013). The pattern of occurrence is indicative of passage, the volume of which within any estuary or embayment, can be expected to be sporadic within and between years, the largest numbers occurring with strong onshore winds. Birds may linger within a large estuary following strong onshore winds and not immediately disperse on abatement of a gale (R.Ward pers obs.). There is an unequal comparison to date between the surveying of one autumn passage period against three during pre-construction. This is particularly pertinent given the variability that exists between years for embayments/outer estuaries and land-based seabird observatories in the total and daily numbers of passage birds throughout the UK (as reported in county bird reports). There is no reason to expect the Solway Firth to be different. For a comparatively small numbers of birds recorded, a statistical difference ($p<0.05$) was found between pre-construction and the subsequent phases in the numbers of Manx Shearwater recorded in the study area.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
		However, this is for the whole 360km² study area of which only 18km² is taken by the wind farm footprint, and across which the difference in bird distribution between the project phases does not frominspection suggest avoidance of Robin Rigg. The Project considers it inappropriate to use a Manx Shearwater displacement value of 80% as derived from current analysis of Robin Rigg data. The incursion of Manx Shearwater into the Solway Firth whilst on passage can be expected to be variable between years, with neither the available data or distributional patterns observed at Robin Rigg supportive of the use of such a high displacement value. In conclusion, for a species with flexibility in habitat use, a displacement value of 30% is considered appropriate for Manx Shearwater until data analyses following further post-construction surveys at Robin Rigg or elsewhere suggests otherwise. The Project agrees that the work that has been published for Walney I and II cannot provide the necessary comparison between pre-construction and operational phases, only pre-construction and during construction.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	We welcome that displacement matrices for Manx Shearwaters have been produced for both Aberdaron Coast and Bardsey Island and Skomer and Skokholm SPA's. However the 100% displacement for each of these sites is 926 individuals, which appears to relate to the mean peak population estimates from Walney extension plus a 4 km buffer taken from the aerial surveys, rather than the data recorded from the boat surveys. Given that the boat surveys recorded the highest peak as 11,591 individuals in the May survey compared to just 1,417 from the aerial survey in May, we would recommend using the boat survey data.	Boat-based surveys were undertaken to provide context supporting the aerial surveys in gathering data such as behaviour and flight height. The aerial surveys were detailed throughout the scoping and baseline data collection periods as being the primary data source to be used to inform the assessment. Therefore, as consulted with JNCC, boat-based surveys were undertaken in key seasonal periods only, without a full programme in order to produce accurate population and density data. The peak count in May 2012 within boat-based surveys refers to a raw count of 2,087 individuals so that the extrapolation of aggregating species such as Manx Shearwater may have had a significant influence on the final population estimate.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	To ensure that the assessment of potential impacts on the Manx Shearwater is sufficiently precautionary, NRW suggest that the mean of inter-annual peak population, (this being the peak in either survey methodology) is used. This would then be consistent with the assessment of other major offshore wind energy developments (such as the Atlantic Array HRA) and would, therefore, allow for comparison in terms of potential cumulative and 'in combination' effects. NRW also recommend that the figure for displacement should just relate primarily to the wind farm site and not the buffer area. This figure should then be apportioned to relevant SPA's (those in mean max range) such as Copeland SPA, Aberdaron Coast and Bardsey Island SPA, & Skomer and Skokholm SPA, which would then bring the assessment in line with the apportioning work for SPA's and collision risk monitoring carried out for these other developments. Once the assessment of how many birds come from which SPA is completed, then that figure should be used in a displacement matrix. To demonstrate how this displacement may have an effect on each population, we recommend that a Potential Biological Removal (PBR) calculation should then be completed for each SPA. Please note that this needs to be assessed cumulatively and consider the potential level of displacement from other wind farms in the mean max range of these SPA's.	The Applicant maintains that aerial survey data is the appropriate source data to inform the assessment. The boat-based survey programme was undertaken for 10 months only and was designed to provide parameters such as behaviour and flight height. Clarification will be sought from NRW regarding the use of data from survey buffer areas – the JNCC / NE guidance (2012) recommends the inclusion of buffer areas in the analysis. This approach has been followed in the HRA. The Applicant understands that the Atlantic Array assessment has not included a PBR analysis for Manx Shearwater and notes that it is not clear how displacement effects would be assessed in a PBR analysis (unless displacement was considered equivalent to mortality).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
JNCC / NE 24 May 2013	As the project includes aspects both within and beyond the 12 nm territorial limit, please accept the following advice minute and comments herein as a joint response from both JNCC and Natural England and without prejudice to any comments that we may make in the future in relation to this development. In consultation with DONG Energy, Natural England and JNCC have preceded this note with advice on high level issues and areas of immediate issue (see Appendix J). This note is in addition to any advice we have sent in the respect. We have also only been unable to address the Habitats Regulation Assessment at a high level and this document has not, therefore, undergone extensive consultation with the SNCB. This approach was agreed with the SNCBs and the developer as being the most appropriate solution in the time frames available. Please also find preliminary comments on HRA issues for SPAs and SACs after Appendix J. After review of the draft ES chapters for Walney Extension Offshore Wind Farm, we would like to draw your attention to the key issues below for most of which we have already provided high level comments to DONG Energy and which are all collated together for your reference in Appendix J. Key issues identified regard the following:	Noted (joint advice). The advice on the draft HRA Report has been provided in response to a consultation issued on the 12th April 2013. The advice provided covers both the draft Environmental Statement chapters and the draft HRA Report. The Applicant's comments recorded in this Table relate to the draft HRA Report or ES chapter comments where reference is made to the HRA Report.
	Marine mammals: with regards to cumulative impact, more context from experiences with Walney I and II, clarification on monopile size and energy needed for driving, scenario modelling, cumulative operational noise, more discussion on how to mitigate beyond the 500 m mitigation zone;	Due to the distance between SAC sites where marine mammals are qualifying features and the Project Site no likely significant effect on these SAC sites is predicted. Natural England and JNCC agreed this conclusion in their response to the HRA Screening and Scoping Report (response dated 26 November 2012). The Applicant has assessed the impact on individual marine mammals and this is documented in the ES Chapter 12 "Marine Mammals".

