Offshore Oil & Gas Licensing

Out of Round Application

St George's Channel

Block 103/01

Appropriate Assessment

URN 11D/900: November 2011

CONTENTS

1 Introduction

1.1 Background and purpose

In advance of the 27th offshore licensing Round, the Secretary of State for Energy and Climate Change (DECC), on 18th August 2010, invited Traditional Licence applications for Block 103/1 in an Out of Round offer. Applications were to be submitted by 17th November 2010; and the Block has been applied for. This Block is close to Natura 2000 sites (SPAs and SACs) on the coast and seas of the UK (Wales) and the Republic of Ireland.

To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) (OPAR 2001), the Secretary of State has undertaken an assessment to determine whether the award of the Block would be likely to have a significant effect on a relevant European conservation site, either individually or in combination with other plans or projects.

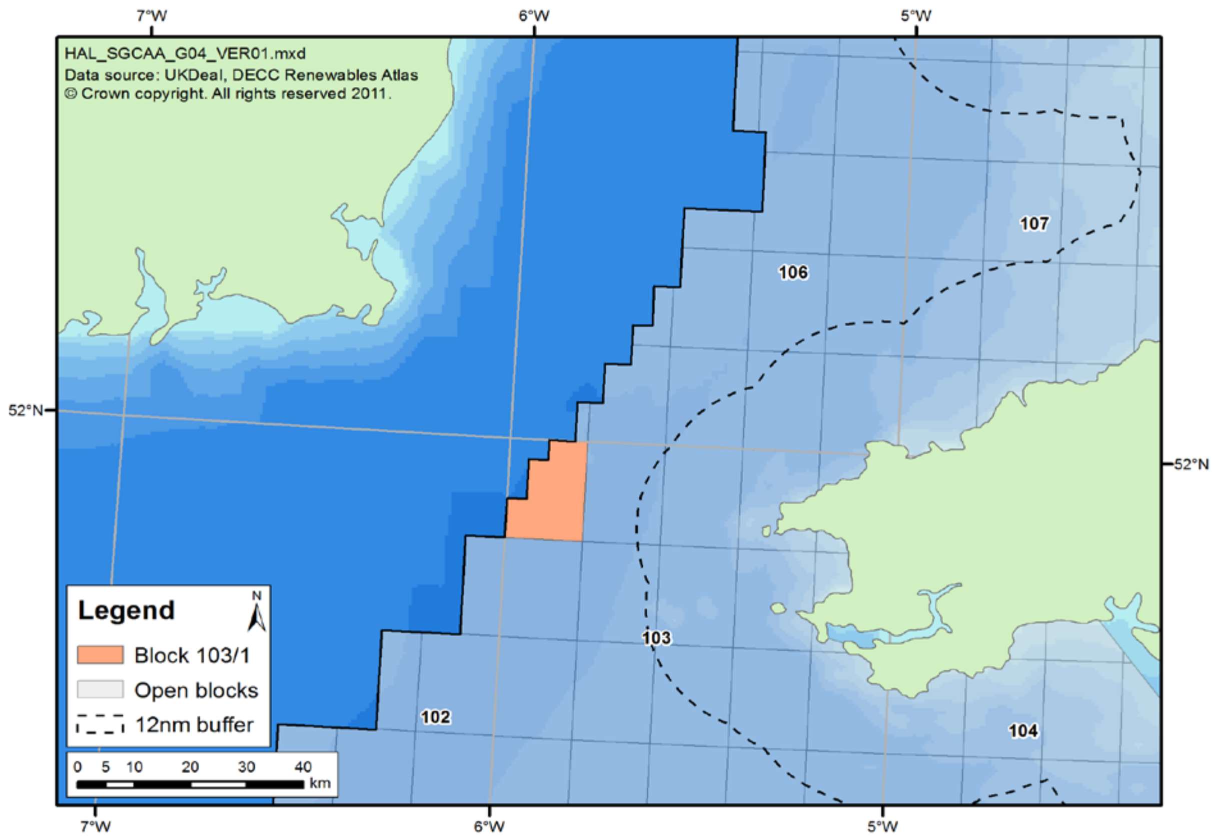
The amplification of the Habitats Directive test provided by the European Court of Justice in the Waddenzee case (Case C-127/02) was used, as follows:

> Any plan or project not directly connected with or necessary to the management of a site must be subject to an Appropriate Assessment 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.
>
> Where a plan or project not directly connected with or necessary to the management of the site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light, inter alia, of the characteristics and specific environmental conditions of the site concerned by such a plan or project.

1.2 Block Location

Block 103/1 is located in the St. George's Channel approximately 32km west of Ramsey Island, some 34km from the Pembrokeshire coast, and approximately 37km east of the Republic of Ireland (Carnsore Point), and is shown in dark orange in Figure 1.1.

Figure 1.1: Location of Block 103/1



2 Licensing and activity

2.1 Licensing

The exclusive rights to search and bore for and get petroleum in Great Britain, the territorial sea adjacent to the United Kingdom and on the UK Continental Shelf (UKCS) are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the Secretary of State the power to grant licences to explore for and exploit these resources. The main type of offshore Licence is the Seaward Production Licence. Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. A Seaward Production Licence may cover the whole or part of a specified Block or a group of Blocks. A Licence grants exclusive rights to the holders "to search and bore for, and get, petroleum" in the area covered by the Licence. A Licence does not confer any exemption from other legal/regulatory/fiscal requirements.

There are three types of Seaward Production Licences, only that relevant to the Block applied for is described below:

- Traditional Production Licences are the standard type of Seaward Production Licences and run for three successive periods or Terms. Each Licence expires automatically at the end of each Term, unless the licensee has made enough progress to earn the chance to move into the next Term. The Initial Term lasts for four years and the Licence will only continue into a Second Term of four years if the agreed Work Programme has been completed and if 50% of the acreage has been relinquished. The Licence will only continue into a Third Term of 18 years if a development plan has been approved, and all the acreage outside that development has been relinquished.

The model clauses and terms and conditions which are attached to Licences are contained in Regulations.

It is noted that the environmental management capacity and track record of applicants is considered by DECC, through written submissions and interviews, before licences are awarded.

2.2 Activity

As part of the licence application process, applicant companies provide DECC with details of work programmes they propose in the first term to further the understanding or exploration of the Blocks(s) in question. These work programmes are considered with a range of other factors in DECC's decision on whether to license a Block and to whom. There are three levels of drilling commitment:

- A **Firm Drilling Commitment** is a commitment to the Secretary of State to drill a well. Applicants are required to make firm drilling commitments on the basis that, if there were no such commitment, the Secretary of State could not be certain that potential licensees would make full use of their licences. However, the fact that a licensee has been awarded a licence on the basis of a "firm commitment" to undertake a specific activity should not be taken as meaning that the licensee will actually be able to carry out that activity. This will depend upon the outcome of all relevant environmental assessments.

- A **Contingent Drilling Commitment** is also a commitment to the Secretary of State to drill a well, but it includes specific provision for DECC to waive the commitment in light of further technical information.

- A **Drill or Drop (D/D) Drilling Commitment** is a conditional commitment with the proviso, discussed above, that the licence is relinquished if a well is not drilled.

Note that Drill-or-Drop and Contingent work programmes (subject to further studies by the licensees) will probably result in a well being drilled in less than 50% of the cases.

It is made clear in the application guidance that a Production Licence does not allow a licensee to carry out all petroleum-related activities from then on (see https://www.og.decc.gov.uk/upstream/licensing/103_1/other_reg_guidance.pdf). Field activities, such as seismic survey or drilling, are subject to further individual controls by DECC, and a licensee also remains subject to controls by other bodies such as the Health and Safety Executive. It is the licensee's responsibility to be aware of, and comply with, all regulatory controls and legal requirements.

The proposed work programmes for the first four-year period (six years in the case of Frontier licences) are detailed in the licence applications. For some activities, such as seismic survey noise and oil spills, the impacts can occur some distance from the licensed Blocks and the degree of activity is not necessarily proportional to the size or number of Blocks in an area. For the case of direct physical disturbance, the licence Block applied for is relevant, although there may still be pipelines that cross unlicensed Blocks should any significant development ensue after the initial four-year exploratory period.

The approach used here has been to take the proposed activity for the Block as being the maximum of any application, and to assume that all activity takes place as a result of the structuring of licences. The estimated work commitment for Block 103/1 derived by DECC is that of a drill or drop well. It is not anticipated that new seismic data is to be acquired, though this possibility is not ruled out for the purposes of this assessment.

Activity after the initial term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically less than half the wells drilled reveal hydrocarbons, and of that half, less than half again will yield an amount significant enough to warrant development. Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). Discoveries that are developed may require further drilling, wellhead infrastructure, pipelines and possibly production facilities such as platforms, although most recent developments are tiebacks to existing production facilities rather than stand alone developments.

The extent and timescale of development, if any, which may ultimately result from the licensing of the Block is therefore uncertain and would be subject to further project level assessment (incorporating Habitats Regulations Assessment (HRA) where appropriate) prior to any consent being issued.

DECC has issued guidance on Block specific issues and concerns and Licensees should expect these concerns to affect DECC's decision whether or not to approve particular activities. The guidance indicates Block 103/1 lies within a Ministry of Defence training range and therefore MoD consent must be sought in advance of siting of an installation.

3 Relevant Natura 2000 Sites

The Natura 2000 sites to be considered in this assessment were identified based on their location in relation to Block 103/1 (see Section 1.2 above) and in terms of the foreseeable possibility of interactions. Sites considered include designated Natura 2000 sites (also referred to as 'European Sites') and potential sites for which there is adequate information on which to base an assessment.

The sites considered are listed and mapped in Appendix A, and Appendix B presents the results of a screening exercise of these sites to identify the potential effects of activities that could follow the licensing of the Block in question. In accordance with Government policy (as set out in Planning Policy Statement 9 (ODPM 2005a[1])), the relevant sites considered include classified and potential SPAs, designated and candidate SACs and Sites of Community Importance[2] (SCIs). Guidance in relation to sites which have not yet been submitted to the European Commission is given by Circular 06/2005 (ODPM 2005b) which states that: "*Prior to its submission to the European Commission as a cSAC, a proposed SAC (pSAC) is subject to wide consultation. At that stage it is not a European site and the Habitats Regulations do not apply as a matter of law or as a matter of policy. Nevertheless, planning authorities should take note of this potential designation in their consideration of any planning applications that may affect the site.*"

The relevant sites are detailed in Appendix A and include:

Coastal and marine Natura 2000 sites along the coasts of Wales and Republic of Ireland
Riverine SACs within the area for migratory fish.

Information gathering is in progress to inform the potential designation of further Natura 2000 sites, for instance the work of Kober *et al.* (2010) and survey work being undertaken on the south coast with a view to the identification of SPAs for the Balearic Shearwater (*Puffinus mauretanicus*). Should further sites be established in the future, these would be considered as necessary in subsequent project specific assessments.

Summaries of sites, together with their features of interest, and location maps are given in Appendix A (Maps A.1 to A.3 and Tables A.1 to A.4). This information is summarised in Figures 3.1-3.2 and Table 3.1-3.2, below.

[1] Which states that "Listed Ramsar sites, also as a matter of policy, should receive the same protection as designated SPAs and SACs". UK coastal Ramsar sites are typically coincident with SACs and/or SPAs.
[2] Sites of Community Importance (SCIs) are more advanced in designation than cSACs in that they have been adopted by the European Commission but not yet formally designated by the government of the relevant country.

Figure 3.1: SPAs Relevant to this Appropriate Assessment

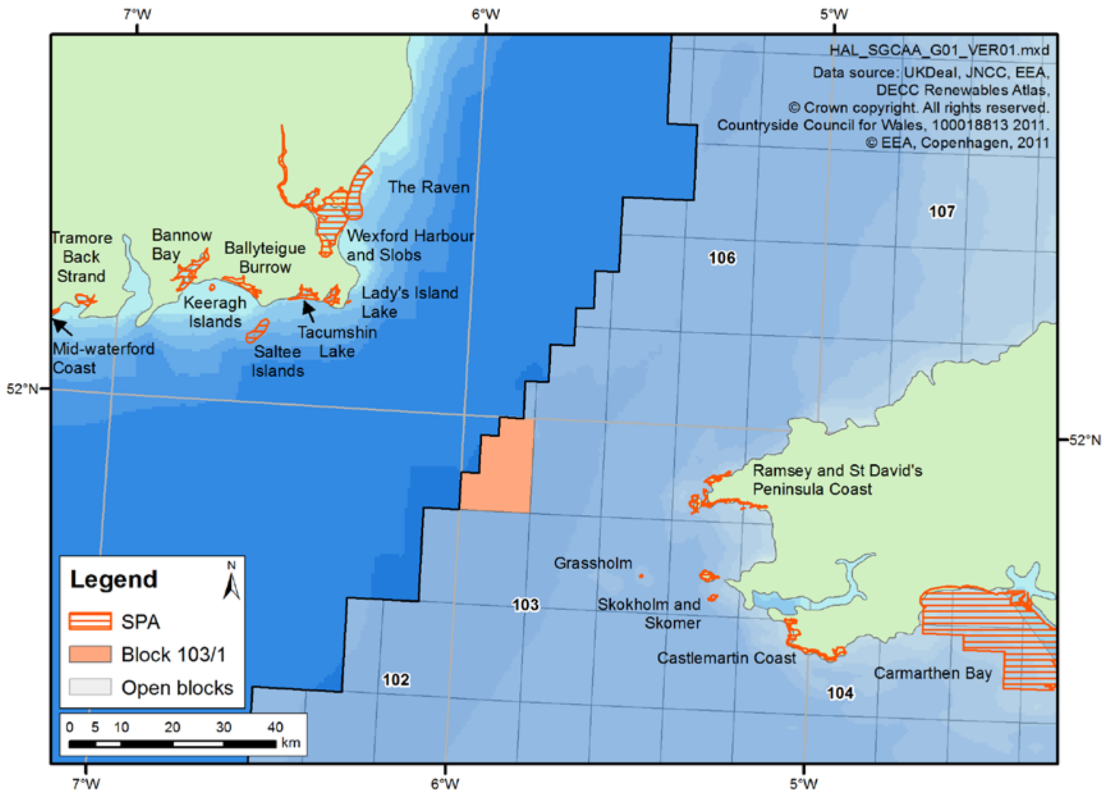


Figure 3.2: SACs Relevant to this Appropriate Assessment

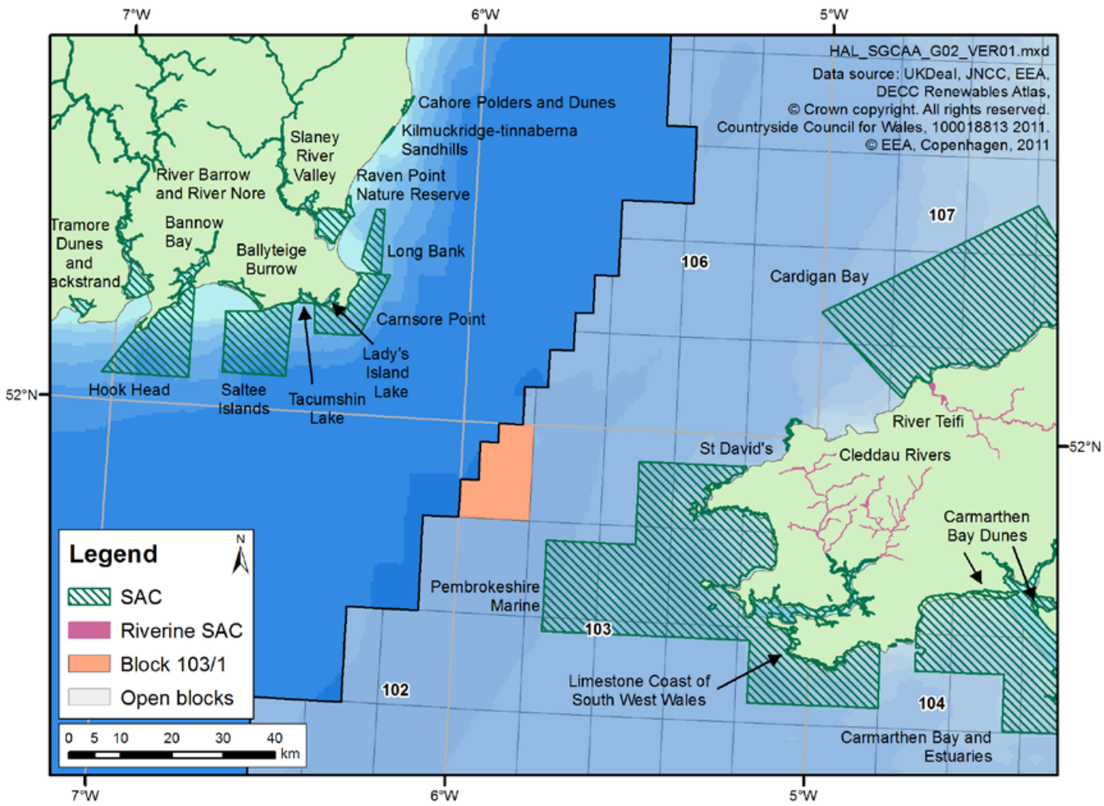


Table 3.1: SPA sites and qualifying features under Article 4.1 and 4.2, relevant to this Appropriate Assessment

	Ramsey and St David's Peninsula	Grassholm	Skokholm and Skomer	Castlemartin Coast	Bae Caerfryddin / Carmarthen Bay	Saltee islands	Lady's Island Lake	The Raven	Ballyteigue Burrow	Tramore back Strand	Bannow Bay	Wexford Harbour and Slobs	Tacumshin	Keeragh Islands	Mid-Waterford Coast
Chough	B,W		B	B,W		B,W									B,W
Gannet		B				B									
Lesser black-backed gull			B			B							W		
Black headed gull								W	W		W	W	W		
Manx shearwater			B			B									
Fulmar						B									
Storm petrel			B												
Herring gull						B									B
Kittiwake						B									
Mediterranean gull							B,W								
Common gull								W				W			
Sandwich tern							B,W								
Roseate tern							B,W								
Common tern							B,W								
Arctic tern							B,W								
Little tern								B	B						
Puffin			B			B									
Guillemot						B									
Razorbill						B									
Cormorant						B		W		W	W	W		B	B
Shag						B									

	Ramsey and St David's Peninsula	Grassholm	Skokholm and Skomer	Castlemartin Coast	Bae Caerfryddin / Carmarthen Bay	Saltee islands	Lady's Island Lake	The Raven	Ballyteigue Burrow	Tramore back Strand	Bannow Bay	Wexford Harbour and Slobs	Tacumshin	Keeragh Islands	Mid-Waterford Coast
Pintail									W		W	W	W		
Mallard								W	W		W	W	W		
Teal									W	W	W	W	W		
Wigeon								W	W	W	W	W	W		
Gadwall							W					W	W		
Shoveler												W	W		
Shelduck								W	W				W		
Pochard												W	W		
Tufted duck												W	W		
Scaup												W			
Goldeneye												W			
Common scoter								W							
Dark-bellied brent goose									W	W	W	W	W		
Greenland white-fronted goose								W				W	W		
Dunlin								W	W	W	W	W	W		
Knot								W		W	W	W			
Curlew sandpiper													W		
Little stint													W		
Coot												W	W		
Black tailed godwit									W	W	W	W	W		
Bar tailed godwit								W	W	W	W	W			
Curlew								W							
Sanderling								W				W			

	Ramsey and St David's Peninsula	Grassholm	Skokholm and Skomer	Castlemartin Coast	Bae Caerfryddin / Carmarthen Bay	Saltee islands	Lady's Island Lake	The Raven	Ballyteigue Burrow	Tramore back Strand	Bannow Bay	Wexford Harbour and Slobs	Tacumshin	Keeragh Islands	Mid-Waterford Coast
Turnstone										W	W	W			
Little egret										B		B			
Grey plover								W	W	W	W	W	W		
Golden plover							W	W	W	W	W	W	W		
Ringed plover								W	W		W	W			
Oystercatcher								W	W	W	W	W			
Greenshank										W	W	W	W		
Redshank									W	W	W	W	W		
Spotted redshank												W	W		
Green sandpiper												W	W		
Curlew								W	W	W	W	W	W		
Ruff							W					W	W		
Lapwing								W	W	W	W	W	W		
Garganey													B		
Bewick's swan												W	W		
Whooper swan							W					W	W		
Great northern diver								W							
Red throated diver								W							
Slavonian grebe								W							
Great crested grebe								W				W			
Red-breasted merganser								W	W	W	W	W			
Wood sandpiper							B					W	W		
Reed warbler													B		

	Ramsey and St David's Peninsula	Grassholm	Skokholm and Skomer	Castlemartin Coast	Bae Caerfryddin / Carmarthen Bay	Saltee islands	Lady's Island Lake	The Raven	Ballyteigue Burrow	Tramore back Strand	Bannow Bay	Wexford Harbour and Slobs	Tacumshin	Keeragh Islands	Mid-Waterford Coast
Peregrine						B									B,W
Marsh harrier							B						B		
Short-eared owl			B									W			
Assemblage			B		W	B	W					W			

Note: B = Breeding, W = Over Wintering, see Appendix C for more details.

Table 3.2: SAC sites and qualifying features under Annex 1 and Annex 2, relevant to this Appropriate Assessment

Annex I Habitats	Cardigan Bay/Bae Ceredigion	St David's/Ty Ddewi	Pembrokeshire Marine/Sir Benfro Forol	Limestone Coast of SW Wales/Arfordir Calchfaen de Orllewin Cymru	Carmarthen Bay and Estuaries/BaeCaerfyrddin ac Aberoedd	Carmarthen Bay Dunes/Twyni BaeCaerfyrddin	Tramore Dunes and Backstrand	Ballyteigue Burrow	Bannow Bay	Cahore Polders and Dunes	Lady's Island Lake	Saltee Islands	Tacumshin Lake	Raven Point nature Reserve	Hook Head	Slaney River Valley	Kilmuckridge Tinnaberna Sandhills	Long Bank	Carnsore Point
Reefs	Q		P								Q	P			P				P
Sandbanks	Q		Q		P													P	
Mudflats and sandflats			Q		P		P	Q	P			Q		Q		Q			Q
Estuaries			P		P			Q	P							P			
Sea caves	Q		Q	P								Q							
Sea cliffs		P		Q								Q			Q				
Heaths		P		Q															
Inlets and bays			P		P							Q			Q				
Coastal lagoons			Q					P			P		P						
Salt marshes and salt meadows			Q		P		P	Q	Q										
Coastal dunes				P		P	P	P	Q	P			Q	P			P		
Grassland				Q															
Caves				Q															
Vegetation of drift lines							P	Q	Q	P			Q	Q					
Vegetation of stony banks							P	Q	Q		Q		Q						
Running freshwater																Q			
Forest																Q			

Annex II Species	Cardigan Bay/Bae Ceredigion	St David's/Ty Ddewi	Pembrokeshire Marine/Sir Benfro Forol	Limestone Coast of SW Wales/Arfordir Calchfaen de Orllewin Cymru	Carmarthen Bayand Estuaries/BaeCaerfyrddin ac Aberoedd	Carmarthen Bay Dunes/Twyni BaeCaerfyrddin	Tramore Dunes and Backstrand	Ballyteigue Burrow	Bannow Bay	Cahore Polders and Dunes	Lady's Island Lake	Saltee Islands	Tacumshin Lake	Raven Point nature Reserve	Hook Head	Slaney River Valley	Kilmuckridge Tinnaberna Sandhills	Long Bank	Carnsore Point	Afon Teifi/River Teifi	Afonydd Cleddau/Cleddau Rivers	River Barrow and River Nore
Freshwater pearl mussel																Q						P
Sea lamprey	Q		Q		Q											Q				P	P	P
River lamprey	Q		Q		Q											Q				P	P	P
Allis shad			Q		Q											Q						
Twaite shad			Q		P											Q						
Atlantic salmon																Q				P		P
Otter			Q		Q											Q						
Grey seal	Q		P									Q										
Bottlenose dolphin	P																					

Note: P = Primary feature, Q = Qualifying feature, see Appendix C for more details – note that primary and qualifying (secondary) features are treated equally within this assessment. Annex 1 habitats follow nomenclature shown in Box A.2 (AppendixA2)

4 Assessment of the effects of the plan on site integrity

4.1 Process

In carrying out this AA so as to determine whether it is possible to grant licences in accordance with Regulation 5(1) of OPAR 2001 (as amended), DECC has:

- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the cumulative and in-combination effects.

- Examined, in relation to elements of the plan where it was not possible to conclude that the integrity of relevant sites would not be affected, whether appropriate mitigation measures could be designed which cancelled or minimised any potential adverse effects identified.

- Considered the comments received from statutory advisers and others on the draft AA

- Completed the AA, including DECC's conclusion on whether or not it is possible to go ahead with licensing of the Block.

In considering the above, DECC used the clarification of the tests set out in the Habitats Directive in line with the ruling of the ECJ in the *Waddenzee* case (Case C-127/02), namely that:

- Prior to the grant of any licence all activities which may be carried out following the grant of such a licence, and which by themselves or in combination with other activities can affect the site's conservation objectives, are identified in the light of the best scientific knowledge in the field.