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Ornithology: At present, there is significant uncertainty about the data used to underpin the impact assessment. Questions remain about: substantial differences between boat and aerial survey population estimates, and how these estimates should be used; proportioning of group level identifications of birds; the sufficiency of temporal coverage of surveys; the methods of population estimation; elements of collision risk modelling; and the way ornithological data have been used for assessing several elements of impact.	Responses are provided (below) on the issues raised. these issues are also addressed in the Consultation Report (Document Reference 5.0).
	We also have concerns about aspects of the approach to assessment. Specifically, the definition of the regional population for contextualisation of importance, and the absence of assessment of SPA features in the non-breeding season require attention. Furthermore, the cumulative assessment for several key receptors is lacking, in some instances significantly. This applies to gulls, Whooper Swans, pink-footed geese and migratory waterbirds in particular.	The Applicant understands that the regional population estimate presents a holistic view of breeding seabirds in the west coast of the UK. Rather than limiting the regional population to colonies that are within mean-maximum foraging range the stated population includes colonies from a wider geographical area in order to provide a more appropriate context. The HRA Report now includes a full assessment of the potential impact on breeding seabird SPAs where these features are present on the Project site outside of the breeding season (see Annex 3). The HRA Report considers an in-combination assessment for migratory Whooper Swan and Pink-footed Goose, breeding seabirds (with respect to collision and displacement), migratory waterbirds, and seabird features of UK SPAs outside of the breeding season.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Finally, we would welcome further discussion on some of the parameters informing the sustainability of predicted impacts. Specifically, the input parameters for Potential Biological Removal models are a potential source of disagreement, and continued dialogue on this issue would be welcome.	The Applicant agrees that continued dialogue will be helpful on this issue.
	Cumulative effects assessment (CEA): with regards to all receptors. High level comments were not provided on CEA as it is receptor-dependent. However, we believe that consideration of other projects older than five years as baseline might not be an exhaustive approach to CEA as it is phase-dependent i.e. an operational wind farm might not have cumulative effects for marine mammals but it can have on birds or coastal processes. More discussion is required on why impacts assessed as less than moderate (adverse) significance have been scoped out for some receptors, as this may not take account of synergistic effects with other projects.	The Applicant notes that the HRA Report includes an in-combination assessment (section 8). The approach to CEA for the environmental assessment is documented in the ES chapter 33 "Cumulative and In-combination effects".
	Saltmarsh: The cable route option through the saltmarsh remains a key issue. The saltmarsh is a feature of Morecambe Bay SAC and Lune Deep SSSI, and supports the last viable population in England of the Belted Beauty moth (Lycia zonaria), a BAP priority species. A more thorough assessment on the potential impacts - and means of mitigation and restoration - from open-cut trenching is required. Additionally, the assessment of impacts and effects on the moth population is confused and does not appear to account for the scarcity and sensitivity of the species. Of the potential mitigations, horizontal directional drilling (HDD) may be suitable but it has not been confirmed as to whether the conditions at the site are conducive to HDD. Additionally, as mentioned in Appendix A, the route option through the caravan park (option 3) has been discounted without clear explanation – given that this route would avoid all the issues described above, we reiterate that this option should not be discounted at this stage. We look forward to addressing this issue in due course.	The Applicant confirms that the saltmarsh and sea wall will be crossed using horizontal directional drilling (HDD) and not open-cut trenching. The use of this technology is a condition of the Deemed Marine Licence.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Cable exposure and protection: the deferment of the assessment of the level of scour and cable protection to a scour protection design plan post-grant of the DCO is of concern. We believe it is important to assess the potential impacts of cable/scour protection, particularly in the intertidal and nearshore areas, at the application stage. Given the precedent for cable protection for other developments in the area, we believe the assessment of potential impacts on features is essential at an early stage.	The Applicant notes that this issue (cable / scour protection) is assessed in the environmental assessment (ES Chapters 4 (Project Description) and 7 (Metocean, Coastal Processes, Geology, and Geomorphology)). The potential for cables close to shore to become exposed has been raised in consultation by Natural England and JNCC. This is discussed further in Chapter 7: Metocean and Coastal Processes. Based on the results of a preliminary burial risk assessment and existing burial data from export cables located in the Irish Sea, cable protection for the preferred cable route close to the shore is unlikely to be necessary and therefore rock protection in these locations will not be needed. In the unlikely event of prolonged cable exposure any exposed cable would most likely be re-buried using the jetting techniques described in ES Chapter 7.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Cumulative impact (effect) assessment in each ES ecology chapter needs to be both EIA and HRA compliant as the results seem to be used to inform both assessments. For the HRA, the application will need to consider all projects which are currently impacting the features of a designated site (even if they alone are not having an adverse impact) which when considered in-combination with the effects of this project may have an adverse impact on the integrity or condition of any designated site or feature. The Cumulative Impact Assessment (CIA) methodology currently screens out any operation or project which has been taking place prior to the project•s baseline surveys/assessments being undertaken as they have been incorporated into the environmental baseline. However, a good CIA would be able to acknowledge the impact operational projects are having on any trends associated with the baseline. Additionally, the HRA should consider any residual effect induced by a project already operational within the in-combination assessment.	The HRA Report considers an in-combination assessment with constructed offshore windfarm sites for migratory Whooper Swan and Pink-footed Goose, breeding seabirds (with respect to collision and displacement), migratory waterbirds, and seabird features of UK SPAs outside of the breeding season. The Applicant disagrees with this statement. Monitoring programmes associated with such projects (which in respect of offshore wind farms have been agreed with Natural England / JNCC) are not capable of delivering this type of information. In the context of natural change the statistical power of data arising from operational projects is poor. In this context it is unlikely to be possible to discern any residual effect. Further discussion on the challenges of EIA practice will take place with Natural England and JNCC (see "Ongoing consultation" in Document 5.0: Consultation Report).
	Further clarification is needed to verify that these projects are not impacting any designated features and do not need to be incorporated into an in-combination assessment. This is especially important as the results of CIA in each ES ecology chapter (specifically the Ornithology) are used to populate the assessment matrices in the nature conservation report which informs the HRA.	In-combination assessment is provided in HRA Report Chapter 8.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	(ES Chapter 13 Offshore Ornithology - Table 13.2, P16): regardless of the view of CCW, Natural England's current view is that SPA assemblage features are treated as qualifying features, and should be viewed as such in this assessment. Therefore, Table 13.5 should be revised, and any new species falling within foraging range should be highlighted in Table 13.6. These assemblage features should be assessed in the same way as listed SPA features within both the final ES and HRA. [Note: this is Natural England's view and is not necessarily shared by JNCC].	This advice is noted and Table 13.5 in the ES Chapter 13 has been revised. Cormorant are identified as assemblage species and are included in the assessment for potential LSE (HRA Report, Table 5.4). Black-headed gull are noted as a feature of Morecambe Bay Ramsar and are included in Table 5.4
	The assessment of "potential" LSE and LSE is only carried out for the project alone. This should be clearly done alone or in combination with other plans and projects. The assessment of LSE should also be carried out in view of the sites conservation objectives. None of the sites conservation objectives are used whether at the potential LSE or LSE stage.	The HRA Report recognises the requirement in the Habitats Regulations to consider whether the Project is likely to have a significant effect on a European site either alone or in combination with other plans or projects. The assessment of sites where there is a potential for LSE is an initial screening exercise only, sites are screened out in this initial stage because there is no mechanism for an effect and consequently no requirement for an in-combination assessment.
	Section 5.7.1 Table 5.4 – whilst we are satisfied that the potential for LSE on features of Liverpool Bay SPA (RTDs and common scoters) is negligible in relation to displacement from the project site itself given the large distance between the OWF and the northern edge of the SPA, the table also makes reference to the cable route passing through the northern extent of the SPA. It will be necessary to provide more detail on this (for instance a map showing the degree of overlap) and to explain in full the method of assessment when judging the LSE test. Please note that the cable corridor also passes through the Lune Deep SAC.	A map is provided in the HRA Report (Chart 2.3) showing the cable corridor route through the Liverpool Bay SPA. The Report includes an assessment of the likely significant effect of this installation activity on red throated divers and common scoter (section 7.5). The Applicant confirms that the cable corridor no longer passes through the Shell Flat and Lune Deep SAC.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Section 5.7.1 Table 5.4 - Gannet – the HRA should not be restricted to those SPAs likely to be affected in the breeding season. Peak densities were recorded in October, which suggests that birds on passage were likely to occur. Collision risk models should thus include an element of flux to allow for movements over an appropriate time period. Impacts to SPAs to the north of the project site, such as St Kilda, should thus be assessed. See Natural England / JNCC advice on HRA in the non-breeding season.	The Applicant has reviewed the Interim Guidance made available in February 2013. The HRA Report now includes (at HRA Report Annex 3) an assessment of the impact on SPAs for breeding seabird where these may be present on the Project site outside of the breeding season. Annex 3 indicates that even when peak aerial survey (or boat survey) populations are incorporated into the analysis there is no potential for a LSE for Gannets in the non-breeding season. Therefore, SPAs - like St Kilda - outside of the foraging range are not screened in to the assessment.
	Table 5.4 - Great Skua – as above for Gannets.	See comment above.
	Table 5.4 - Kittiwake – as above for Gannets.	See comment above.
	Table 5.4 - Guillemot, Razorbill, Puffin – see NE / JNCC advice on HRA in the non-breeding season. Displacement effects of birds likely to be associated with SPAs in the breeding season should be assessed using appropriate methods to estimate what proportion of the impact could fall on SPA birds.	See comment above.
	Section 6.2 - NE has provided previous commentary to Walney Extension owf on collision risk modelling (CRM) for geese and swans in February 2013. This focused on a further understanding of the worst case scenario, and cumulative effects. We hope this will be investigated for the final ES and HRA.	Natural England's letter of 6/2/13 sought clarification on: Justification for choice of CRM (Band 2007); Starting population figures; Definition of migratory front for cumulative assessment; Interactive effects of CRM parameters; and Cumulative assessment of PFG, including within UK movements. These points have been considered and are included in the CRM report (HRA Report, Annex 1).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Section 6.3 The assessment of effects of operational turbines on migratory waterbird features associated with coastal SPAs is currently incomplete, in that no cumulative effects are examined. This will likely be relevant to all SPAs listed in Table 6.8, with the possible exception of the Duddon Estuary SPA which lies north of the majority of Irish Sea OWFs. However, we advise the assessment considers movement of SPA features across all Irish Sea OWFs likely to be encountered in combination with Walney Extension.	The proposed Walney Extension owf is the largest within the cluster of 6 windfarms off the Isle of Walney. The results from the Migratory Assessment Tool (HRA Report section 6.3 and Table 6.10) show negligible numbers of migratory waterbirds collisions. As such the Applicant feel that a cumulative assessment of this feature is not necessary.
	Section 6.3 Additionally, we raised the issue of examining the need for assessment of migratory Pintail associated with Martin Mere SPA (November 2012). This does not appear to have been done.	This is now included within the HRA Report (section 6.3 and Table 6.8).
	Section 7.3.6 We have drawn attention elsewhere to large and unexplained differences between boat and aerial survey estimates of gull abundance. This HRA is based on assessment of aerial survey density, but there remains uncertainty about methodological difference and so we reserve judgement on the conclusion of no adverse impact, at this stage.	The Applicant has previously identified that at the proposed Walney Extension owf site its assessment will be based on the use of aerial survey data and that boat based survey data will be used as supporting information. Boat based surveys at Walney Extension are timed to co-incide with key periods of bird activity during the summer/post-breeding season (eg Manx Shearwater and Lesser Black-backed Gull) and winter (eg Common Scoter, Red-throated Diver, Auks).
	Section 7.3.7 The mitigation to avoid overwintering bird populations seems appropriate. However, the effectiveness of this is not explored in terms of bird numbers and recovery of sediment and therefore bird prey items in the autumn period. It is likely there will be a net loss of prey items from the cable corridor for t least each winter after a cable installation. This feature (intertidal mud and sand flat) is effectively screened out of the SAC assessment and therefore there is an illogical dichotomy in approach. Please see our comments on SAC assessment below.	Noted (no intertidal working during the period October to March). The impact on prey species from construction disturbance of intertidal mudflats / sandflats as a result of cable installation is now subject to further consideration in section 7.4.5 of the HRA Report.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Section 7.5.4. Although the conclusion of no adverse impact may stand, the current assessment does not recognise that disturbance is likely to result beyond the cable corridor, as divers and scoters are known to be highly sensitive to activity. An appropriate buffer should be drawn around the 800 m cable corridor, as effects may extend out by 1 or even 2 km (Kaiser et al. 2006; Schwemmer et al. 2011).	Advice noted. The Applicant notes that the cable corridor itself includes a buffer element (being some 800 m wide whilst the cable trenching operation is 40 m wide per cable installation). The HRA Report concludes that the installation activity will not result in a significant effect on the qualifying features of the Liverpool Bay SPA due to the nature and short duration of the activity (approximately 4 days cable laying activity within the SPA per cable system). (See section 7.5.16).
	Section 7.6.5 The project has only apportioned two Lesser black backed gulls to the Ribble and Alt Estuary SPA. This is clearly a very low number but we would just draw you attention to the ongoing case on the Ribble involving BAE Warton. The Secretary of State is currently considering representations from the parties before making a final decision on whether or not to allow an application from BAE Systems to cull 1,500 pairs of Lesser Black-backed Gull on the Ribble and Alt Estuaries SPA, for air safety reasons. The decision before the Secretary of State follows from Natural England's refusal to consent to the proposal and BAE Systems' appeal against that decision. The decision will be made following a public Inquiry held in autumn 2011, the Inspector's report following that Inquiry and the further representations made by the parties at the request of the Secretary of State. We will of course update you on this process insofar as it is relevant to this case.	The Applicant has recently become aware of the SoS decision with respect to the proposed gull cull in the Ribble and Alt Estuaries SPA (letter 29 May 2013). The Applicant will continue to discuss with the SNCB the need to undertake further work to incorporate the implications of this decision into the PBR analysis for gull species at this site.
	Section 8.4 As has been discussed with WEOW, cumulative impact assessment for pink-footed geese needs to recognise the highly mobile nature of the species, the likely association with multiple SPAs within the non-breeding season, and the interaction with other offshore, and onshore, wind farms when moving between wintering sites.	The HRA Report (section 5.9.4) contains an assessment of the impact of multiple wind farm sites in the eastern Irish Sea on the migratory movement of pink-footed geese and (in section 8.5) the winter movement of geese between England and Ireland. We are aware that pink-footed geese also move across England between west and east coast wintering sites. A qualitative assessment of the potential impact of onshore wind farms on this movement is included at section 8.5.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	HRA Report Annex 2 The assessment for Herring Gull is currently incomplete, as only one of the other Irish Sea OWFs is included in cumulative assessment. This risks underestimating the impacts to breeding Herring Gulls as features of the Morecambe Bay SPA. Although it is stated that ESs of the other relevant OWFs did not record birds at rotor height, recent work (i.e. SOSS) has made generic predictions for such figures. Thus we would advise using these, in conjunction with density information from either pre- or post-construction monitoring, to complete the assessment.	The assessment of potential impact on the population of breeding Herring Gull at Morecambe Bay SPA / Ramsar identifies that a total of 29 birds are at collision risk from the project alone. Together with the predicted collision mortality from the Burbo Bank Extension offshore wind farm this represents 0.79% of the SPA population for this site. Whereas we can use generic flight height data from the SOSS model the population and density information is not available from other recent owf projects to allow an estimate of Herring Gull collision risk at these sites. Similarly the relevant data from the proposed Rhiannon owf site is not currently available.
	Non-English SPAs This represents a joint response from Natural Resource Wales (NRW), Northern Ireland Environment Agency (NIEA) and JNCC on non-English SPA-related HRA issues within the HRA report. In addition, SNH have advised that whilst there are some differences in methodological approach to assessing impacts, the overarching conclusions in respect of Scottish SPA sites are agreed.	Noted (response from SNH).
	Passage turnover. Table 5.4 concludes no LSE for Great Skuas due to its presence in low densities (a peak of 20 birds, recorded in just two surveys). However, as Great Skuas are known to be passage migrants, it is difficult to assess the likely magnitude of effect from snap-shot temporal counts and abundance estimates. Rather than correcting for passage turnover within the abundance estimates for these types of passage species (this also applies to tern species) it is perhaps easier to undertake a CRM analysis, to confirm that there is indeed no LSE from collisions for this species.	A flux model has now been used for Great Skua and the HRA Report has been updated (HRA Report, Annex 1).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Apportioning collision and displacement impacts during the non-breeding season to SPA populations The HRA should not be restricted to those SPAs likely to be affected in the breeding season. Consequently, Section 6.4 needs to address the extent of displacement and collisions occurring in the non-breeding season, which may be attributable back to various SPA populations. See Natural England/JNCC advice on HRA in the non-breeding season.	The Applicant has reviewed the Interim Guidance made available in February 2013. The HRA Report has followed this guidance to produce (at HRA Report Annex 3) an assessment of the impact on UK breeding seabird SPAs where these birds may be present on the Project site outside of the breeding season.
	Ailsa Craig SPA – Gannets Table 6.12 states "*At a 98% avoidance rate 25 Gannet collisions per annum were predicted (see HRA Report, Annex 1). This equates to 0.05 % of the SPA population (54260 individuals SMP 2004), and a 0.57 % increase in background mortality)*". JNCC is content that, on the basis of a figure of up to 25 collisions per annum from Ailsa Craig SPA due to Walney Extension OWF alone, this level of additional mortality will not pose a significant risk of an adverse impact on this feature. However, we note that this figure will need to be revisited in light of some of the methodological issues raised elsewhere in the response.	The Applicant is unclear as to the methodological issue being referred to here. If the comment refers to Gannet flight height then in using option 3 in the CRM it circumvents using a flight height, rather, it uses a flight height distribution model (Band (2012)).
	It is not clear to what extent the total predicted mortalities from collision have been estimated to occur during the non-breeding season, which may need to be apportioned out to a range of further afield SPAs than those identified as being within foraging range in the breeding season (see Natural England/JNCC advice on HRA in the non-breeding season).	The HRA Report now includes (at HRA Report Annex 3) an assessment of the impact on UK breeding seabird SPAs - including those where Gannet are qualifying features - where these birds are present on the Project site outside of the breeding season.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Aberdaron Coast and Bardsey Island SPA – Manx Shearwater In terms of mortality from collisions, Table 6.1 states: "*At a 98% avoidance rate no Manx Shearwater collisions were predicted*". This needs to be confirmed using mean peak abundance estimates (averaged inter-annually) from boat-based surveys – the higher of the two counts by an order of magnitude (11,591 MSW in May compared to just 1,417 from aerial). We suggest the mean peak abundance be consistently calculated from the peak estimates of either survey methodology (in the absence of a more appropriate means of integrating the two datasets). This has been done for the Atlantic Array HRA assessment and would therefore give consistency and allow for comparison in terms of cumulative effects. Any mortalities resulting from this re-analysis would then need to be correctly apportioned to Aberdaron Coast and Bardsey Island SPA and other Welsh and NI SPAs within the mean maximum foraging range.	The Applicant understands that the quoted value of 11,591 birds is not a count but an extrapolation from the boat based observations. The approach (two years of bird data collected in tandem by aerial and boat survey) to the collection of bird survey data is different at Atlantic Array and was agreed at the scoping stage of that project. That approach was not requested by the SNCBs for the Walney Extension project.
	In terms of displacement effects, paragraph 7.8.4 states: "*all monitoring work that has investigated construction period effects including at Walney I and II (NIRAS, 2012) and at Robin Rigg (eon / Natural Power, 2012) have not recorded any significant changes in numbers or distribution of this species*". This does not seem to be correct. At Robin Rigg on the west coast of Scotland pre-construction counts recorded 1,566 individuals (0.26 individuals per unit sample effort). During construction 1,672 individuals were recorded (0.13 individuals per unit sampling effort), while during the first year of operation only 160 individuals were recorded (only 0.05 per unit sample effort) (Eon / Natural Power, 2012). This equates to c. 80% reduction from pre-construction to operation counts. The work that has been done at Walney I and II cannot provide the necessary comparison between pre-construction and operational phases, only pre-construction and during construction.	The Applicant understand that conclusions can not yet be drawn from the early post construction monitoring results - very recently (May 2013) supplied to the MMO - for Walney I and II and that these data will be subject to review by the SNCBs. The analysis at Walney I and II (NIRAS, 2012a) concludes that little displacement occurred during the construction phase although the analysis did not include post-construction data. Manx Shearwaters were less abundant at Robin Rigg although there was some evidence of a decline in numbers during the operation phase (eon/npower, 2012).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Given the availability of data for Robin Rigg, we suggest that a more precautionary estimate for MSW percentage displacement would be 80%, and that the displacement matrices for MSW should be revised to reflect this. However, we agree that MSW, as wide-ranging foragers particularly in the non-breeding and migratory periods, are unlikely to be subject to levels as high as 60% mortality as a result of displacement. To see how this displacement may have an effect on each population a PBR should be completed for each SPA.	The Project considers it inappropriate to use a Manx Shearwater displacement value of 80% as derived from current analysis of Robin Rigg data. The incursion of Manx Shearwater into the Solway Firth whilst on passage can be expected to be variable between years, with neither the available data or distributional patterns observed at Robin Rigg supportive of the use of such a high displacement value. In conclusion, for a species with flexibility in habitat use, a displacement value of 30% is considered appropriate for Manx Shearwater until data analyses following further post-construction surveys at Robin Rigg or elsewhere suggests otherwise.
	Finally, the revision of assessment of LSE from collision and displacement of MSW from Aberdaron Coast and Bardsey Island SPA needs to be looked at in combination with impacts on all other relevant SPA populations.	See comments above concerning displacement values.
	Skokholm and Skomer SPA – Manx Shearwater. Given the larger MSW population present at Skokholm and Skomer SPA, we recognise that no LSE is predicted even at 100% displacement and 100% mortality. However, as with Aberdaron Coast and Bardsey Island SPA, these figures need to be revisited in light of the boat-based survey data and high numbers of MSW recorded. Consequently, until such time as these figures indicate no LSE, our response for this SPA remains the same as for Aberdaron Coast and Bardsey Island SPA.	See comments above concerning displacement values.
	Copeland Islands SPA – Manx Shearwater. Response on LSE from collisions and displacement as for Aberdaron Coast and Bardsey Island SPA.	See comments above concerning displacement values.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Within-winter movements of Whooper Swan between England and Ireland. We acknowledge that all available evidence indicates that movements of Whooper Swan (WS) between England and Ireland (and vice versa) are relatively rare but note that tracking studies and field observations have concentrated on the main Spring and Autumn migration periods, whereas the majority of trans-Irish Sea movements may occur during Winter in response to extreme cold weather in Great Britain. We recognise that the occurrence of hard weather episodes is inherently unpredictable and that little data exist on the scale of any WS movements initiated as a result, but we believe that the possibility of additional collision risk arising from this source should be addressed in the HRA report.	The HRA Report includes an assessment of collision risk from within-winter movements (see section 6.2).
	There appears to be some inconsistency in the Northern Ireland Whooper Swan SPAs identified as being potentially affected by the project. The initial screening summary (Table 5.5) lists Lough Neagh/Beg, Upper Lough Erne and Lough Foyle, whereas Section 6.1 refers only to Lough Neagh/Beg. We cannot find any reference to the latter two sites being subsequently screened out.	This omission from the text at HRA section 6.1 has now been corrected.
	Finally, we suggest that if an LSE is predicted for Lough Foyle then the analysis should also include the neighbouring Lough Swilly SPA in the Republic of Ireland.	The HRA Report now includes an assessment of this site (section 5.9.7 and 6.2).
	Assessment of in-combination effects. All conclusions regarding no LSE from in-combination effects will need to be revisited in light of revised abundance estimates for the Project Area plus buffer, as well as the revised displacement matrices. These revisions may change conclusions regarding no LSE both for the project alone and in-combination.	The Applicant believes that the abundance estimates used in the assessment are valid and based on a survey approach agreed with the SNCBs.
	Table 8.13 presents in-combination displacement impacts for MSW for a cumulative SPA population. In-combination effects need to examine combined impacts on qualifying features of specific SPA populations. In other words, the total LSE from each OWF within the area under consideration needs to be considered in-combination at each individual SPA. It should not involve an assessment of displacement impacts from all OWFs on a cumulative SPA population.	The Applicant agrees that the numbers used have not been apportioned to individual SPAs. Data from the other offshore wind farm sites is not appropriate to permit this analysis at this stage.
	Figure 3.1 seems to have a mistake at the IROPI stage (the "No" adverse impact to priority species/habitat stage leads, after an interim stage, to "Authorization must not be granted"). Was this lifted directly from PINS Advice Note 10?	The Figure is copied directly from the Planning Inspectorate Advice Note 10.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	Table 6.1 (pg. 102) As highlighted previously, due to the high numbers of MSW present in the site plus buffer, we do not feel it is appropriate to confirm the absence of LSE from collisions on MSW populations associated with the three SPAs mentioned in Table 6.1 (i.e. Aberdaron Coast and Bardsey Island SPA, Skokholm and Skomer SPA, and Copeland Islands SPA). This can be ascertained relatively quickly through CRM at the reported PCH (0.55%).	The Applicant believes that the abudance estimates used in the assessment are valid and based on a survey approach agreed with the SNCBs.
	Tables 6.5 and 6.7 shows 0.3% of the Martin Mere and Ribble and Alt Estuaries SPAs WS population subject to collision mortality. However, Table 6.5 presents a figure of 0.18% for what seems to be the whole year, although this is not explicit. This inconsistency should be clarified.	The values in Tables 6.5 and 6.7 have now been updated. Table 6.5 relates to migratory movement (spring and autumn) of Whooper Swan, Table 6.7 is the cumulative value of migratory and within-winter movements.
	Tables 4 and 5 have no values in bold as indicated. In addition, it is necessary to display abundance estimates taken forward for use in CRM modelling, as opposed to just density estimates. This latter point applies to all species presented in the CRM section, not just Gannets.	The emboldened values in Annex 1 Tables 4 and 5 have been re-instated. Band (2012) incorporates monthly density values into the model rather than abundance estimates – Tables 4 and 5 are designed to purely show the parameters used in the modelling process.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	SAC features. The effects of some features in some sites are too readily screened out. In particular at the potential LSE phase the Reefs feature of Morecambe Bay is screened out based on distance from the feature (Table 5.2). However, chart 5.5 [now Chart 5.4] clearly shows the cable corridor intersecting a large area of potential reef. Given our comments on the ES in relation to Annex 1 habitat surveys, and ongoing concerns about cumulative impacts form cable installation and cable scour we cannot agree with the conclusion of no LSE.	The Applicant has surveyed within the cable corridor to assess the potential for submarine Annex I habitats features (cobble reef). We identified the presence of potential Annex I stony reef habitat within and around the proposed export cable route options during our original benthic characterisation surveys in 2011-12. From a wider literature review, both Natural England and JNCC also confirm there are areas of potential Annex I stony reef habitat within the inshore area of Walney Extension Offshore Wind Farm. We analysed the geophysical survey data for the revised cable route in March 2013 and identified areas to survey using an underwater camera to look for the presence of stony reef habitat. This re-survey has recently (end May 2013) been completed and one small area of cobble reef has been identified. This will be avoided by micrositting the cable(s) around it. Details of the survey results are given in ES Technical Annex B.4.K.
	Also impacts to Shell Flat and Lune Deep SAC are screened out at the LSE stage. As the cable corridor crosses the boundary of the Lune Deep part of the SAC we would require more evidence to be presented in Table 6.4 in order to support the conclusion of no LSE. This is especially true in light of uncertainty about location of reef, operational impacts form potential cable protection and lack of an in-combination assessment.	The export cable corridor has now been revised to no longer cross the Shell Flat and Lune Deep SAC. (See Chart 2.3)