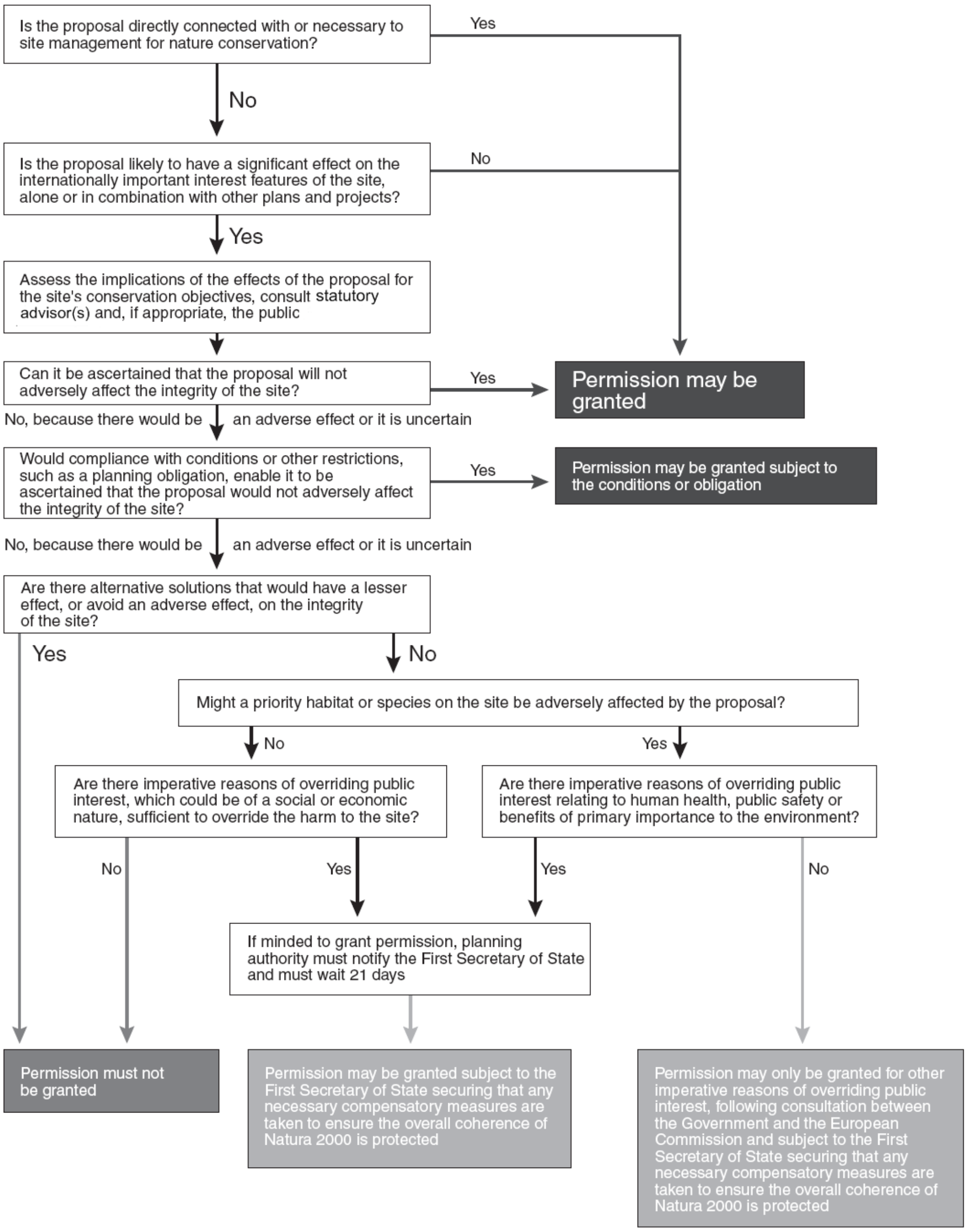
- A licence can only be granted if DECC has made certain that the activities to be carried out under such a licence will not adversely affect the integrity of that site (i.e. cause deterioration to a qualifying habitat or habitat of qualifying species, and/or undermine the conservation objectives of any given site). That is the case where no reasonable scientific doubt remains as to the absence of such effects.

A flowchart summarising the process is shown in Figure 4.1.

4.2 Site integrity

Site integrity is defined by the ODPM Circular 06/2005 to accompany PPS9 (ODPM 2005b) as follows: "The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified." As clarified by Section 4.6.3 of the EC Guidance (2000), the integrity of a site relates to the site's conservation objectives. These objectives are assigned at the time of designation to ensure that the site continues, in the long-term, to make an appropriate contribution to achieving favourable conservation status for the qualifying interest features. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected. The AA must therefore conclude whether the proposed activity adversely affects the integrity of the site, in the light of its conservation objectives. For sites where the potential for adverse affects has been identified, their conservation objectives are listed in a site-by-site consideration in Appendix C.

Figure 4.1: Summary of procedures under the Habitats Directive for consideration of plans or projects affecting Natura 2000 sites



Note: 'Statutory advisor(s)' refers to the relevant statutory Government advisor(s) on nature conservation issues. Source: After ODPM (2005b).

4.3 Assessment

The approach to ascertaining the absence or otherwise of adverse effects on the integrity of a European Site is set out in Section 4.1 above. This assessment has been undertaken in accordance with the European Commission Guidance (EC 2000), and with reference to various other guidance and reports including the Habitats Regulations guidance notes (e.g. SEERAD 2000), the Planning and Policy Statement note 9 (ODPM 2005a & b), the English Nature Research Reports, No 704 (Hoskin & Tyldesley 2006) and the Scottish Natural Heritage Habitats Regulations Appraisal of Plans, No 1739 (Tyldesley & Associates 2010).

Appendix A lists and summarises the relevant European Sites as defined in Section 3. Appendix B then presents the results of a screening exercise of these sites to identify the potential effects of activities that could follow the licensing of Block 103/1. Where potential effects are identified, more detailed information on the relevant sites is provided in Appendix C.

Detailed assessments are made in Sections 5-8 of the implications for the integrity of the relevant European Sites and their qualifying features and species, were a licence for Block 103/1 to be granted. The assessment is based on an indication of the potential work programme for the Block and likely hydrocarbon resources if present, along with the characteristics of the relevant sites as described in the Appendices. As noted in Section 2.2, the potential work programme is taken as the maximum of any application for the Block; however, on past experience, less activity actually takes place than is bid at the licence application stage. Activities which may be carried out following the grant of a licence, and which by themselves or in combination with other activities can affect the conservation objectives of relevant European Sites, are discussed under the following broad headings:

- Oil spills (including all liquid phase hydrocarbons)
- Physical disturbance and other effects (e.g. pipeline trenching, marine discharges)
- Underwater noise (in particular, seismic surveys)
- In-combination effects (e.g. cumulative and synergistic and secondary/indirect effects).

Use has been made of advice prepared by the conservation agencies under the various Habitats Regulations, since this typically includes advice on operations that may cause deterioration or disturbance to relevant features or species. Advice given under Regulation 33 (now Regulation 35 of the 2010 Regulations) includes an activities/factors matrix derived from MarLIN (www.marlin.ac.uk) where applicable. Several of the “probable” effects highlighted in the MarLIN matrices are not inevitable consequences of oil and gas exploration and production, since through the regulatory EIA and permitting processes they are mitigated by timing, siting or technology requirements (or a combination of one or more of these). There is a requirement that these options would be evaluated in the environmental assessments required as part of activity consenting. It should be noted that the award of a licence in Block 103/1 would result in activities associated with gas exploration and production only, and that spills of oil (including all liquid phase hydrocarbons) would be restricted to those used in the operation of any rig and associated support vessels. The estimated work commitment for this Block does not include acquiring new seismic data.

The conservation objectives identified for SAC and SPA features for sites where the potential for effects have been identified are listed in Appendix C and referred to where relevant throughout the document. These objectives, in relation to the specific qualifying features of each site, and the conservation status of these features, have been considered during this Appropriate Assessment. The basis and primary concern of the conservation objectives are to maintain or achieve favourable conservation status. Table 4.1 provides definition of conservation status based on Articles 1(e) and (i) of the Habitats Directive.

Table 4.1: Definition of Favourable conservation status for sites defined in the Habitats Directive

For habitats	Conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as 'favourable' when: • its natural range and areas it covers within that range are stable or increasing • 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 • the conservation status of its typical species is favourable (see below)
For species	Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The *conservation status* will be taken as 'favourable' when: • population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and • the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

A set of high level mitigation measures have been identified with regards to each of the broad sources of effect listed above (see Table 4.2). These mitigation measures, which are discussed in more detail in sections 5-8, should *inter alia* help to avoid the deterioration of any qualifying habitats, and habitats supporting species, and seek to prevent undermining any of the conservation objectives for a given site in relation to the features for which it is designated. These high-level mitigation measures can be partly interpreted as "...conditions or other restrictions such as a planning obligation, [compliance with which would] enable it to be ascertained that the proposal would not adversely affect the integrity of the site" (see Figure 4.1, above), though also represent other non-statutory guidance etc. with regards to the avoidance of significant effects on sites. Where it is considered that no effect can arise from any of the given sources of effect for a particular species or habitat (e.g. due to animal behaviour and/or the location/characteristics of a particular habitat), certain sites may be screened out of the assessment, and these are listed in the relevant section (5-8) where this is the case (also see Appendix B).

Table 4.2: High level mitigation measures identified for potential sources of effect

High level Mitigation	
Physical disturbance	All blocks under consideration are at least several kilometres offshore and remote from Natura 2000 sites. While new pipelines could conceivably come ashore at existing terminals, either through or near to coastal SACs and SPAs, there are well proven methods to prevent significant impacts – such mitigation would be defined at the project level, and be subject to project specific EIA and HRA.
Marine Discharges	Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades, and oil and other contaminant concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated. Discharges would be considered in detail in project-specific Environmental Statements, AAs (where necessary) and chemical risk assessments under existing

High level Mitigation	
	permitting procedures.
Other effects	The IMO International Convention for the Control of Ballast Water and Sediment, serves to mitigate against the possible introduction of invasive alien species through shipping ballast, which may degrade sensitive local habitats and communities. Measures include the mid-ocean exchange of ballast water (with ultra-violet irradiation of ballast a proposed alternative). The potential for collision of birds with offshore infrastructure, increased by attraction of birds to lights, may be mitigated by controlling well test and routine flaring during production and by avoiding or limiting activities during months when large numbers of birds aggregate in the area.
Underwater noise	Application for consent to conduct seismic and other geophysical surveys – PON14 Seismic operators are required, as part of the application process, to justify that their proposed activity is not likely to cause a disturbance etc. under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (& 2007 Amendments) for oil and gas related seismic surveys that the JNCC, *Guidelines for minimising the risk of disturbance and injury to marine mammals from seismic surveys,* are followed. European Protected Species (EPS) disturbance licences can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007*. DECC will expect that passive acoustic monitoring (PAM) will be routinely used as a mitigation tool.
Oil Spills	Oil Pollution Emergency Plans (OPEPs): regulatory requirements on operators to prepare spill prevention and containment measures, risk assessment and contingency planning – these are reviewed by DECC, MCA, JNCC, MMO, and relevant SNCB. Project level mitigation through permitting/HRA of specific activities (including conditions attached to consents/permits or potentially consent/permit refusal). MCA is responsible for a National Contingency Plan and maintains aerial spraying and surveillance aircraft based at Coventry and Inverness and counter-pollution equipment (booms, adsorbents etc.). The MCA presently has four Emergency Towing Vessels stationed around the UK which remain on standby at sea[3].
In-combination effects	The competent authorities will assess the potential for in-combination effects during Habitats Regulations Assessments of project specific consent applications; this process will ensure that mitigation measures are put in place to ensure that subsequent to licensing, specific projects (if consented) will not result in adverse effects on integrity of European sites.

[3] The future of these vessels is presently subject to debate as a new funding stream is required for their maintenance, with the present contract terminated in 2011. The role of these vessels may be filled by a commercial alternative (see: http://www.parliament.uk/business/committees/committees-a-z/commons-select/transport-committee/inquiries/coastguard/).

5 Consideration of potential effects from oil spills on relevant sites

5.1 Overview of spill effects and context

Oil spills can have potentially adverse environmental effects, and are accordingly controlled by a legal framework aimed at minimising their occurrence, providing for contingency planning, response and clean up, and which enables prosecutions. It is however, not credible to conclude that in spite of the regulatory controls and other preventative measures, an oil spill will never occur as a result of further licensing on the UKCS.

In April 2010, a major incident occurred in the US Gulf of Mexico. During drilling of an exploratory well in deep water approximately 50 miles offshore of Louisiana, there was an explosion and fire on the semi-submersible drilling rig, Deepwater Horizon. The rig was drilling in a water depth of 5,000ft with the oil reservoir at 18,000ft. UK regulators have been in contact with their counterparts in the United States (the Bureau of Ocean Energy Management, Regulation, and Enforcement - BOEMRE) to understand the cause of the incident and whether there are implications for safety at offshore operations on the UK continental shelf.

The Health and Safety Executive (HSE) is responsible for regulating the risks to health and safety arising from work in the offshore industry on the UKCS. Inspectors from HSE's Offshore Division undertake offshore inspections of well control/integrity arrangements and related safety issues, and also review well designs and procedures. In the UK a safety case regime exists with specific safeguards including:

- The *Offshore Installations (Safety Case) Regulations 2005* require written safety cases and risk assessments to be prepared by the operator, and then approved by HSE, for all mobile offshore drilling rigs operating in the UK.
- A system of well notification, where the HSE reviews well design and procedures.
- A requirement for the design and construction of a well to be examined by an independent and competent specialist.
- A scheme of independent verification of offshore safety critical equipment such as blowout preventers to ensure they are fit for purpose.
- Checks that workers involved in well operations have received suitable information, instruction, training and supervision.
- Offshore inspections of well control and integrity arrangements, and related safety issues, by specialist inspectors from HSE’s Offshore Division.
- Weekly drilling reports submitted to HSE by operators.

A review has been carried out by DECC which has found that the existing system is fit for purpose, but in light of the Deepwater Horizon spill the regime is being strengthened further:

1. DECC has increased the oversight of drilling operations through the recruitment of additional inspectors in its Aberdeen office. This will allow the Department to carry out double inspections (i.e. inspections carried out by 2 inspectors) for more complex drilling operations and it will also allow annual inspections of all mobile and fixed oil

and gas installations, once all of the new inspectors are recruited and have completed relevant training.

2. In light of the Gulf of Mexico incident, DECC has reviewed the indemnity and insurance requirements for operating in the UK Continental Shelf.
3. DECC has issued letters (dated: 23rd December 2010, 21st July 2011, 20th September 2011) to all UK operators specifying a number of requirements and expectations regarding oil pollution prevention, response, emergency plans and consenting.
4. Industry trade association Oil and Gas UK established a group comprised of regulators, industry and trade union representatives (the Oil Spill Prevention and Response Advisory Group - OSPRAG) to examine the UK's strengths and weaknesses in responding to a Gulf like incident. DECC participated in this group. OSPRAG's work is documented in their final report, *Strengthening UK Prevention and Response*, published September 2011 and the Secretary of State is examining its findings closely.

As a result of the Deepwater Horizon incident a UK Parliamentary Select Committee Inquiry into the safety and environmental regulations and spill prevention and response provisions of oil and gas operations on the UKCS was held which reported in January 2011 (Energy and Climate Change Committee 2011). The report includes a series of recommendations regarding regulatory oversight, spill prevention, response and understanding. However, the Committee report did not conclude that a moratorium on drilling, even in deep water, was justified in the UK.

In January 2011 the US Government National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling released an extensive report (National Commission 2011) into the disaster, citing systematic management failures by the main companies involved and shortcomings in the US government regulatory regime as the principal sources of blame. A series of general recommendations are included in the report regarding spill prevention, response and understanding.

DECC (along with other parts of government) have considered the implications of these various findings and implemented a series of actions in response.

The potential for oil spills associated with exploration and production, the consequences of accidental spillages, and the prevention, mitigation and response measures implemented have been assessed and reviewed in successive SEAs covering the UKCS area, including the recent Offshore Energy SEA2. Previous SEAs have concluded that given the UK regulatory framework and available mitigation and response, in relation to objective risk criteria (such as existing exposure to risk as a result of shipping), the incremental risk associated with exploration and production (E&P) is moderate or low.

A large number of site- and activity-specific risk assessments have also been carried out as a component of Environmental Assessments and under the relevant legislation implementing the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) (see the *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998*).

Direct mortality of seabirds in the event of oil spill is highly relevant in the context of coastal breeding site classified as SPAs (and possible SPA extensions). Waterbird vulnerability to surface pollution has been quantified for each month on a block-by-block basis by JNCC in terms of the Offshore Vulnerability Index (OVI) (see Table 5.1), and seasonal concerns in relation to drilling have been identified for a number of Blocks considered in this AA (see Table 2.1) for which there would be a presumption against such activity taking place.

The following section provides a high-level overview of risks, regulation, contingency planning and response capabilities; followed by an assessment of risks presented to relevant European Sites by activities resulting from the proposed licensing of Block 103/1. As risks tend to be generic between sites, these have been categorised based on ecological sensitivity and an evaluation of spill probability and severity.

5.2 Spill risk

Risk assessment, under the terms of OPRC, includes considerations of probability and consequence, generally comprising an evaluation of: historical spill scenarios and frequency, fate of spilled oil, trajectory of any surface slick, and potential ecological effects. These considerations are discussed below.

The expected hydrocarbons in Block 103/1 are natural gas based on the findings of previous discovery and appraisal wells. As a result, although blowout risk cannot be excluded, it would not result in significant oil spillage. The only significant blowouts on the UKCS to date have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas and not resulting in significant pollution.

Potential risks of oil spills are mitigated in the case of Block 103/1 by the nature of the hydrocarbons present (natural gas). Spill risk is therefore associated mainly with transfer and storage of fuel and lubricating oils. Modelling, and field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind). This allows a distinction in terms of relative risk, to be made between activities associated with licensing Block 103/1 and those in other areas.

5.3 Historical spill scenarios and frequency

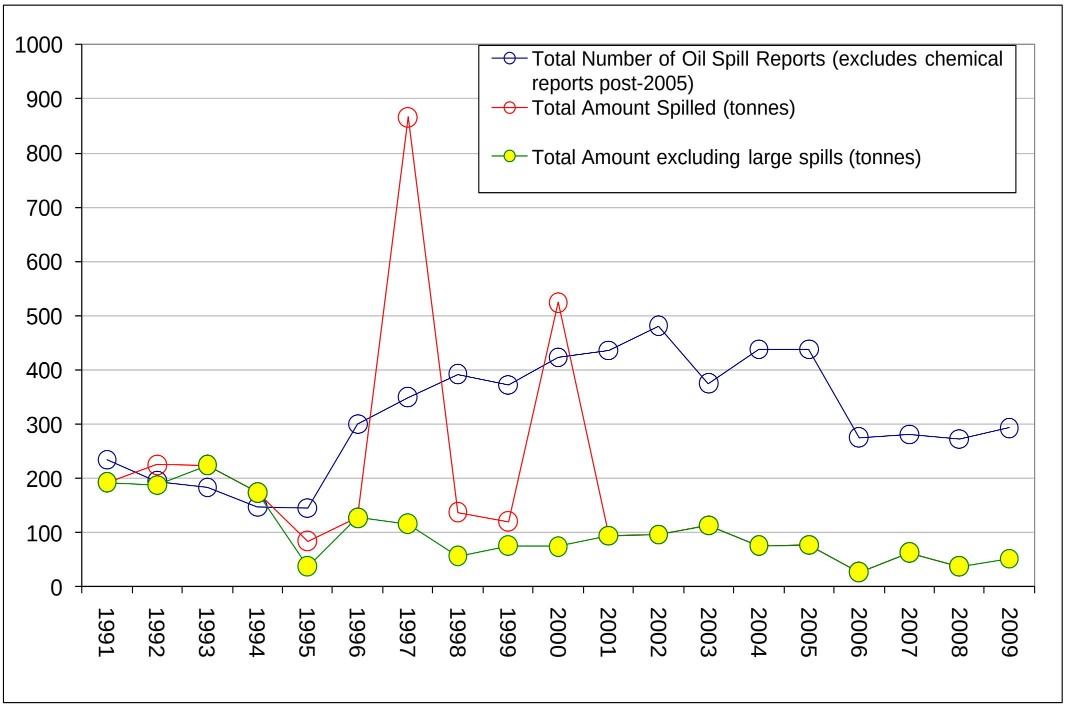
Oil spills on the UKCS have been subject to statutory reporting since 1974 under PON1 (formerly under CSON7); annual summaries of which were initially published in the "Brown Book" series, now superseded by on-line data available from the DECC website[4] (Figure 5.1). Discharges, spills and emissions data from offshore installations are also reported by OSPAR (e.g. OSPAR 2009).

DECC data indicate that the most frequent types of spill from mobile drilling rigs have been organic phase drilling fluids (and base oil), diesel and crude oil. Topsides couplings, valves and tank overflows; and infield flowlines and risers are the most frequent sources of spills from production operations, with most spills being <1 tonne. A large proportion of reported oil spills in recent years (since about 1990) have resulted from process upsets (leading to excess oil in produced water). Estimated spill risk from UKCS subsea facilities was equivalent to a risk of 0.003 spills/year for an individual facility, with almost all reported spills less than a tonne (<5bbl) in size.

Well control incidents (i.e. "blowouts" involving uncontrolled flow of fluids from a wellbore or wellhead) have been too infrequent on the UKCS for a meaningful analysis of frequency based on historic UKCS data. A review of blowout frequencies cited in UKCS Environmental Statements as part of the OESEA2 gives occurrence values in the range 1/1,000-10,000 well-years.

[4] Oil and chemical discharge notifications (accessed October 2010) https://www.og.decc.gov.uk/information/bb_updates/chapters/Table_chart3_1.htm

Figure 5.1: Number and volume of reported oil spills from UKCS oil and gas installations over the period 1991-2009



Source: DECC website

An annual review of reported oil and chemical spills in the UKCS – covering both vessels and offshore installations – is made on behalf of the Maritime and Coastguard Agency (MCA) by the Advisory Committee on Protection of the Sea (e.g. ACOPS 2008 as reported in Dixon 2009). This includes all spills reported by POLREP reports by the MCA and PON1 reports to DECC. The number of accidental discharges attributed to oil and gas installations during 2008 showed a reduction of 6.5% over the previous year's total. Of these discharges, 65% were fuel, lubrication or hydraulic oils; additionally, of the discharges with volume information, 95% were less than 455 litres.

Since the mid-1990s, the reported number of spills has increased, consistent with more rigorous reporting of very minor incidents (e.g. the smallest reported spill in 2003 was 0.0001 litres). However, the underlying trend in spill quantity (excluding specifically-identified large spills) suggests a consistent annual average of around 100 tonnes. In comparison, oil discharged with produced water from the UKCS in 2009 totalled 2,900 tonnes (DECC website[5]).

Historic major spill events from UKCS production facilities include the 1986 Claymore pipeline leak (estimated 3,000 tonnes), 1988 Piper Alpha explosion (1,000 tonnes), 1996 Captain spill (685 tonnes) and 2000 Hutton TLP spill (450 tonnes). Although potentially significant at a local scale, these volumes are minor when compared to other inputs of oil to the marine environment, such as riverine inputs (OSPAR 2000, 2010).

5.3.1 Trajectory and fate of spilled oil

The main oil weathering processes following a surface oil spill are spreading, evaporation, dispersion, emulsification, dissolution, oxidation, sedimentation and biodegradation. Diesel

[5] Oil discharged with produced water 2005 – 2009
https://www.og.decc.gov.uk/information/bb_updates/chapters/Table3_2.htm

spills generally evaporate and disperse without the need for intervention. Deterministic modelling of a major diesel spill of ~1,200m^3 from Block 103/1 shows that it would disperse naturally in about 8 hours and travel some ~25km in conditions of a constant unidirectional 30 knot wind, with no beaching resulting.

Coincident with these weathering processes, surface and dispersed oil will be transported as a result of tidal (and other) currents, wind and wave action. Generally, the slick front will be wind-driven on a vector equivalent to current velocity plus approximately 3% of wind velocity. Although strong winds can come from any direction and in any season, the predominant winds are from the southwest and a funnelling effect in the St George's Channel creates strong winds throughout the year. For Block 103/1, this would push spilled oil northeast into the Irish Sea. To support environmental assessments of individual drilling or development of gas projects, modelling is carried out for diesel oil releases. Representative modelling cases from various parts of the UKCS have been reviewed by successive SEAs.

5.3.2 Potential ecological effects

The most vulnerable components of the ecosystem to oil spills in offshore and coastal environments are seabirds and marine mammals, due to their close association with the sea surface. Seabirds are affected by oil pollution in several ways, including oiling of plumage resulting in the loss of insulating properties and the ingestion of oil during preening. Pollution of the sea by oil, predominantly from merchant shipping, can be a major cause of seabird mortality. Although locally important numbers of birds have been killed on the UKCS directly by oil spills from tankers, for example common scoter off Milford Haven following the Sea Empress spill in 1996, population recovery has generally been rapid. Chronic pollution resulting from illegal dumping or tank washing probably has a greater chronic impact on seabirds than accidental spills from shipping casualties.