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	No LSE is concluded for impacts to mud and sand flats of Morecambe Bay SAC. However we would require further evidence to be certain of this. Currently we would anticipate that the best way to treat this feature would be to take it to the appropriate assessment stage. Here more information can be provided recovery and prediction of recovery rates as alluded to in Table 6.3. The project may find a recent report published by Natural England useful here (http://publications.naturalengland.org.uk/publication/5091106). Also, in Table 6.4 the uncertainty of any scour protection would suggest an LSE on the mud and sand flats is at least possible. Also for coastal process – the assessment in the table states that it is dependent on amount and type of scour which is not given. For that reason an LSE cannot be ruled out.	The proposed method for installing the export power cable across the intertidal zone has now been changed from open-cut trenching to HDD under the saltmarsh and annual vegetation habitats on Middleton Sands. HDD will require exit pits to be excavated within the mudflat / sandflat habitat of Middleton Sands and consequently there is now a LSE on this habitat feature. This is assessed in the HRA Report in section 7.4.5.
	It is concluded that there will be an LSE but no adverse effect on site integrity for the saltmarsh features of Morecambe Bay SAC. This is primarily due to the size of area affected (1.05ha). However, the rationale behind this is not clear. If the 1.05ha is impacted to the point where the entire area is lost, why would this not be adverse? Would the total area be significantly reduced if, for example, only two cables were installed, thus limiting impact? As there is no clear mitigation and restoration plan proposed – and trenching is the only installation method discussed – we would recommend reassessment of the conclusion of no adverse effect as there is currently insufficient evidence for us to agree with the conclusion. Additionally, there is no mention of the alternative option of the cable route going through the caravan park. This would avoid any impact on the salt marsh, and should therefore be thoroughly pursued before being dismissed.	The Project has now identified that the export cable landfall route (landfall option 2a) will now cross the saltmarsh and sea defence using HDD (horizontal directional drilling) thereby avoiding the need to trench through the saltmarsh. The HRA Report now assesses no LSE on the saltmarsh and annual vegetation features of the Morecambe Bay SAC/ Ramsar.
Marine Management Organisation (MMO) 24 May 2013	Thank you for the draft Habitats Regulations Assessment Report received by the Marine Management Organisation (MMO) on 12 April 2013. The MMO have reviewed this report along with our scientific adviser the Centre for Fisheries and Aquaculture Science (Cefas). The content of the report is largely outside the MMO's remit and we generally defer to the relevant Statutory Nature Conservation Body. However, upon review of the relevant sections of the report, I can confirm that we have no comments to submit.	Noted.
RSPB	Has not offered comments at this stage.	Noted.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
Planning Performance Agrement (PPA) Authorities 17th May 2013	Cumbria County Council as lead PPA authority consulted the relevant local authorities about this report and has not received any comments. I have reminded Lancashire County Council that the deadline has passed and I will let you know next week if I have any further information to pass on. I think it is likely that the PPA authorities will be relying upon Natural England to make a judgement on this matter as the competent authority.	Noted.
	Having read the conclusions myself, I would make the following minor observations: 1. on Page 227, I suggest the the word "know" should be "known". 2. on P. 227, I suggest the last line of para.3 should probably read, "...and its features' conservation objectives." 3. in the first row of Table 11.2 (p.227 - 228) the layout could be improved to make it clearer which birds are affected by the operation phase.	The HRA Report has been amended to reflect these comments.
	Provided Natural England shares your conclusion that the project will have no adverse effect on these European and International wildlife sites, the PPA authorities will be unlikely to raise any concerns.	Noted.
Isle of Man Government 16th May 2013	Does not wish to comment on this document.	Noted.
Manx Wildlife Trust 16th May 2013	No comments to make at this stage.	Noted.
Whale and Dolphin Conservation 16th May 2013	Do not wish to comment at this stage.	Noted.
Manx National Heritage 16th May 2013	Do not wish to comment at this stage.	Noted.
Environment Agency 17th May 2013	We confirm we have received a copy of the Habitats Regulations Assessment for the proposals but do not intend to make specific comment on the document. We may have an input into the Natural England response if there are any issues where they wish to seek our advice.	Noted.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
Planning Inspectorate 31st May 2013	Please note that the comments provided are without prejudice to any decisions taken by Inspectors during acceptance or the Examining Authority during examination stages. The comments are not intended to be a detailed review of the report and its findings but are more a high level review intended to provide helpful comments/ observations as necessary.	Noted.
	The Inspectorate is pleased to see the use of a 'realistic' worst case for the assessment as given the uncertainty around some of the design options this represents the most practical approach to the assessment. However, at this stage the details of the realistic worst case have not been provided and so it's not possible to know what assumptions have been made. The Inspectorate expects that information will be provided as the agreement reached with the SNCBs and others that the realistic worst case has been agreed.	The Design Envelope approach used in the assessment (ES and HRA) allows for flexibility in project design (within the envelope boundary). The Applicant understands that the assessment must be made on the worst case basis within the Envelope - these worst case scenarios are listed in the Environmental Statement as "maximum adverse scenarios". The maximum adverse scenarios for each receptor have been consulted on as part of consultation in respect of the PEI and the draft ES chapters. The Applicant confirms that the relevant worst case parameters are identified in the HRA Report.
	The Inspectorate considers that it would be useful to have a plan to delineate the various study areas for the HRA including the tidal excursion zone study area for Annex 1 habitats.	The study area extents are presented in table format in Section 3. There are not fixed study area boundaries for each receptor class, breeding bird colonies, for example, will have a species specific study area based on the mean maximum foraging range, whilst the same species outside of the breeding season will have a study area set by the biologically defined minimum population scale (see analysis at HRA Report, Annex 3). Where appropriate these ranges are presented on Charts within the report. Where plans are used to illustrate study areas these have now been more clearly referenced in Table 3.1

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Inspectorate considers that the justifications provided to explain the choice of study area at Table 4.1 [definition of study area used in the HRA] could be more clearly detailed. For example the study area for fish is determined to be rectangle 37E6 and those adjacent (regional study area) but it is not clear why this is appropriate based on predicted impact zones. A justification should be provided.	The study area for migratory fish has been expanded to include SAC rivers to the south (River Dee and Bala Lake, and Afon Gwyrfai a Llyn Cwellyn). This is represented in Chart 4.3. The study area for each receptor contains the maximum potential geographical extent of the relevant likely impact associated with the Project. Thus for fish the potential impact with the greatest geographical extent is considered to be underwater noise from piling activity. The study area for migratory fish includes this extent and, for completeness, includes SAC sites (where migratory fish are qualifying features) beyond this boundary. In the absence of any information linking, say, Atlantic salmon present within the Project study area and specific SAC rivers the study area boundary limits are in this case likely to be arbritary. For other receptors, such as colonial breeding seabirds, where some tracking data exist and mean maximum foraging ranges have been established study area boundaries can be more confidently established.
	The HRA report acknowledges that there has been some "manipulation" of baseline conditions to take into account the effect of construction works at Walney 1 & 2. It refers to further information within the Technical chapters. The Inspectorate emphasises the importance of providing a clear description of the approach that has been taken in this regard and explain any assumptions that have been made.	This has now been included at section 4.8.35 of the HRA Report and in Technical Annex B.7.A of the Environmental Statement. The approach identifies the potential for construction activity to have affected the abundance and/ or distribution of birds during individual baseline surveys. It then seeks to provide a baseline that is independent of these potential effects.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Inspectorate notes that the boat based [bird] surveys are for one annual cycle whereas the aerial surveys cover two annual cycles, there is no explanation as to why two annual cycles have not been provided for the boat based surveys; or to the implications of using one annual cycle for the boat based surveys.	The Applicant has previously identified that at the proposed Walney Extension owf site its assessment will be based on the use of aerial survey data and that boat based survey data will be used as supporting information particularly with respect to data that aerial survey cannot provide (e.g. behavioural data). Boat based surveys at Walney Extension are timed to coincide with key periods of bird activity during the summer/post-breeding season (eg Manx Shearwater and Lesser Black-backed Gull) and winter (eg common scoter, red-throated diver, auks). The Applicant understands that this was discussed with Holly Niner (JNCC) on 22/08/11 and that the response received was: "provided DONG are aware of and have assessed the potential risks (eg including sensitive species w.r.t HRA) involved in not collecting [boat based] data for these periods [Spring and Autumn months] then we are happy with the outlined approach to survey".
	The Inspectorate highlights the reference made to the monitoring report following the construction of the Walney 1 & 2 project. The draft HRA report states that at present no data is available covering the operational period for Walney 1 & 2. It would be interesting to know if this information is likely to be available during examination or prior to recommendation/ decision stages.	Further summary detail is now provided in HRA Report section 4.9.6 and full detail is provided in ES Chapter 13 Technical Annex B.7.A.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The report states in several areas that the detail of mitigation will be agreed with the project engineer. The Inspectorate highlights that the mitigation measures should be agreed (where possible) before submission with SNCB's and other relevant bodies and secured by way of requirements within the DCO or conditions to the draft deemed marine license if applicable.	Mitigation relevant to the Habitats Regulations Assessment is detailed in the HRA Report, Chapter 9. Where this mitigation is relied upon in the assessment the mitigation measures are a condition of the relevant licence forming part of the application – for example the Marine Licence for works below MHWS and the DCO for works above MLWS (with an overlap in the inter-tidal zone).
	The Inspectorate has noticed that some of the plans referred to in the report are provided with poor resolution which makes it difficult to view all of the features required. For example Chart 4-6 is at particular low resolution. Plans should be clear and easy to read.	All Charts are now found in HRA Report Chapter 14 and have been produced to be displayed as A3 sized images for greater clarity.
	Chart 4.3 details the locations of SACs within the regional study area in which diadromous fish species are qualifying features. The Inspectorate understands that this chart will be amended to show all of the SAC sites identified in Table 4.2 but also at present there is no clear explanation within the report detailing why the chosen study area is appropriate - this should be provided.	The study area for each receptor contains the maximum potential geographical extent of the relevant likely impact associated with the Project. Thus for fish the potential impact with the greatest geographical extent is considered to be underwater noise from piling activity. The study area for migratory fish includes this extent and, for completeness, includes SAC sites (where migratory fish are qualifying features) beyond this boundary. In the absence of any information linking, say, Atlantic salmon present within the Project Site and specific SAC rivers the study area boundary limits are in this case likely to be arbitrary although the extent of the direct effect (eg. piling noise) can be predicted.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Inspectorate notes that the report assesses the effects of the cable installation as a temporary effect limited to the construction phase. However, if the area of land proposed for the cable installation is required to be permanently managed it should be clarified whether or not this would amount to a permanent loss of affected habitat.	The Applicant understands that there are no marine areas where the cable installation requires the cable trench to be permanently managed. In some areas - such as cable crossing points - there will be a requirement for rock or mattress placement to secure the cable. The cable corridor has been surveyed to confirm that sub-marine Annex I habitats will not be affected. In the intertidal zone the Project will use horizontal directional drilling (HDD) to install cables below the saltmarsh and sea wall with no loss of saltmarsh habitat. The cables will be trenched through the mudflat / sandflat habitat at Middleton Sands, this temporary disturbance is not assessed as a permanent loss of habitat.
	It is stated within the report that the working area on mudflats will be 500m and in significant less in saltmarsh areas but there is no explanation as to why there is such a large difference in the area required or why a smaller working corridor is not acceptable for mudflats. The Inspectorate considers that an explanation to this should be provided and be likely to form part of the 'realistic' worst case.	The Applicant is no longer proposing to open-cut through the saltmarsh but will use HDD instead. Consequently the working area (beneath the saltmarsh) will not be restricted to a 30 m width. A large working area is required on the beach to provide flexibility in choosing the final cable route and to provide space for the installation vessel and its anchors that will be placed on the beach during the cable pull-in operation.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The screening stage of the assessment has not separately assessed the Ramsar sites and the features as stand alone designations. This separate assessment is expected by the Inspectorate as it will clearly demonstrate that all relevant designations have been fully addressed. The Inspectorate notes however that relevant Ramsar sites have been separately assessed in the later stage assessment and this is welcomed.	The HRA Report does identify the location of all Ramsar sites where there is a potential for a LSE (see Chart 5.2). The Report does not separately assess LSE on Ramsar sites (in Chapter 6) because The Applicant understands that the relevant interest features are covered by the co-located SAC and SPA designations. As you indicate the further assessment (Chapter 7) does identify Ramsar features for those sites where further assessment is appropriate. The Planning Inspectorate matrices (HRA Report, Annex 4) includes an assessment of Ramsar designations for both stages (Stage 1 and Stage 2).
	The report refers to Interim Advice issued by JNCC/ NE 2013 but does not include this as a reference within the main report. The Inspectorate considers that if this document is not readily available but has been relied upon for the assessment then it should be included within an Appendix to this report or the ES.	This Interim Advice (assessment of breeding SPA birds outside of the breeding season) is now available and has been referenced. The HRA Report includes (Section 6.4) a summary assessment based on this advice and a full report (HRA Report, Annex 3).