The Offshore Vulnerability Index (OVI) developed by JNCC (Williams *et al*. 1994) is used to assess the vulnerability of bird species to surface pollution; it considers four factors:

- the amount of time spent on the water
- total biogeographical population
- reliance on the marine environment
- potential rate of population recovery

Vulnerability scores for offshore areas (see Table 5.1, below) are determined by combining the density of each species of bird present with its vulnerability index score. Of the species commonly present offshore in UK offshore waters, gannet, skuas and auk species (e.g. SPA sites include Grassholm, Skokholm and Skomer and Carmarthen Bay) may be considered to be most vulnerable to oil pollution due to a combination of heavy reliance on the marine environment, low breeding output with a long period of immaturity before breeding, and the regional presence of a large percentage of the biogeographic population. In contrast, the aerial habits of the fulmar and gulls, together with large populations and widespread distribution, reduce vulnerability of these species. Vulnerability is seasonal, with a general trend of high vulnerability in coastal areas adjacent to colonies during the breeding season. In winter, vulnerability in inshore waters can also be very high in some areas. Vulnerability is high to very high throughout the year (with the exception of January and March) in Block 103/01 and surrounding Blocks.

Table 5.1: Monthly seabird vulnerability to surface pollution in 26th Round Blocks

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
106/26	3	3	3	2	1	1	1	1	1	2	2	2	1
106/27	3	3	3	2	1	1	1	1	1	2	2	2	1
102/05	3	2	3	2	1	1	1	1	1	2	2	2	1
103/01	3	2	3	2	1	1	1	1	1	2	2	2	1
103/02	3	2	3	2	1	1	1	1	1	2	2	2	1
102/10	3	1	3	2	1	1	1	1	1	2	2	2	1
103/06	3	1	3	2	1	1	1	1	1	2	2	3	1
103/07	3	1	3	2	1	1	1	1	1	2	2	3	1

Note: 1 = very high, 2 = high, 3 = moderate, 4 = low.
Source: JNCC (1999).

As the major breeding areas for most wildfowl and wader species are outside the UK (in the high Arctic for many species), population dynamics are largely controlled by factors including breeding success (largely related to short-term climate fluctuations, but also habitat loss and degradation) and migration losses. Variability in movements of wintering birds, associated with winter weather conditions in continental Europe, can also have a major influence on annual trends in UK numbers, as can variability in the staging stops of passage migrants.

Oil spill risks to marine mammals have been reviewed by successive SEAs and their supporting technical reports (e.g. Hammond *et al*. 2008, Murphy *et al*. 2008).

Generally, marine mammals are considered to be less vulnerable than seabirds to fouling by oil, but they are at risk from hydrocarbons and other chemicals that may evaporate from the surface of an oil slick at sea within the first few days. Symptoms from acute exposure to volatile hydrocarbons include irritation to the eyes and lungs, lethargy, poor coordination and difficulty with breathing. Individuals may then drown as a result of these symptoms.

Grey and harbour seals come ashore regularly throughout the year between foraging trips and additionally spend significantly more time ashore during the moulting period (February-April in grey seals and August-September in harbour seals) and particularly the pupping season (October-December in grey seals and June-July in harbour seals). Animals most at risk from oil coming ashore on seal haulout sites and breeding colonies are neonatal pups, which rely on their prenatal fur and metabolic activity to achieve thermal balance during their first few weeks of life, and are therefore more susceptible than adults to external oil contamination.

Coastal otter populations are also vulnerable to fouling by persistent oil, should it reach nearshore habitats. They are closely associated with the sea surface and reliant upon fur, rather than blubber, for insulation.

Benthic habitats and species may be sensitive to deposition of oil associated with sedimentation, or following chemical dispersion. The proportion of a surface spill that is deposited to the seabed might be expected to increase as a result of high turbulence and suspended solids concentrations in the water column, both associated with storm conditions in shallow water. Studies of macrobenthic infauna following the Braer spill (Kingston *et al*. 1995), which occurred under such conditions, found no significant changes in benthic community structure, as characterised by species richness, individual abundance and diversity, which could be related to the areas of seabed affected by the spill. This may have been because Braer oil was of low toxicity, or because the sampling programme was carried out too soon after the spill to enable the full effects of its impact to be detected. In recognition of this as part of the DECC SEA programme further sampling of the study area has been conducted, ten years after the spill, results from which have indicated a substantial decline in sediment hydrocarbon concentrations.

In contrast, evidence from the Florida barge spill (Buzzards Bay, Massachusetts, September 1969, in which 700m^3 of diesel fuel were released) suggests that in certain circumstances, contamination from oil spills could be long-term. Monitoring immediately following the spill suggested rapid recovery (reviewed by Teal & Howarth 1984), while subsequent studies (sampling in 1989) indicated that substantial biodegradation of aromatic hydrocarbons in saltmarsh sediments had occurred (Teal *et al.* 1992). However, thirty years after the spill, significant oil residues remain in deep anoxic and sulphate-depleted layers of local salt marsh sediments (Reddy *et al.* 2002, Peacock *et al.* 2005). The ecological consequences of this residual contamination are unclear, although there is potential for remobilisation of sediment-bound contaminants through bioturbation or storm events (in which case, aerobic biodegradation would be expected to be rapid).

Those coastal and marine Annex I habitats which are most sensitive to oil spills are identified in Table 5.2, below. Generally, sheltered habitats of lower exposure to wave energy are considered most vulnerable; oil may persist for long periods in such environments.

5.4 Implications for relevant European Sites

Relevant sites have been screened in Appendix B and all sites where the potential for effects were identified are listed in detail in Appendix C. The identification of potential effects from oil spills on specific European Sites considers the following factors:

- Oil spill probability and severity (taking into account distance from the Block under offer, and probable hydrocarbon type)
- The ecological sensitivity of the qualifying feature(s) to oil spills
- Connected with the above, in what way an oil spill would have an immediate effect on the conservation objectives of SACs and SPAs as listed in Appendix C, and any long-term implications of a spill on these objectives

It should be noted that at a project level, DECC requirements for the preparation of OPEPs and ES submissions include, amongst other mitigation and response criteria, the modelling of a worst case blowout scenario considering a specific release location, crude oil type and historic metocean conditions as well an unlikely 30 knot onshore wind, over a release time of 10 days. As any hydrocarbons to be recovered from licensing Block 103/1 are likely to be gas, no significant hydrocarbon release is likely, and such a release would be restricted to diesel or lube oil.

5.4.1 Special Areas of Conservation

The ecological sensitivity of the qualifying features of relevant sites to oil spills varies. For several Annex I habitats and Annex II species, it is considered that any potential source of effect is unlikely to degrade the qualifying habitat or habitat of species, or undermine the conservation objectives of related sites. These include:

- **Submerged reefs and sandbanks** – not generally vulnerable to surface oil pollution, except possibly following application of chemical dispersants (generally not permitted in waters shallower than 20m) – it is not expected that the extent, distribution or functioning of these habitats would be affected in the long-term, and therefore those of any species associated with, or relying on the functioning of these habitats, such that conservation objectives would be undermined.
- **Lagoons, dunes** – sites above Mean High Water Springs not generally vulnerable to surface oil pollution, except possibly to wind-blown oil or evaporated hydrocarbons.

Lagoons typically have periodic connections to the sea; such connections can be protected from the ingress of surface pollutants e.g. by booming.

- **Sea cliffs, sea caves** – generally not considered sensitive due to wave reflection and rapid recovery (e.g. Gundlach & Hayes 1978) – it is not expected that the extent, distribution or functioning of these habitats would be affected in the long-term, and therefore those of any species associated with, or relying on the functioning of these habitats such that conservation status would be detrimentally affected.
- **Terrestrial and freshwater aquatic sites and species** – effects on the conservation objectives of these species and their supporting habitats is essentially negated by their distribution, as they generally do not utilise marine or estuarine environments. Includes: narrow-mouthed whorl snail (*Vertigo angustior*), freshwater pearl mussel (*Margaritifera margaritifera*), and non-coastal otter populations (*Lutra lutra*). It should be noted that salmonids play a critical role in the life cycle of the freshwater pearl mussel, and potential indirect effects of this association are considered in the assessment below.

Table 5.2 provides information on those categories of Annex I habitats and Annex II species which may have their conservation objectives undermined in the event of being impacted by an oil spill - those sites for which such potential for effects from oil spills has been identified (see Appendix B) are listed. Due to the limited distance spilled diesel oil travels before dispersion (up to *ca.* 24km), oil spill effects potential relates to a limited number of sites. Note: several sites are represented in more than one risk category.

Table 5.2: Annex I habitat types and Annex II species potentially vulnerable to oil spills

Mudflats and sandflats
Particularly vulnerable in sheltered areas where wave energy is low. The biological communities associated with these sites are related to the degree of sheltering and subsequent sediment type; sheltered sites with fine, muddy sediments may support a high diversity and abundance of invertebrates and waterfowl. **Sites potentially at risk:** Pembrokeshire Marine/Sir Benfro Forol SAC, Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Tramore Dunes and Backstrand SAC (RoI), Ballyteigue Burrow SAC (RoI), Bannow Bay SAC (RoI), Saltee Islands SAC (RoI), Raven Point Nature Reserve SAC (RoI), Slaney River Valley SAC (RoI), Carnsore Point SAC (RoI).
Estuaries
Complexes of several subtidal and intertidal habitats with varying freshwater influence. The sediments of estuaries support various biological communities, while the water column provides an important habitat for free-living species, such as fish, and juvenile stages of benthic plants and animals. Estuaries often contain several different Annex I habitats. **Sites potentially at risk:** Pembrokeshire Marine/ Sir Benfro Forol SAC, Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Ballyteigue Burrow SAC (RoI), Bannow Bay SAC (RoI), Slaney River Valley SAC (RoI).
Saltmarshes
Comprise intertidal mud and sandflats colonised by vegetation due to protection from strong wave action. Pioneering saltmarsh vegetation exists where tidal flooding is frequent, with progression to more diverse, stable communities in upper reaches where tidal flooding is less frequent. Upper reaches can be valuable for plants, invertebrates and wintering or breeding waterfowl. **Sites potentially at risk:** Pembrokeshire Marine/ Sir Benfro Forol SAC, Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Dunes and Backstrand SAC (RoI), Ballyteigue Burrow SAC (RoI), Bannow Bay SAC (RoI).

Contd. overleaf

Inlets and Bays
Large indentations of the coast, and generally more sheltered from wave action than the open coast. They are relatively shallow, with water depth rarely exceeding 30m, and support a variety of subtidal and intertidal habitats and associated biological communities. **Sites potentially at risk:** Pembrokeshire Marine/ Sir Benfro Forol SAC, Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Saltee Islands SAC (RoI), Hook Head SAC (RoI).
Bottlenose dolphin
Sites comprise a variety of marine habitats utilised by bottlenose dolphins (*Tursiops truncatus*) for foraging and other activities, with extensive areas beyond the site boundary also utilised. Vulnerable to oil spills due to their dependence on the sea surface for breathing. **Sites potentially at risk:** Cardigan Bay/Bae Ceredigion SAC,
Seals
Designated sites comprise coastal habitats (beaches, estuaries, sandflats and rocky shores) supporting important breeding colonies of harbour seals (*Phoca vitulina*) and/or grey seals (*Halichoerus grypus*). Seals spend considerable periods of time at these sites during the breeding season and during the moult. Seals forage for prey in surrounding waters and also travel considerable distances beyond the boundaries of sites (particularly grey seals). **Sites potentially at risk:** Pembrokeshire Marine/ Sir Benfro Forol SAC, Cardigan Bay/Bae Ceredigion SAC, Saltee Islands SAC (RoI).
Coastal otters
Sites contain shallow, inshore coastal areas utilised by important populations of otter (*Lutra lutra*) for feeding. **Sites potentially at risk:** Pembrokeshire Marine/ Sir Benfro Forol SAC, Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Slaney River SAC (RoI).
Atlantic salmon
Though not generally vulnerable to surface oil pollution due to the absence or paucity of time spent at the water's surface, available evidence suggests that smolts utilise shallow water depths (1-6m) and that adults show varying behaviour, swimming generally close to the surface (0- 40m depth), with occasional deeper dives – e.g. Holm *et al.* (2005) noted dive depths of between 85 and 280m (Malcolm *et al.* 2010). As salmonids play a critical role in the life cycle of the freshwater pearl mussel, any significant impact on populations of Atlantic salmon may also affect those of the pearl mussel. **Sites potentially at risk:** Afon Teifi/River Teifi SAC, River Bannow and Nore (RoI), Slaney River Valley SAC (RoI)

Note: RoI – Republic of Ireland sites

5.4.1.1 Consideration

The conservation features of the sites listed in Table 5.2 are potentially vulnerable to a large diesel spill due to the proximity of Block 103/1 to coastal SACs (see Table 5.2).