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The applicant has consistently referred to the methodology used to predict the significance of collision risk associated with the proposed development. The assessment has made use of the Band (2012) model and this is an approach endorsed by the Natural England/ JNCC. However the methodology applied in relation to the assessment of Whooper Swan is the older Band (2007) model as the newer methodology is deemed not appropriate. The Inspectorate notes that at present there is no proper explanation to support this statement. An explanation should be provided together with a note that the approach is accepted by the SNCBs.	The Band (2012) model is the preferred model for collision risk assessment where bird density information is available. This model is applied to all species recorded at potential collision height in the baseline surveys of the Project. This is not the case for Whooper Swan and Pink-footed Goose which were unrecorded in the baseline surveys. With agreement from Natural England a theoretical modelling exercise was implemented for these species. As site specific density information is relied upon in Band (2012) it was considered that Band (2007) allows a more appropriate estimation of collision risk. This model was designed to assess recorded flight activity of species and therefore transfers well to the theoretical migration process.
	The Inspectorate notes the approach taken to in-combination assessment within the report (paragraph 8.1) and the deviation away from the approach proposed in the Inspectorate's own advice notes. The applicant should be aware that the advice notes are prepared to inform developers about good practice and process matters in relation to the Planning Act (as amended) regime. However, despite the statement at paragraph 8.1 the assessment does appear have considered proposed development on the Inspectorates programme of projects most importantly the proposed development in the Celtic Array area (Rhiannon).	This text has now been updated to align with the advice note.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Inspectorate agrees with Natural England/JNCC that the in-combination assessment should include all relevant projects onshore and offshore where zones of impact are likely to overlap or interact. This should include projects other than windfarm development.	The assessment for impacts on migratory pink-footed goose and whooper swan for potential collsion and barrier effects has been updated to include other offshore wind farms considered to be in the species' flyway. The Applicant considers that the other offshore wind farm developments in the study area are by far the greatest contributor to potential in-combination effects for migratory species through potential displacement, barrier, or collision impacts and therefore the in-combination assessment justifiably focuses on these effects. No current data is available (from JNCC / NE or within the public domain) to make a robust assessment of the in-combination collision risk (for pink-footed goose within-winter movements) with onshore sites. However, the HRA Report discusses the evidence for the limited potential for such onshore sites to contribute to an in-combination effect (see Section 7.11).
	The Inspectorate highlights the comments made by CCW (now Natural Resources Wales (NRW)) with regards to sites and features in Wales currently not part of the assessment. The applicant is encouraged to consider carefully and respond to the request being made by the NRW as at present the report does not provide detailed reasons why an assessment of the sites and features identified is not necessary.	The sites and features identified by NRW are now included in the HRA Report, (See section 5.7.2), and where subsequently scoped out of the assessment a justification has been provided.

Table 10.4: Summary of responses received to the draft HRA report

Consultee	Response	Applicant Response
	The Inspectorate welcomes the approach at the conclusion of the report to have a statement of issues agreed and not agreed with the SNCB's this is a very useful approach in advance of the examination. The Inspectorate would like to emphasise the importance of the applicant agreeing as many issues as is possible prior to submission of the application.	The Applicant has sought to agree as much as possible with the SNCBs ahead of submission. We note that Natural England has identified that it expects that issues will be carried forward for discussion beyond submission and has agreed that it wishes to progress with these outstanding issues in this way.
	The Inspectorate is pleased to see evidence throughout the report of the applicant responding to requests made during consultation and to statements affirming the applicants commitment to respond to the points raised. It will be important for the final report to set out clearly where information prepared in response to consultation comments can be located.	Noted. The approach taken in this Table is to identify the chapter or section number where information has been updated to address consultation responses.
At the time of writing (and following a further request on the 16th May) no response has been received from the following organisations: Lancashire Wildlife Trust Development Applications Unit (DAU), Department of Arts, Heritage & the Gaeltacht, Republic of Ireland Icelandic Government (in response to issues raised in the draft ES Ornithology chapter).		

10.2.6 Following a review of the consultation responses to the draft HRA Report, the Applicant understands that the following issues relevant to the Habitats Regulations Assessment are agreed between the Applicant and the statutory bodies:

- Natural England – agree that there are no SACs designated for diadromous fish features in proximity to the Site and so these features can be screened out from further assessment;
- Natural England – satisfied that both Shell Flat and Lune Deep SAC and Drigg Coast SAC can be screened out as beyond the footprint of any sediment transport regime changes;
- Natural England – Disturbance to wintering birds in the intertidal zone at Middleton Sands provided that disturbance is avoided between October and March;
- Natural England - no impacts on marine mammals within SACs in English territorial waters;
- Natural Resources Wales (CCW) – marine mammals can be screened out as far as Welsh Sites are concerned but a marine mammal mitigation protocol will need to be in place to prevent injury to individual mamals; and
- Scottish Natural Heritage – SNH has advised that whilst there are some differences in methodological approach to assessing impacts, the overarching conclusions in respect of Scottish SPA sites are agreed.

10.2.7 The Applicant believes that the assessment provided in this HRA Report now allows a conclusion of "no significant effect" for the following issues referred to by consultees:

- Natural Resources Wales (CCW) – impacts on the Dyfi Estuary with respect to Greenland white-fronted goose; impacts on the Grassholm SPA with respect to Gannets; impacts on Ynys Feurig, Cemlyn Bay and The Skerries SPA with respect to Sandwich tern;
- Natural Resources Wales (CCW) - impacts on the Dee Estuary SPA with respect to tern species;
- Natural Resources Wales (CCW) - impacts on the River Dee and Bala Lake SAC with respect to Atlantic salmon;
- Northern Ireland Environment Agency – consideration of within-winter movements of Whooper Swan between England and Ireland;
- Natural England / JNCC – assessment of SPA seabird features present at the Project Site during the non-breedng season;
- Natural England – impacts to the saltmarsh habitat at Middleton Sands assuming that the export power cables are installed under the saltmarsh using HDD;
- Natural England – red-throated diver and common scoter displacement in Liverpool Bay SPA as a result of cable installation;
- Natural England / JNCC – assessment of impact on migratory pintail associated with Martin Mere SPA;
- Natural England / JNCC – cumulative impact assessment for Pink-footed Goose cross-country winter movements;
- JNCC / Natural Resources Wales / Northern Ireland Environment Agency - assessment of collision risk to great skua;
- Natural England / JNCC – the impact on Annex I habitat features (cobble reef) from cable installation in Morecambe Bay SAC; and
- Natural England / JNCC – impact on Annex I habitat features (cobble reef) in Shell Flat and Lune Deep SAC from cable installation

10.2.8 The Applicant believes that the assessment provided in this HRA Report allows a conclusion on "no adverse effect" for the following issues referred to by consultees:

- Natural England / JNCC - cumulative (collision risk) assessment for gulls, swans, geese, and migratory waterbirds; and
- Natural England / JNCC - impact on mudflat / sandflat of Morecambe Bay SAC.

10.2.9 The Applicant and the consultation bodies acknowledge that the following issues require further discussion to reach agreement:

- Natural Resources Wales - the potential displacement of Manx Shearwater from the Project Site and the interpretation of, and emphasis placed on, the bird monitoring data from the operational Robin Rigg offshore wind farm site;
- Natural England / JNCC - the interpretation and use of operational bird monitoring data from the Walney I and II offshore wind farm sites;
- Natural England / JNCC / Natural Resources Wales - the interpretation of differences between boat-based and aerial survey population estimates and the use of these abundance estimates in (re-)assessing displacement risk for Manx Shearwater;
- Natural England / JNCC - the range of input parameters for potential biological removal (PBR) models;
- Natural England - the approach to the assessment of impacts on breeding Lesser Black-backed Gull at the Ribble and Alt Estuaries SPA and Ramsar in light of the SoS decision to authorise a cull at this site; and
- Natural Resources Wales / JNCC - in-combination assessment for each Manx Shearwater SPA site.

11.0 Summary and conclusions

11.1 This Report has considered the impact of the Walney Extension Offshore Wind Farm ("the Project") on European Sites in the study area and provides information for a Habitats Regulations Assessment (HRA) to be undertaken by the Secretary of State as Competent Authority. It should be read in conjunction with the Environmental Statement (ES) for the application for development consent for the Project which reports the findings of the environmental impact assessment process. This HRA Report has been developed using the survey data and impact assessments documented in the ES together with supporting technical reports, reference to an extensive range of literature and mediated by the use of professional judgement.

11.2 The HRA Report documents a three phase process; screening, testing for likely significant effect (LSE), and - where required - further assessment. Within this process, mitigation measures are identified where appropriate. The potential for significant effects has been assessed for the Project alone as well as in-combination with other plans or projects.

11.3 The European sites screened into the Habitats Regulations Assessment for the Project, following an initial screening for likely significant effect, are shown in Table 11.1.

Table 11.1: Sites screened into HRA

Site	Feature
Morecambe Bay SAC	Mudflats and sandflats Salicornia and other annuals colonising mud and sand Atlantic salt meadow
Shell Flat and Lune Deep SAC	Sandbanks which are slightly covered by sea water all the time Reefs
Morecambe Bay SPA and Ramsar	Wintering birds in the intertidal: Shelduck, oystercatcher, golden plover, grey plover, ringed plover, curlew, bar-tailed godwit, redshank, knot, dunlin, sanderling, turnstone, cormorant, Lesser Black-backed Gull, and black-headed gull. Lesser Black-backed Gull (breeding) Herring Gull (breeding) Pink-footed Goose (wintering)
Liverpool Bay SPA	Red-throated diver (wintering) Common scoter (wintering)
Bowland Fells SPA	Lesser Black-backed Gull (breeding)
Ribble and Alt Estuaries SPA and Ramsar	Lesser Black-backed Gull (breeding) Whooper Swan (wintering), Pink-footed Goose (wintering)
Skokholm and Skomer SPA	Manx Shearwater (breeding)

Table 11.1: Sites screened into HRA

Site	Feature
Aberdaron Coast and Bardsey Island SPA	Manx Shearwater (breeding)
Copeland Islands SPA	Manx Shearwater (breeding)
Ailsa Craig SPA	Gannet (breeding)
Martin Mere SPA and Ramsar	Whooper Swan (wintering), Pink-footed Goose (wintering)
Lough Neagh and Lough Beg SPA and Ramsar	Whooper Swan (wintering)
Upper Lough Erne SPA and Ramsar	Whooper Swan (wintering)
Lough Foyle SPA and Ramsar	Whooper Swan (wintering)
Lough Swilly SPA	Whooper Swan (wintering)

11.4 On the basis of the known presence and distribution of designated interest features relevant to the assessment and the likely effects of the development (as set out in the ES) a likely significant effect test was undertaken to determine the potential for the Project activities to influence the designated features of the relevant European Sites listed in Table 11.1.

11.5 The result of the likely significant effect test identified those interest features where there was a potential for likely significant effect to occur as a result of the proposed Project. Features for which it can be concluded there will be no likely significant effect are screened out from further assessment. Mitigation proposed as part of the Project - such as a "soft start" procedure to lessen initial piling noise and the use of a Marine Mammal Mitigation Plan to reduce construction impacts on marine mammals - is taken into account to reach a conclusion of no significant effect for some sites and features.

11.6 Where it was concluded there was potential for likely significant effect, relevant information from the technical studies and ES has been compiled in order to enable a further assessment of the impacts of the Project on the integrity of the European Site, either alone or in-combination with other plans of projects, with regard to the site's function and it's features' conservation objectives.

11.7 The Project has the potential to have a significant effect on the sites and features listed in Table 11.22

Table 11.2: European Sites and features for which the project may have a LSE

Site	Feature	Project phase	Effect
Morecambe Bay SAC	Mudflats and sandflats not covered by seawater at low tide	Construction	Habitat loss and disturbance as a result of export cable installation
Morecambe Bay SPA and Ramsar	Bar-tailed godwit; golden plover; curlew; dunlin; grey plover; knot; oystercatcher;; pintail; redshank; shelduck; turnstone; Ringed plover; sanderling Lesser Black-backed Gull Herring Gull	Construction Operation	Disturbance and displacement of wintering birds resulting in loss of foraging/roosting areas due to intertidal installation and burial of the export cables Mortality as a result of turbine collision
Liverpool Bay SPA	Red-throated diver Common scoter	Construction	Displacement as a result of cable laying
Bowland Fells SPA	Lesser Black-backed Gull	Operation	Mortality as a result of turbine collision
Ribble and Alt Estuaries SPA	Lesser Black-backed Gull	Operation	Mortality as a result of turbine collision
Skokholm and Skomer SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence
Aberdaron Coast and Bardsey Island SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence
Copeland Islands SPA	Manx Shearwater (breeding)	Construction Operation	Displacement as a result of construction activity Displacement as a result of turbine presence

11.8 Further assessment of potential effects from the Project alone on the integrity of the sites listed in Table 11.2 is detailed in Section 7. For each site and feature it was concluded there would not be an adverse effect on the integrity of any Natura 2000 sites and features as a result of the Project.

11.9 Further assessment of potential effects from the Project in-combination with other plans and projects is detailed in Section 8. It was concluded there was no potential for an adverse effect as a result of the Project acting in-combination with other plans and projects on European Sites and features.

11.10 The development of the Project has been an iterative process based on a selection of designs that have taken account of the views and comments received from the significant consultation undertaken during the development of the Project. This has resulted in some changes to the design of the Project and the adoption of a range of specific measures to mitigate for identified impacts on environmental interests. As a result, alternative design options and ways of working have been tested and assessed on an ongoing basis throughout the Project development, these are detailed in Chapter 5 of the Environmental Statement,"Site Selection and Alternatives".

11.11 The project activities and development as assessed in the ES and this HRA Report therefore represent the culmination of a process of the examination of options and alternatives to avoid and reduce the potential for adverse environmental impacts where feasible. The conclusions reached in this report regarding the potential effects of the Project reflect this process.

11.12 As this assessment reaches a positive conclusion, that the Project, either alone or in-combination with other plans and projects, will not have an adverse effect upon the integrity of the designated features of the European and international sites of nature conservation importance under consideration, there is no requirement to consider further conditions or restrictions or examine alternative solutions and imperative reasons of overriding public importance.

GLOSSARY

Term	Description
Appropriate Assessment	A key requirement of the Habitats Regulations *under the European Habitats Directive) for the 'competent authority' to determine if a plan or project is likely to have an adverse effect on the integrity of any Natura 2000 sire (including Ramsar, SPA and SAC).
Cumulative Effects	The combined impact of a number of different projects within the vicinity (in-combination with the environmental impact assessment project) on a single receptor/ resource.
Gravity base foundation	A foundation structure resting on the seabed, relying on its large mass to stay in place.
Hydrodynamic	Pertaining to the movement of tides, currents, waves etc.
Jacket foundation	A foundation structure formed of a lattice work of several vertical elements inter-linked with lateral elements to make the structure stronger and more rigid.
Mitigation	Actions that may include process or design to avoid/reduce/remedy or compensate for adverse impacts of a development. Avoids or reduces a significant effect.
Monopile foundation	A wind turbine foundation that is a single vertical column inserted deep into the sea bed.
Nacelle	A nacelle is a housing accommodating all of the generating components in a wind turbine, including the generator, any gearbox, drive equipment and brake assembly.
Piling	Activity.process to drive a foundation structure deep into the seabed by pushing, hammering or vibrating the pile.
Precautionary principle	Where precise information to quantify the risk of an adverse effect is insufficient, decisions are based on the precautionary basis that action to avoid or reduce the effect should be taken even though the impact may not occur.
Spoil	Material gained from drilling into the seabed.
Transboundary effects	Effects that could occur in another nation/state.