The proposed work programme indicates a potential drill or drop well. Therefore, following examination of existing seismic information, decisions will be made by the prospective licensee to drill a well or relinquish the block. As the location and design of the proposed drill or drop well is not known, a detailed assessment of the potential for effects cannot be made at this time. Modelling, field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind).

Following licensing, specific activities require permitting (see Section 5.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and HRA procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities will not have an adverse affect which could undermine the conservation objectives of the qualifying features of relevant SACs.

5.4.2 Special Protection Areas

Table 5.3 provides information on those SPA types which are potentially vulnerable to oil spills. Those sites where the potential for effects from oil spills has been identified are listed (see Appendix B). Due to the limited distance spilled diesel oil travels before dispersion (up to *ca.* 24km), oil spill effects potential relates to a limited number of sites. Note: several sites are represented in more than one risk category.

Table 5.3: SPA types potentially vulnerable to oil spills

Cliff-breeding seabird colonies
Designated for colonial breeding seabirds (including auks, fulmar, kittiwake, cormorant, and gannet) which nest either on, or generally associated with sea cliffs. Birds extensively utilise adjacent coastal waters for a variety of activities, and also forage beyond site boundaries. **Sites potentially at risk:** Grassholm SPA, Skokholm and Skomer SPA, Saltee Island SPA (RoI).
Petrel, tern, skua or gull breeding populations
Designated for breeding seabirds, which generally forage over sea areas adjacent to (or in some cases at considerable distance from) breeding sites. **Sites potentially at risk:** Skokholm and Skomer SPA, Saltee Islands SPA (RoI), Lady's Island Lake SPA (RoI), The Raven SPA (RoI), Ballyteigue Burrow SPA (RoI).
Red-throated diver breeding populations utilising coastal waters
Inland sites designated for breeding red-throated diver (*Gavia stellata*) which forage in neighbouring coastal waters. **Sites potentially at risk:** The Raven SPA (RoI).
Open coastline supporting wintering waders and seaduck
Contain coastal and intertidal habitats which support a variety of wintering waders and seaduck, often in large aggregations. The birds feed on wetlands and the surrounding shallow waters. **Sites potentially at risk:** Lady's Island Lake SPA (RoI), The Raven SPA (RoI), Ballyteigue Burrow SPA (RoI), Tramore Back Strand SPA (RoI), Bannow Bay SPA (RoI), Wexford Harbour and Slobs SPA (RoI), Tacumshin SPA (RoI).
Firths, lochs and estuaries supporting wintering waterfowl
Contain enclosed and semi-enclosed coastal and intertidal habitats (particularly wetlands) supporting a variety of wintering waterfowl and waders, often in large aggregations. Some species (e.g. seaducks) feed beyond the boundaries of sites. **Sites potentially at risk:** Bae Caerfryddin/Carmarthen Bay SPA, Lady's Island Lake SPA (RoI), Ballyteigue Burrow SPA (RoI), Tramore Back Strand SPA (RoI), The Raven SPA (RoI), Bannow Bay SPA (RoI), Wexford Harbour and Slobs SPA (RoI), Tacumshin SPA (RoI).

Note: RoI – Republic of Ireland sites

5.4.2.1 Consideration

The conservation features of the sites listed in Table 5.3 are potentially vulnerable to a large diesel spill due to the proximity of some of the Blocks to coastal SPAs (see Table 5.3).

The proposed work programme indicates one potential drill or drop well. Therefore, following examination of existing seismic information, a decision will be made by the prospective licensee to drill a well or relinquish the block. As the location and design of the proposed drill or drop well is not known, a detailed assessment of the potential for effects cannot be made at this time. Modelling, field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind).

Following licensing, specific activities require permitting (see Section 5.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities will not have an adverse affect which could undermine the conservation objectives of the qualifying features of relevant SPAs.

5.4.3 Adjacent waters SACs and SPAs

The potential for oil spills to impact the integrity of SACs and SPAs in the Republic of Ireland has been assessed. Tables 5.2 and 5.3 above highlight those Irish sites that could be vulnerable to oil spills. The dominant wind direction in the region is from the south west, with residual currents moving north augmented by a strong tidal flux with a northern flood (20-30°) and south-western ebb (210-220°). This, aligned with the rigorous spill prevention, response and other mitigation measures that would be in place (including the prospect of gas rather than oil hydrocarbons being produced), would mean these sites are unlikely to be impacted by spills originating from activities in the Block.

5.5 Regulation and mitigation

Spill prevention and mitigation measures are implemented for offshore exploration and production inter alia through the *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation) Regulations 1998* and the *Offshore Installations (Emergency Pollution Control) Regulations 2002*. The required measures include spill prevention and containment measures, risk assessment and contingency planning. Under the Regulations, all operators of an offshore installation or oil handling facility must have an Oil Pollution Emergency Plan (OPEP) in place. The plans are reviewed by DECC, MCA and relevant environmental consultees, such as the Marine Management Organisation or relevant Devolved Authority, the Joint Nature Conservation Committee and the relevant inshore statutory nature conservation body, e.g. Countryside Council for Wales, before approval by DECC. OPEPs set out the arrangements for responding to incidents with the potential to cause marine pollution by oil, with a view to preventing such pollution or reducing or minimising its effect. Additional conditions can be imposed by DECC, through block-specific licence conditions (i.e. “Essential Elements”).

Offshore, primary responsibility for oil spill response lies with the relevant Operator, although the Secretary of State’s Representative may intervene if necessary. The Maritime and Coastguard Agency is responsible for a National Contingency Plan and currently maintains four Emergency Towing Vessels stationed around the UK, which remain on standby at sea (see footnote 3 on page 19). The MCA maintains a contractual arrangement for provision of aerial spraying and surveillance, with aircraft based at Coventry and Inverness. Within two days, aircraft can deliver sufficient dispersant to treat a 16,000 tonne spill within 50 miles of the coast anywhere around the UK. MCA holds 1,400 tonnes of dispersant stockpiled in 14 locations around the UK, in addition to counter-pollution equipment (booms, adsorbents etc.) which can be mobilised within 2-12 hours depending on incident location. It is, however, unlikely that dispersants would be used in the event of a spill in the St George's Channel, as the oil would be likely diesel, which rapidly disperses without intervention. DECC is a partner in undertaking regular aerial surveillance operations of offshore installations.

For activities in proximity to sensitive shorelines, the Department's guidance (DECC 2009a) requires that the risk of shoreline contamination be determined through an appropriate risk assessment, and operators with oil spill scenarios that could impact the shoreline must have access to appropriate oil spill response resources suitable for shoreline clean-up operations. Additional resources are required for installations operating in any Block wholly or partly within 25 miles of the coastline dependent on the hydrocarbon inventory and the oil pollution incident scenarios identified, including:

- The presence near the facility at all times of a vessel:
    - with the capability of spraying dispersant within 30 minutes of an oil pollution incident notification
    - has a stock of dispersant sufficient to deal with an oil pollution incident of 25 tonnes, and if required, have the capability (equipment and capacity) of recovering any oil likely to be lost from the installation under a Tier 1[6] scenario
- In the event of a Tier 2 incident, Tier 2 resources must be available on scene within half the time taken for the oil to reach shore in 30 knot wind conditions
- Details of resources to deal with a Tier 3 incident (i.e. an oil pollution incident that cannot be controlled by Tier 1 or 2 resources), including sources transport and delivery system
- A Shoreline Protection Strategy Plan

UK oil spill contingency planning and response capabilities have been reviewed and revised following the Deepwater Horizon spill (see Section 5.1). Oil & Gas UK established the Oil Spill Prevention and Response Advisory Group (OSPRAG) to provide a focal point for the sector's review of the industry's practices in the UK, in advance of the conclusion of investigations into the Gulf of Mexico incident. The Group had four specialist review groups whose remit was to focus on:

- technical issues including first response for protection of personnel;
- oil spill response capability and remediation including national emergency response measures;
- indemnity and insurance requirements;
- pan-North Sea regulations and response mechanisms.

The Oil Spill Response Group (OSRG) of OSPRAG was established to review the UK's oil spill response capability and industry co-ordination with the national response mechanism. Its areas of focus were spill scenarios and modelling, review of physical response capability,

[6] Oil pollution incidents are classified according to the response levels they are most likely to require and not the volume of oil pollution, unless this is supported by a location specific risk assessment. For example, if a pollution incident requires the use of resources from a regional centre, this would be used to classify the necessary response level, irrespective of its size.
For consistency with the National Contingency Plan, the following Tier definitions apply:
- Tier 1 Local (within the capability of the operator on site);
- Tier 2 Regional (beyond the in-house capability of the operator);
- Tier 3 National (requiring national resources).

sensitivity and protection mapping in relation to clean up and restoration, Oil Pollution Emergency Plans (OPEPs) and exercising OPEPs. An early action of the OSRG was to facilitate planning for an early exercise of the NCP (see above).

OSPRAG's technical review group has completed its review of the UK offshore oil and gas industry's practices in the following areas: well examination verification and primary well control, blow-out preventers (BOPs) and competency, behaviours and human factors. This work concluded that there is a high degree of confidence in the UK regulatory regime and that it drives the right safety and environmental behaviours. The Well Life Cycle Practices Forum (WLCPF) will advance recommendations made by OSPRAG and facilitate the dissemination of lessons from Macondo and other similar events, with a specific focus (among others) on BOP issues, including liaison with the HSE on the recommendation made by the House of Commons Select Committee that it examines the case for prescribing the equipment of BOPs on the UKCS with two blind shear rams.

5.6 Conclusions

Individual European Sites have been categorised in terms of potential vulnerability, based on location in relation to known hydrocarbon prospectivity of the proposed licence Block and therefore the nature and magnitude of credible risks. Two categories of vulnerability were identified:

- Those sites considered to be at potential risk, with the possibility of impacts in the event of a significant spill of diesel or lube oil (i.e. where site conservation objectives are at risk of being undermined/where present conservation status may be negatively affected).
- Many sites are considered not to be at risk from oil spills associated with activities in the Blocks, due to their distance from the Blocks and relative sensitivity of the features.

The incremental risk associated with activities resulting from the proposed licensing (i.e. additional to existing risk; primarily associated with shipping and other maritime activities) is low. This results from the combination of low probability and low severity (since most spills would be small in volume and be of diesel oil). The activities which could reasonably be expected to follow from the proposed licensing would not have a significant effect on the existing risks associated with other activities.

Oil spills can have potentially adverse effects, and are controlled in direct proportion to this by a legal framework that minimises their occurrence, provides for contingency planning, response and clean up, and which enables prosecutions. It is not possible to say that in spite of the regulatory controls and other preventative measures, an oil spill will never occur as a result of activities which may follow licensing; however, as oil spills are not intended activities, a risk-based assessment is appropriate.

Following licensing, specific activities require permitting (see section above) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Given the availability of prevention and mitigation measures which are applied prior to consenting any activity including project specific safety, oil spill risk assessment, response, inspection and other monitoring, and the requirement for project specific Habitats

Regulations Assessment, DECC considers that the granting of a Seaward Production Licence for Block 103/1 would not adversely affect the integrity of European Sites.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities, which may include the drilling of a well, will not have an adverse affect on the site integrity of Natura 2000 sites.

6 Consideration of sites and potential physical and other effects

6.1 Introduction

Several activities associated with oil and gas exploration and production can lead to physical disturbance, damage, alteration or contamination of seabed habitats and geomorphological features, with consequent effects on benthic communities. The prime potential sources of effect are summarised below, followed by a consideration of the foreseeable effects on European Sites assessed to be at potential risk.

6.2 Physical damage at the seabed

The main sources of physical disturbance of the seabed from oil and gas activities are:

- **Anchoring of semi-submersible rigs**. Semi-submersible rigs use anchors to hold position, typically between 8 and 12 in number at a radius depending on the water depth, and cause seabed disturbance from the anchors and chain or cables, and in cohesive sediments, leave 'anchor mounds' after their retrieval.
- **Placement of jack-up rigs**. Jack-up rigs, normally used in shallower water, leave three or four depressions from the feet of the rig (the spud cans) around 15-20m in diameter. In locations with an uneven seabed, material such as grout bags may be placed on the seabed to stabilise the rig feet.
- **Drilling of wells and wellhead removal**. The surface hole sections of exploration wells are typically drilled riserless, producing a localised (and transient) pile of surface-hole cuttings around the surface conductor. After installation of the surface casing (which will result in a small quantity of excess cement returns being deposited on the seabed), the blowout preventer (BOP) is positioned on the wellhead housing. These operations (and associated activities such as ROV operations) may result in physical disturbance of the immediate vicinity (a few metres) of the wellhead. When an exploration well is abandoned, the conductor and casing are plugged with cement and cut below the mudline (sediment surface) using a mechanical cutting tool deployed from the rig and the wellhead assembly is removed. The seabed "footprint" of the well is therefore removed.
- **Production platform jacket installation**. Limited physical footprint similar to a drilling rig, but present on site for longer period. Physical disturbance associated with platform removal during decommissioning is comparable to that of installation.
- **Subsea template and manifold installation**. Limited physical footprint at seabed, smaller than a drilling rig, but present on site for longer period. Physical disturbance associated with subsea template and manifold removal during decommissioning is comparable to that of installation.
- **Pipeline, flowline and umbilical installation, trenching and potentially, placement of rock armour**. Anticipated hydrocarbons are gas and given the location of the Block applied for and the lack of existing infrastructure, it is anticipated that new field developments would require new infrastructure. Large pipes (greater than 16" diameter) do not have to be trenched according to a general industry agreement as they will not

be moved by fishing gear, but they may still need to be trenched for reasons of temperature loss or upheaval buckling (due to buoyancy). Trenches may require several passes before they are of the required depth, or it may be impossible to achieve the required depth due to obstructions, in which case rock is usually placed on the pipeline (rock dump) to protect and stabilise it.

DECC Oil and gas SEAs have compared the physical disturbance effects of oilfield activities to those of fishing and natural events in shallow water (e.g. storm wave action), and concluded that oilfield effects are typically minor on a regional scale. It is generally accepted that the principal source of human physical disturbance of the seabed and seabed features is bottom trawl fishing. Trawl scarring is a major cause of concern with regard to conservation of shelf and slope habitats and species (e.g. Witbaard & Klein 1993, de Groot and Lindeboom 1994, Kaiser *et al.* 2002a, Kaiser *et al*. 2002b, Gage *et al.* 2005). On the basis that seabed disturbance is qualitatively similar to the effects of severe storms in the southern North Sea, sand and gravel habitat recovery from the processes of anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) in most shallower and exposed (as opposed to sheltered) areas. Consequently, the effects of drill rig positioning and the installation of seabed infrastructure (including pipelines, umbilical and other cables) are considered minor and transient and such that they would not compromise the conservation objectives of relevant sites; this assumes that standard industry information gathering and regulatory controls are in place (see below).

The broad distribution of large scale biotopes of conservation importance is relatively well understood in the St. George's Channel, and in the vicinity of Block 103/1 (e.g. see McBreen *et al.* 2011). Within the boundaries of designated and potential SACs the occurrence of habitats of interest is usually known with greater precision. The routine sources of potential physical damage are controlled by a range of statutory measures including Consent to Locate, PON15B, Environmental Statement, Pipeline Works Authorisation and, where relevant, AA. Provisions under the Marine and Coastal Access Act (2009) include certain activities previously covered by the Food and Environment Protection Act; guidance on these is pending. Based on the results of the assessments including AA, DECC may require additional mitigation measures to avoid or minimise any adverse effects, or where this is not possible, refuse consent.

6.3 Marine discharges

As described in previous oil and gas SEAs, marine discharges from exploration and production activities include produced water, sewage, cooling water, drainage, drilling wastes and surplus water based mud (WBM), which in turn may contain a range of hydrocarbons in dissolved and suspended droplet form, various production and utility chemicals, metal ions or salts (including Low Specific Activity radionuclides).

Most studies of produced water toxicity and dispersion, in the UK and elsewhere (see E&P Forum 1994, OLF 1998, Riddle *et al*. 2001, Berry & Wells 2004) have concluded that the necessary dilution to achieve a No Effect Concentration (NEC) would be reached at <10 to 100m and usually less than 500m from the discharge point. However, under some circumstances (e.g. strong stratification: Washburn *et al.* 1999), a plume concentration sufficient to result in sub-lethal effects may persist for >1,000m (Burns *et al*. 1999).

Monitoring with caged mussels in the Netherlands and Norwegian sectors of the North Sea has shown that mussels exposed to produced water discharges may accumulate PAH and show biological responses up to 1,000m from the discharge. Concentrations of PAHs and alkyl phenols and measured biological responses in wild fish such as cod and haddock caught in the vicinity of offshore installations from Norwegian waters in 2002 and 2005 showed a mixed pattern mostly with no increased concentrations, but some elevated biological responses suggesting past exposure. Exposure of cod sperm cells to environmentally relevant concentrations (100, 200, 500 ppm) of produced water from the Hibernia platform, Newfoundland, did not result in a strong toxicity to the cells (only subtle changes were observed) or a significant change in fertilisation rate (Hamoutene *et al.* 2010).

The OSPAR QSR (2010) noted that results from water column monitoring are complex to interpret, particularly for wild fish for which it is not possible to link observed biological responses to a specific exposure source. Monitoring data are limited and do not yet allow conclusions to be drawn on the significance of observed responses for marine life and ecosystems. However, OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations includes a presumption against the discharge to sea of produced water from new developments. Only under certain circumstances (e.g. injection pump maintenance) may the effluent be routed to sea. Any produced water discharged will be treated since it is still required to meet legal quality standards in terms of oil in water concentration (DECC 2011).

Drilling wastes are a major component of the total waste streams from offshore exploration and production, with typically around 1,000 tonnes of cuttings resulting from an exploration or development well. Water-based mud cuttings are discharged at, or relatively close to sea surface during “closed drilling” (i.e. when steel casing and a riser is in place), whereas surface hole cuttings will be discharged at seabed during “open-hole” drilling. Use of oil based mud systems, for example in highly deviated sections or in water reactive shale sections, would require the onshore disposal or reinjection of a proportion of waste material (DECC 2011).

In contrast to historic oil based mud discharges, effects on seabed fauna of the discharge of cuttings drilled with WBM and of the excess and spent mud itself are usually subtle or undetectable, although the presence of drilling material at the seabed close to the drilling location (<500m) is often detectable chemically (e.g. Cranmer 1988, Neff et al. 1989, Hyland *et al.* 1994, Daan & Mulder 1996). Considerable data has been gathered from the North Sea and other production areas, indicating that localised physical effects are the dominant mechanism of ecological disturbance where water-based mud and cuttings are discharged (DECC 2011).

Currie & Isaacs (2005) reported that water based drilling muds and associated cuttings modified population densities of benthic infaunal species at sampling sites up to 200m from an exploration well in the Minerva field, Australia. The most pronounced effects were evident within 100m of the well-head, where declines in density of most abundant species exceeded 70% immediately following drilling. However, effects on the community structure at sites 100 and 200m from the wellhead did not persist beyond four months as natural species recruitment swamped residual effects over the same period. In contrast, benthic communities at the well-head site remained modified 11 months after drilling, in spite of recoveries in species diversity and abundance. This persistent community difference was likely due to the physical modification of the sediment at this site by drill cuttings discharge.

OSPAR (2009) concluded that the discharge of drill cuttings and water-based fluids may cause some smothering in the near vicinity of the well location. The impacts from such discharges are localised and transient, but may be of concern in areas with sensitive benthic fauna, for example corals and sponges.

In addition to these mainly platform-derived discharges, a range of discharges is associated with operation of subsea infrastructure (hydraulic fluids), pipeline testing and commissioning (treated seawater), and support vessels (sewage, cooling and drainage waters). Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades, and oil concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated. Amendments to the Offshore Chemical Regulations (2002) in 2011 mean that additional activities are now captured within a permit. The effects of marine discharges are judged to be negligible in the context of proposed licensing and the Natura 2000 sites in the area and are not considered further here. They would also be considered in detail in project-specific Environmental Statements, AAs (where necessary) and chemical risk assessments under existing permitting procedures.

6.4 Other effects

Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, non-native species may be introduced to the marine environment. Should these introduced species survive and form established breeding populations, they can exert a variety of negative effects on the environment. These include: displacing native species by preying on them or out-competing them for resources such as prey and habitat; irreversible genetic pollution through hybridisation with native species; increased occurrence of toxic algal blooms. The economic repercussions of these ecological effects can also be very significant. In response to these risks, a number of technical and procedural measures have been proposed (such as the use of ultraviolet radiation to treat ballast water) or introduced such as a mid-ocean exchange of ballast water (the most common mitigation against introductions of non-native species). International management of ballast waters is addressed by the International Maritime Organisation (IMO) through the International Convention for the Control and Management of Ships Ballast Water & Sediments, which was ratified in 30 States in 2005. The Convention includes Regulations with specified technical standards and requirements (IMO Globallast website).

The potential effects of light on birds have been raised in connection with offshore oil and gas over a number of years (e.g. Wiese *et al.* 2001). As part of navigation and worker safety, oilfield installations and associated vessels are lit at night and the lights will be visible at distance (some 10-12nm in good visibility). Furthermore, the flaring of hydrocarbons generates a bright light which may also be visible over a considerable distance. Platform illumination and flares have been shown to have an attractive effect on many species of seabird; this attraction is enhanced by conditions of poor visibility such as fog, haze and drizzle (Wiese *et al.* 2001 and references therein). Bird mortality resulting from collisions with the structure and flare (leading to incineration) is the primary concern, although any such mortality will be several orders of magnitude lower than that of natural or other anthropogenic mortality (e.g. predation by domestic cats) and is not considered to be significant at a population-level. The lights on installations and vessels are primarily non-flashing so the strong behavioural effects noted by Bruderer *et al.* (1999) in response to a strong searchlight being switched on and off are not anticipated. Potential effects can be mitigated through the control or avoidance of well test and routine flaring during production, and timing controls can be used since drilling and construction are temporary activities. It is therefore concluded that light effects will not affect site integrity, nor undermine the conservation objectives of sites with qualifying mobile species which could potentially interact with illuminated platforms and vessels.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with hydrocarbon exploration and production is possible, particularly in SPAs established for shy species. Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. As with light, it is considered this source of potential effect will not result in significant disturbance to the species within Natura 2000 sites or threaten the viability of populations of qualifying features at the sites because of the location of the SPAs relative to the Block. Available mitigation measures include strict use of existing shipping and aircraft routes, timing controls on temporary activities to avoid sensitive periods. Oil and gas developments also tend to be primarily subsea infrastructure based, and therefore any disturbance at the sea surface is reduced to periods of construction and decommissioning only, with the likelihood of adverse significant impacts on disturbance to species is further reduced. It is therefore concluded that adverse effects from physical disturbance are not expected.

6.5 Implications for relevant European Sites

The screening process (summarised in Appendix B) did not identify that the conservation objectives/status of any of the relevant sites would be undermined by the potential for physical disturbance, discharge effects or the potential light effects in any relevant sites, largely due the distance between the blocks under consideration and Natura 2000 sites. The potential for physical disturbance, including acoustic disturbance, was noted for a number of sites which are discussed below. Additionally, any potentially damaging activities that could following licensing of Block 103/1 would be subject to statutory risk assessment, mitigation and permitting measures, which would include assessment of the potential effects on the integrity of Natura 2000 sites.

6.6 Conclusions

Block 103/1 is in the centre of the St George's Channel, at least 30km from any coast and remote from most Natura 2000 sites, the closest site boundary being that of the Pembrokeshire Marine SAC, 5km to the east. While new pipelines could conceivably come ashore to existing terminals in Milford Haven, either through or near to coastal SACs and SPAs, there are well proven methods to prevent significant impacts. There is a legal framework, including the EIA regulations and those implementing the Habitats Directive, to ensure that there are no adverse effects on the integrity of Natura 2000 sites. Adverse effects identified with regards to physical effects on the seabed, marine discharges and other disturbance effects (e.g. lighting, vessel and aircraft traffic), when aligned with project level mitigation and relevant activity permitting, will not threaten the long-term viability of qualifying habitats and/or populations of species of the Natura 2000 sites considered in this assessment.

Taking into account the information presented above and in the Appendices, it is concluded that activities arising from the licensing of Block 103/1 will not cause an adverse effect on the integrity of the European Sites, though consent for activities will not be granted unless the operator can demonstrate that the proposed activities, which may include the drilling of a well, will not have an adverse affect on the integrity of European Sites.

7 Consideration of sites and potential acoustic effects

7.1 Overview of effects of acoustic disturbance

Of all marine organisms, marine mammals are regarded as the most sensitive to acoustic disturbance, due to their use of acoustics for echolocation and vocal communication and their possession of lungs which are sensitive to rapid pressure changes. Most concern in relation to seismic noise disturbance has been related to cetacean species. However, some pinnipeds are known to vocalise at low frequencies (100-300Hz) (Richardson *et al*. 1995), suggesting that they have good low frequency hearing and are therefore sensitive to acoustic disturbance. Otters in coastal habitats may also experience acoustic disturbance from seismic exploration or piling. However, they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited.