UNITS

Unit	Description
dB	Decibels (sound volume)
GW	Gigawatt (power)
kJ	Kilojoule (energy)
km	Kilometre (distance)

Unit	Description
kV	Kilovolt (electrical potential)
kW	Kilowatt (power)
MW	Megawatt (power)
nm	Nautical miles (distance)

ACRONYMS

Unit	Description
AA	Appropriate Assessment
DCLG	Department of Communities and Local Government
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
ES	Environmental Statement
GBF	Gravity Base Foundation
GIS	Geographical Information System
HDD	Horizontal Directional Drilling
HLV	Heavy Lift Vessel
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICC	Inter Connection Cables
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect
MCA	Maritime and Coastguard Agency
NE	Natural England
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
PCC	Platform Connection Cables
RES	Renewable Energy Strategy

Unit	Description
TCE	The Crown Estate
TP	Transition Piece
TSHD	Trailer Suction Hopper Dredger
WTG	Wind Turbine Generator

REFERENCES

ABP Marine Environmental Research Ltd (ABPmer Ltd). (2003). Fleetwood Salt Cavern Gas Storage: Marine Ecology Work for Environmental Statement.

ABPmer (2012) Walney Extension Windfarm Coastal Processes: Baseline Characterisation and Scheme Impact Assessment. Southampton, ABP Marine Environmental Research Ltd.

Aqua-Fact International Service Ltd. (2007) Oriel Windfarm Ltd. Offshore Wind Farm Environmental Impact Statement Non-Technical Summary. Report for Oriel Windfarm Ltd.

Baines, M. and Evans, P. (2009). Atlas of the Marine Mammals of Wales. CCW Monitoring Report No. 68.

Band, W., Madders, M. & Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (eds)

Band, B. (2012). Using a collision risk model to assess bird collision risks for offshore wind farms – with extended method. Report to Strategic Ornithological Support Services, March 2012.

Banks, AN (eds) (2006) surveying for waterbirds in morecambe bay for wetland bird survey (WeBS) low tide count scheme.

British Trust for Ornithology on behalf of the WeBS Partnership.

Begg, G.S. and Reid, J.B. (1997). Spatial variation in seabird density at a shallow sea tidal mixing front in the Irish Sea. ICES Journal of Marine Science, 54: 552-565.

BERR (2007). Aerial Surveys of Waterbirds in Strategic Wind Farm Areas: 2004/05 Final Report. Department for Business Enterprise & Regulatory Reform.

BERR (2008) Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Royal Haskoning and Bomel, Technical Report for BERR. January 2008.

Birdguides, 2013. Birdguides Sightings Database.. Available at: http://www.birdguides.com/ (Accessed May 2013).

Bowind (2008) Barrow Offshore Wind Farm Post Construction Monitoring Report.

Brown, A. and Grice, P. (2005). Birds in England. T & AD Poyser, London, UK: 694pp. ISBN 07136 6530 0.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. (2001). Introduction to Distance Sampling: estimating abundance of biological populations. Oxford University Press, Oxford, UK: 432pp.

Budgey, R. (2010). Walney Offshore Windfarms Ltd. Radar Trial. FERA, October 2010.

Camacho-Ibar, V.F., Wrench, J.J. and Head, P.C. 1992. Contrasting Behaviour of Arsenic and Mercury in Liverpool Bay Sediments. Estuarine and Coastal Shelf Science. Vol 34, pp 23-36.

Camphuysen, C. J., Fox, A. D. and Leopold, M. F. (2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK: A comparison of ship and aerial sampling for marine birds, and their applicability to offshore wind farm assessments. Report commissioned by COWRIE. Available at: www.offshorewindfarms.co.uk.

Centrica Energy (2012) Irish Sea Zone: Zonal Appraisal and Planning (ZAP) Report. http://www.centrica.com/files/pdf/centrica_energy/chapter_13_zap_ornithology.pdf.

CMACS (2012a). Walney Extension Offshore Wind Farm benthic characterisation survey technical report (2011-12 survey). Report to Walney Extension Offshore UK Ltd/DONG Energy. 2012 v2.

CMACS (2012b) Walney Extension Offshore Wind Farm: Boat-based ornithological survey report 2011-12. Centre for Marine and Costal Studies Ltd.

Cole, S., Codling, I.D., Parr, W. & Zabel, T. (1999) Guidelines for managing water quality impacts within UK European marine sites. Prepared for the UK Marine SAC Project. Natura 2000

Coull, K. A., Johnstone, R. and Rogers, S.I., (1998) Fisheries Sensitivity Maps in British Waters. UKO. OA Ltd.

DONG Energy. (2006) Walney Offshore Windfarm Ornithological Impact Assessment.

DONG Energy (2010). Walney Extension Offshore Wind Farm. Environmental Impact Assessment Scoping Report. DONG Energy, September 2010.

DONG Energy (2012). Walney Extension Offshore Wind Farm. Preliminary Environmental Information. DONG Energy, August 2012.

DONG Energy (2012a). Walney Extension Offshore Wind Farm. Habitats Regulations Assessment Screening and Scoping Report. DONG Energy, October 2012.

DONG Energy (2013). Project programme West of Duddon Sands. (http://www.dongenergy.com/west_of_duddon_sands/Project_Programme/Pages/Project_Programme.aspx). Dong Energy. Accessed 24th January 2013.

DONG Energy (2013a). Burbo Bank Extension offshore wind farm. Environmental Statement. DONG Energy, March 2013.

DONG Energy (2013b). Walney Extension Offshore Wind Farm. Environmental Statement. DONG Energy, draft issued April 2013.

DTI (2006). Aerial Surveys of Waterbirds in Strategic Wind Farm Areas: 2004/05 Final Report. Department of Trade and Industry.

Ecology Consulting (2005) Ormonde Proposed Offshore Wind Farm. Ornithological Impact Assessment. Ecology Consulting, Durham.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012) Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp.

Entec (2009) Habitats Regulations Assessment of the Round 3 Plan. Report for The Crown Estate.

Entec UK, 2010. Chiplow Wind Farm Environmental Statement Volume 1 Main Text. Newcastle-upon-Tyne: Entec UK Limited.

Eon / Natural Power Consultants (2012). Robin Rigg Wind Farm, Scotland – Analysis of MEMP Ecological Data (Operational Year 1) : Technical Report.

Eon, 2012. Loch Urr Wind Farm Environmental Impact Assessment Scoping Report. [Online]. Available at: http://www.eon-uk.com/Loch_Urr_Scoping_Report_FINAL.pdf (Accessed May 2013).

Fernley, J., Lowther, S. and Whitfield, P., 2006. A Review of Goose Collisions at Operating Wind Farms and Estimation of the Goose Avoidance Rate. Banchory: Natural Research Ltd.

Fox, A.D., Ebbinge, B.S., Mitchell, C., Heinicke, T., Aarvak, T., Colhoun, K., Clausen, P., Dereliev, S., Faragó, S., Koffijberg, K., Kruckenberg, H., Loonen, M.J.J.E., Madsen, J., Mooij, J., Musil, P., Nilsson, L. Pihl, S. and Van der Jeugd, H., 2010. Current estimates of goose population sizes in western Europe, a gap analysis and an assessment of trends, Ornis Svecica, 20, pp. 115-127.

Fox, A.D., Mitchell, C., Stewart, A., Fletcher, J.D., Turner, J.V.N., Boyd, H., Shimmings, P., Salmon, D.G., Haines, W.G. and Tomlinson, C., 1994. Winter movements and site-fidelity of Pink-footed Geese Anser brachyrhynchus ringed in Britain, with particular emphasis on those marked in Lancashire. Bird Study, 41 (3), pp. 221-234.

Furness, R.W. & Wade, H. (2012). Vulnerability of Scottish seabirds to offshore wind turbines. Report to Marine Scotland,: 39 pp

Goss-Custard, J.D. (2007). National Cycle Network – Exe Estuary Proposal. Assessment of the anticipated effects on the Exe Estuary Special Protection Area. A report to Devon County Council.

Gray, P., 2013. TOP FIVE: Best wildfowling spots in the UK. Shooting Gazette, [Online]. Available at: http://www.shootinggazette.co.uk/shootfeatures/536865/TOP_FIVE_Best_wildfowling_spots_in_the_UK.html (Accessed May 2013).

Griffin, L., Rees, E. & Hughes, B. (2011). Migration routes of Whooper Swans and geese in relation to wind farm footprints – final report. WWT Final Report to COWRIE Ltd. WWT, Slimbridge

Guilford, T.C, Meade, J., Freeman, R., Biro, D., Evans, T., Bonadonna, F., Boyle, D., Roberts, S. and Perrins, C.M. (2008). GPS tracking of the foraging movements of Manx Shearwaters Puffinus Puffinus breeding on Skomer Island, Wales. Ibis, 150: 462-473

Hammond, P., Northridge, S., Thompson, D., Gordon, J., Hall, A., Aarts, G. and Matthiopoulos, J. (2005) Background information on marine mammals for Strategic Environmental Assessment 6, May 2005

Hammond, P.S., Berggren, P., Benke, H., Borchers, D.L., Collet, A., Heide-Joergensen, M.P., Heimlich, S., Hiby, A.R., Leopold, M.F., Oeien, N. (2002). Abundance of harbour porpoise and other cetaceans in the North Sea and adjacent waters. J Appl Ecol 39: 361-376.

Hanley, L.J., Gell, F.G., Kennington, K., Stone, E., Rowan, E., McEvoy, P., Brew, M., Milne, K., Charter, L., Gallagher, M., Hemsley, K., eds. (2012). Manx Marine Environmental Assessment. Isle of Man Marine Plan. Isle of Man Government.

Holt, C.A., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R., Stroud, D.A., Wotton, S.R.,

Musgrove, A.J. (2012). Waterbirds in the UK 2010/11: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford.

Icelandic Goose Censuses 1980 – 2011. All reports available at: http://monitoring.wwt.org.uk/reports.php#reports1 (Accessed May 2013).

IECS. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. University of Hull report to Humber INCA.

JNCC. (2006). Morecambe Bay Natura 2000 Standard Data Form. (Version 1.1, 05/05/06). Joint Nature Conservation Committee, Peterborough.

JNCC. (2008). Morecambe Bay. Information Sheet on Ramsar Wetlands. (Version 3.0, 13/06/2008). Joint Nature Conservation Committee, Peterborough.

Joint Nature Conservation Committee (2009a). Factsheet A6.16 Whooper Swan Cygnus cygnus. Available at: http://jncc.defra.gov.uk/page-1419.

Joint Nature Conservation Committee (2009b). Factsheet A6.18 Pink-footed Goose Anser brachyrhynchus. Available at: http://jncc.defra.gov.uk/page-1419.

Kahlert, J., Desholm, M., Clausager, I. and Petersen, I.K. (2000) Environmental Impact Assessment of an Offshore Wind Park at Rødsand. Technical report on birds. NERI Report. Rønde, Denmark: National Environmental Research Institute.

Kiely, O., Lidgard, D., McKibben, M., Connolly, N. and Baines, M. (2000). Grey Seals: Status and Monitoring in the Irish and Celtic Seas. Maritime Ireland / Wales INTERREG 1994-1999. June 2000

Langston, W.J., Chesman, B.S., Burt, G.R., Hawkins, S.J., Readman, J. & Worsfold, P. (2003) Site characterisation of the South West European Marine Sites; Plymouth Sound and Estuaries cSAC, SPA. Report for Environment Agency and English Nature. 216pp.

Laubek, B., Knudren, H.L. & Ohtonen, A. 1998. Migration and winter range of Whooper Swans Cygnus cygnus breeding in different regions of Finland, In Laubeck, B. The Northwest European Whooper Swan (Cygnus cygnus) population: ecological and management aspects of an expanding waterfowl population. Unpubl. PhD thesis, University of Aarhus, Denmark.

LUC, 2012. River Valley Wind Farm Environmental Statement. Bristol: LUC.

Maclean, I.M.D., Wright, L.J., Showler, D.A. & Rehfisch, M.M. (2009). A Review of Assessment Methodologies for Offshore Windfarms. COWRIE METH-08-08.

Marsh, P. (2012). Walney Offshore Extension (WOE) Intertidal Bird Survey Report for November 2011 to March 2012 and September/October 2012. Unpublished report for DONG Energy.

Mitchell, P. I., Newton, S., Ratcliffe, N. and Dunn, T. E. (2004). Seabird populations of Britain and Ireland (Results of the Seabird 2000 Census 1998-2000). T&AD Poyser, London, UK: 511pp.

Mitchell, C. (2010) Status and distribution of Icelandic-breeding geese: results of the 2009 international census. WWT, Slimbridge

Mitchell, C. and Hearn, R., 2004. Pink-footed Goose (Anser brachyrhynchus) (Greenland/Iceland population) in Britain 1960/61 – 1999/2000.

Musgrove, A.J., Austin, G.E., Hearn, R.D., Holt, C.A., Stroud, D.A. & Wotton, S.R. (2011).

Overwinter population estimates of British waterbirds. British Birds 104: 364-397

National Parks and Wildlife Service (2011) Lough Swilly Conservation Objectives – supporting documents

Natural England (2012). The Lune Estuary SSSSI Citation. (http://www.sssi.naturalengland.org.uk/Special/sssi/sssi_details.cfm?sssi_id=1001709). Natural England. Accessed 11th October 2012.

NIRAS (2011) Strategies for survey and assessment of birds and marine mammals at Walney Extension: Note for Dong Energy

NIRAS (2012a) Walney Construction Boat-based Bird Monitoring Report. Walney Offshore Windfarm. NIRAS, Aarhus, Denmark.

NIRAS (2012b). Manx Shearwater – report to inform cumulative impact assessment of wind farm development in the Irish Sea and Bristol Channel. NIRAS Consulting Ltd, Cambridge

Npower Renewables Ltd. (2005) Gwynt y Môr Offshore Wind Farm Environmental Statement.

Npower Renewables Ltd. (2008) FEPA Monitoring Report (2006-2007)& Five Year Monitoring Programme Summary. North Hoyle Offshore Wind Farm

Partnership for Renewables, 2012a. Louth Canal Wind Energy Development. Chapter 12 Ornithology. [Online]. Available at: http://www.pfr.co.uk/documents/Chapter%2012%20-%20Ornithology%20[ISSUE]%20220312[1].pdf (Accessed May 2013).

Partnership for Renewables, 2012b. Carron Valley Wind Farm. Environmental Statement Volume 1 – Written Statement. [Online]. Available at: http://www.pfr.co.uk/documents/1-Carron%20Valley%20-%20ES%20Volume%201%20-%20Written%20Statement.pdf (Accessed May 2013).

Perrins, CM, Wood, M.J., Garroway, CJ, Boyle, Oakes, N, Revera, R, Collins, P and Taylor, A (2012) A Whole Island census of Manx Shearwaters Puffinus Puffinus breeding on Skomer island in 2011. Seabird 25 1 -13.

Royal Haskoning and Bomel Ltd (2008) Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical report published by BERR in association with Defra, January 2008

RPS (2006) West of Duddon Sands Windfarm. Ornithological Impact Assessment. RPS,

RSKENSR Ltd (2006). West of Duddon Sands Offshore Wind Farm: Environmental Statement. Report to Morecambe Wind Ltd.

SeaScape Energy Ltd. (2002) Burbo Bank Offshore Wind Farm Environmental Statement.

SeaScape Energy (2008a), Burbo Bank Offshore Wind Farm Year 1 Post-construction Ornithology Report. Report prepared by CMACS Ltd and Avian Ecology.

SeaScape Energy (2008b), Burbo Bank Offshore Wind Farm Ornithologial Survey - Construction Period. Report prepared by Hyder Consulting (UK) Ltd on behalf of CMACS Ltd for SeaScape Energy.

SeaScape Energy (2009), Burbo Bank Offshore Wind Farm Post-construction Year 2 Environmental Monitoring Report. Report prepared by CMACS.

SNH, 2013. Avoidance rates for wintering species of geese in Scotland at onshore wind farms. [Online]. Available at: http://www.snh.gov.uk/docs/A916616.pdf (Accessed May 2013).

Special Committee On Seals (2011). Scientific

Advice on Matters Related to the Management of Seal Populations

Stone, C. J., Webb, A., Barton, C., Ratcliffe, N., Reed, T. C., Tasker, M. L., Camphuysen, C. J. and Pienkowski, M. W. (1995). An atlas of seabird distribution in north-west European waters. Joint Nature Conservation Committee, Peterborough, UK: 326pp.

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds).(2001). The UK SPA network: its scope and content. JNCC, Peterborough

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, H. W. and Burton N. H. K. (2012). Seabird Foraging Ranges as a Tool for Identifying Candidate Marine Protected Areas. Biological Conservation.

Thaxter, C.B., Sansom, A. Thewlis, R.M., Calbrade, N.A, Ross-Smith, V.H., Bailey, S., Mellan, H.J. & Austin, G.E. (2010). Wetland Bird Survey Alerts 2006/2007: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs). BTO Research Report 556. BTO, Thetford.

Thomas, L., S.T. Buckland, E.A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. R.B. Bishop, T. A. Marques, and K. P. Burnham. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology 47: 5-1

Walney Bird Observatory. (2006). Wildfowl and Seabird Migration along the Eastern Irish Sea Flyway. Annex 5.5.3 to Environmental Statement for Walney offshore Windfarms, March 2006.

Webb A., McSorley C.A., Dean B.J. and Reid J.B. (2006) Recommendations for the selection of, and boundary options for, an SPA in Liverpool Bay. JNCC Report, No. 388

Wernham, C.V., Toms M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (eds.). (2002). The Migration Atlas: movements of the birds of Britain and Ireland. T. & A.D. Poyser, London.

Wetlands International (2012). Waterbird Population Estimates . Retrieved from wpe. wetlands.org on Friday 12 Oct 2012.

Whitehouse, R.J.S. (1998) Scour at marine structures: A manual for practical applications. Thomas Telford, London

Wildfowl and Wetland Trust (WWT) (2009). Distributions of Cetaceans, Seals, Turtles, Sharks and Ocean Sunfish recorded from Aerial Surveys 2001-2008. WWT Consulting. Report to Department of Energy and Climate Change.

Worden, J., Crowe, O., Einarsson, Ó., Gardarsson, A., McElwaine, G. and Rees, E. (2009) Population size and breeding success of the Icelandic Whooper Swan Cygnus cygnus: results of the January 2005 international census. Wildfowl. 59, pp. 17-40

Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P. and Burton, N.H.K. (2012). Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species). BTO Research Report No. 592.

WWT Consulting. (2009). Aerial Surveys of Waterbirds in the UK: 2007/08 Final Report. Report to: Department of Energy and Climate Change. WWT Consulting, Glos.

12.0 CHARTS

CONTENTS

Chart 2.1 Project Site and offshore export cable corridor

Chart 2.2 Project Site and adjacent offshore wind farms

Chart 2.3 European Sites and Ramsar sites adjacent to the Project Site

Chart 2.4 Existing or planned cables and pipelines where crossings may be required

Chart 2.5 Onshore Project Site

Chart 4.1 Subtidal biotopes recorded in the survey area

Chart 4.2 Intertidal biotopes recorded during characterisation survey of the intertidal area

Chart 4.3 Location of SAC rivers within and adjacent to the regional study area in which diadromous fish are qualifying features for site selection

Chart 4.4 Distribution of marine mammal sightings during Project boat-based surveys

Chart 4.5 Export cable corridor and intertidal bird survey areas

Chart 4.6 Onshore nature conservation sites

Chart 5.1 Location of SACs in relation to the Project Site and export cable corridor

Chart 5.2 Location of SPAs and Ramsar sites in relation to the Project Site and export cable corridor

Chart 5.3 Location of the export cable corridor in relation to the Shell Flat and Lune Deep SAC and Drigg Coast SAC

Chart 5.4 Location of the export cable corridor in relation to areas of Annex I habitat cobble reef

Chart 5.5 Location of European Sites screened into the assessment

Chart 8.1 Location of offshore wind farms used for cumulative collision risk modelling

Chart 8.2 Offshore wind farms and other plans and projects located within the study area

Chart 8.3 Foraging radii for Gannet from Ailsa Craig SPA

Chart 8.4 Foraging ranges of Lesser Black-backed Gull from Ribble and Alt Estuaries SPA, Bowland Fells SPA, Morecombe Bay SPA, and Ailsa Craig SPA

Chart 8.5 Foraging range for Herring Gull from Morecambe Bay SPA

Chart 8.6 Foraging range for Manx Shearwater from Skokholm and Skomer SPA, Copeland Islands SPA, and Aberdaron Coast and Bardsey Island SPAHRA Report

Chart 8.6 Foraging range for Manx Shearwater from Skokholm and Skomer SPA, Copeland Islands SPA, and Aberdaron Coast and Bardsey Island SPA

13.0 ANNEXES

Annex 1: Collision risk modelling

Annex 2: Assigning birds to SPAs and Potential Biological Removal

Annex 3: Breeding SPA birds assessed outside of the breeding season

Annex 4: Planning Inspectorate matrices

Annex 5: HRA Screening and Scoping Report

Annex 6: Draft HRA Report (April 2013)

Annex 7: Consultation responses