Many species of fish are highly sensitive to sound and vibration (review in MMS 2004). Exposure to high sound pressure levels has been shown to cause long-term (>2 months) damage to sensory cells in fish ears (Hastings *et al*. 1996, McCauley *et al*. 2003). Other reported effects include threshold shifts (hearing loss), stress responses and other behaviour alterations (review in Popper *et al*. 2003). A number of field studies have observed displacement of fish and reduced catch rates, suggested to be attributable to behavioural responses to seismic exploration (e.g. Skalski *et al*. 1992, Engås *et al*. 1996, Hassel *et al*. 2004, Slotte *et al*. 2004). While lamprey, shad and Atlantic salmon are the only qualifying fish species of relevant European Sites in the St George's Channel area, numerous fish species present in the region provide important components of the diet of qualifying species of other relevant European Sites, such as grey seal *Halichoerus grypus* and several seabird species.

There are currently no UK Natura 2000 sites with mobile marine invertebrates as qualifying features. However, as with fish, invertebrates such as crabs and squid may form an important component of the diet of qualifying species of relevant European Sites, for example grey seal. The study of effects of seismic noise on invertebrates is limited, and it has been suggested that no reliable conclusions can be made that negative effects exist or not (Moriyasu *et al.* 2004). Recent studies into the effects of seismic exploration on crustaceans have shown no significant long term effects on physiology, behaviour or catch rates (Christian *et al*. 2003, DFO 2004, Parry & Gason 2006). Due to their well developed nervous system, cephalopods such as squid may be more sensitive to seismic noise than other invertebrates; however, evidence for effects of seismic noise on them is very limited (review in Moriyasu *et al*. 2004).

Direct effects on seabirds because of seismic exploration noise could occur through physical damage, or through disturbance of normal behaviour. Diving seabirds (e.g. auks) may be most at risk of acute trauma. The physical vulnerability of seabirds to sound pressure is unknown, although McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic in some species (penguins) would be high, hence only at short ranges would individuals be adversely affected. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. A study has investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thickbilled murre (Brünnich's guillemot). Impact on prey species (e.g. fish) could undermine conservation objectives for sites through the deterioration of conservation status, for instance this may represent an indirect disturbance to qualifying species, or a temporary deterioration of the functioning of the habitats which support qualifying species, though mitigation measures are available (see Section 7.5) the implementation of which will also be assessed in detail once project plans are available.

Airborne noise, for example from helicopter overflights, could potentially disturb birds in coastal SPAs, although in the context of other military and civilian aircraft activities the anticipated level of E&P related noise is insignificant. In specific cases of concern, mitigation through routeing restrictions could be implemented.

7.2 Noise sources and propagation

Compared to the noise derived from seismic surveys and piling, noise from other oil and gas activities is relatively minor; previous DECC SEAs have assessed noise in some detail, and the following discussion is focussed on seismic noise as the primary concern. The potential for significant effect is therefore largely related to the anticipated type, extent and duration of seismic survey associated with proposed licensing (although no seismic survey is proposed by the work programme). The range over which noise propagates (and effects may result) varies with water depth, density stratification, substrate and other factors, and is therefore area-specific.

7.2.1 Seismic survey

With the exception of explosives and modern military sonar (and possibly wind farm monopile piling), airgun arrays used for seismic surveys are the highest energy man made sound sources in the sea; broadband peak-to-peak (p-p) source levels of 248-259dB re 1µPa are typical of large arrays (Richardson *et al*. 1995). The proposed work programme for the Blocks does not include undertaking a 2D or 3D seismic survey. However, prior to the drilling of a proposed drill or drop well, a rig site survey would be required to determine the presence of shallow gas deposits or any other potential hazard prior to locating a drilling rig. Rig site surveys utilise much reduced source level in comparison to deep seismic; a typical equipment spread includes analogue sidescan sonar (100/500kHz), hull-mounted single beam echo sounder, multibeam swathe bathymetry and subbottom profiler. For some high resolution digital surveys a small airgun source of 150-200 cubic inches may be used. The area covered by rig site surveys is small (a few km^2) and the surveys are of short duration (<5 days).

The offshore energy SEA process has reviewed general aspects of noise propagation. Most environmental assessments of noise disturbance in deeper water use simple spherical propagation models to predict sound pressure levels at varying distances from source. However, additional signal modification and attenuation may result from a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium. In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed).

In general, as distance from the array increases, higher frequencies are attenuated more rapidly and beyond a few kilometres, the main contribution is in the 2kHz region. Finally beyond around 12km it will be the main low-frequency pulse of around 250Hz that has the main contribution. However, local propagation effects may have significant influence: for example frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal. Simple models of geometric transmission loss may therefore be unreliable in relatively shallow water; in areas of complex seabed topography and acoustic reflectivity; where vertical density stratification is present in deep water; and where the noise does not originate from a point source. In the St George's Channel, Goold and Fish (1998) recorded 8kHz sounds above background levels at a range of 8km from the source, even in a high noise environment.

7.2.2 Other activities

Pile-driving of foundations may generate high source levels and has been widely recognised as a potential concern, in particular for large offshore wind developments where many piles may be installed sequentially over long time scales (as reviewed in DECC 2011). Brandt *et al.* (2011) reporting on piling operations at the Horns Rev II site off the Danish west coast, indicated that during 1 pile driving event, the peak noise level reached 196 dB re 1 μPa, the sound exposure level (SEL) reached a maximum of 176 dB re 1 μPa^2 s and the M-weighted SEL (see below) reached 170 dB re 1 μPa^2 s at 720m distance. At a distance of 2,300m, peak levels reached 184 dB re 1 μPa, SEL 164 dB re 1 μPa^2 s and M-weighted SEL reached 157 dB re 1 μPa^2 s. Pile-driving also occurs in connection with oil and gas facilities, although the pile diameters are smaller than wind turbine monopiles and typically result in lower source levels and durations.

Available measurements indicate that drilling activities produce mainly low-frequency continuous noise from several separate sources on the drilling unit (Richardson *et al*. 1995, Lawson *et al*. 2001). The primary sources of noise are various types of rotating machinery, with noise transmitted from a semi-submersible rig to the water column through submerged parts of the drilling unit hull, risers and mooring cables, and (to a much smaller extent) across the air-water interface. Noise transmission from jack-up rigs used in shallower water is less because of limited coupling with the water column. Under some circumstances, cavitation of thruster propellers is a further appreciable noise source, as may be the use of explosive cutting methods (e.g. for conductor removal).

Measured farfield sound pressure of around 170dB re 1μPa, in the frequency range 10-2000Hz (Davis *et al.* 1991) is probably typical of drilling from a semi-submersible rig and is of the same order and dominant frequency range as that from large merchant vessels (e.g. McCauley 1994). Drilling noise has also been monitored west of Shetland, in the vicinity of the Foinaven and Schiehallion developments (Swift & Thompson 2000). High and variable levels of noise were initially believed to result from drilling related activity on two semi-submersible rigs operating in the area. However, subsequent analysis found more direct correlation between the use of thrusters and anchor handlers, during rig moves, and high levels of noise (Swift & Thompson 2000). Further measurements of drilling and pipelay noise in the North Sea have been undertaken (Nedwell & Needham 2001, Nedwell *et al*. 2001, Nedwell *et al*. 2002). Drilling duration may range from a few weeks for an exploration well, to years in the case of a large development programme.

Pipelay operations will result mainly in continuous noise (associated with rotating machinery), with relatively little impulse or percussive noise in comparison to many other marine construction activities. The overall source levels resulting from pipelay operations on the UKCS have not been measured, however, near-field cumulative sound levels associated with pipelay for the Clair field development were predicted to be a maximum of 177dB (Lawson *et al*. 2001), with a duration of weeks or months.

Although there is little published data, noise emission from production platforms is thought to be qualitatively similar to that from ships, and is produced mainly by rotating machinery (turbines, generators, compressors) (Richardson *et al*. 1995).

A further source of noise associated with all stages of the offshore oil industry is helicopter overflights. There is relatively little quantitative information on the transmission of helicopter airborne noise to the marine environment (Richardson *et al*. 1995). Measurements of an airsea rescue helicopter over the Shannon estuary (Berrow *et al*. 2002) indicated that due to the large impedance mismatch when sound travels from air to water, the penetration of airborne sound energy from the rotor blades was largely reflected from the surface of the water with only a small fraction of the sound energy coupled into the water.

7.2.3 Effects thresholds

Richardson *et al.* (1995) defined a series of zones of noise influence on marine mammals, which have been generally adopted by SEAs and EAs undertaken in relation to previous Licensing Rounds. Similarly, data on marine mammal responses have been exhaustively reviewed (e.g. Richardson *et al*. 1995, Gordon *et al*. 1998, Lawson *et al*. 2001, Simmonds *et al*. 2003, Nowacek *et al*. 2007, Weilgart 2007, Southall *et al*. 2007). Four zones are recognised which will generally occur at increasing sound level: (1) the zone of audibility; (2) zone of responsiveness; (3) zone of masking; (4) zone of hearing loss, discomfort or injury. Potential acute effects include physical damage, noise-induced hearing loss (temporary and permanent threshold shifts, TTS and PTS respectively) and short-term behavioural responses. Postulated chronic effects (for which evidence is almost entirely absent) include long term behavioural responses, exclusion, and indirect effects. The most likely physical/physiological effects are generally considered to be shifts in hearing thresholds and auditory damage.

There is now a reasonable body of evidence to quantify noise levels associated with both seismic survey and pile-driving, and to understand the likely propagation of such noise within the marine environment. There is less clarity about the potential effects on marine mammals (and other receptors including fish), particularly in relation to distinguishing a significant behavioural response from an insignificant, momentary alteration in behaviour. Consequently, recent expert assessments have recommended that onset of significant behavioural disturbance resulting from a single pulse is taken to occur at the lowest level of noise exposure that has a measurable transient effect on hearing. A similar approach can be taken to multi-pulsed sounds although the evidence base is small and contradictory.

Behavioural responses to anthropogenic noise have generally been studied by visual or acoustic monitoring of abundance. Visual monitoring of cetaceans during seismic surveys has been carried out for several years throughout the UKCS. Statistical analysis of 1,652 sightings during 201 seismic surveys, representing 44,451 hours of observational effort, was reported by Stone (2003) and Stone & Tasker (2006). Sighting rates of white-sided dolphins, white-beaked dolphins, *Lagenorhynchus* spp., all small odontocetes combined and all cetaceans combined were found to be significantly lower during periods of shooting on surveys with large airgun arrays. In general, small odontocetes showed the strongest avoidance response to seismic activity, with baleen whales and killer whales showing some localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

Brandt *et al.* (2011) reported on the spatial and temporal scale of behavioural responses of harbour porpoises to construction noise at the Horns Rev II offshore wind farm site. Porpoise acoustic activity (measured by passive acoustic monitoring devices (T-PODs)) was reduced by 100% during 1h after pile driving and stayed below normal levels for 24 to 72 h at a distance of 2.6km from the construction site. This period gradually decreased with increasing distance. A negative effect was detectable out to a mean distance of 17.8km. At 22km it was no longer apparent, instead, porpoise activity temporarily increased. This might indicate that porpoises at this distance showed no behavioural reaction to pile driving.

Animals moving away from the construction site might have caused porpoise abundance and thus porpoise acoustic activity to temporarily increase as animals aggregated there. Out to a distance of 4.7km, the recovery time was longer than most pauses between pile driving events. Consequently, porpoise activity and possibly abundance were reduced over the entire 5 month construction period.

Both harbour and grey seals have shown short-term avoidance behaviour during controlled exposure experiments with small airguns (Thompson *et al*. 1998). In both cases seals abandoned foraging sites and swam away from airguns but returned to forage in the same areas on subsequent days. By contrast, Harris *et al.* (2001) making observations from a seismic vessel operating in a shallow lagoon system in the Canadian Arctic, found no significant change in sightings rate between firing and non firing periods. Mean radial distance to sightings did increase, suggesting some local avoidance behaviour.

7.2.4 Injury and behavioural criteria

The Offshore Energy SEAs (DECC 2009b, 2011) reviewed recent data and recommendations for injury and behavioural criteria for noise assessment in marine mammals, although with emphasis on pulse noise from high-energy deep seismic survey and pile-driving. The OESEA utilised injury criteria proposed by Southall *et al*. (2007) composed both of unweighted peak pressures and M-weighted sound exposure levels which are an expression for the total energy of a sound wave. The M-weighted function also takes the known or derived species-specific audiogram into account. For three functional hearing categories of cetaceans, proposed injury criteria are an unweighted 230dB re 1μPa p-p for all types of sounds and an M-weighted sound exposure level of 198 or 215dB re 1 $\mu Pa^2 \cdot s$ for pulsed and non-pulsed sounds respectively. For pinnipeds, the respective criteria are 218dB 1μPa p-p for all types of sound and 186 (pulsed) or 203 (non-pulse) dB re 1 $\mu Pa^2 \cdot s$ (M-weighted). These proposals are based on the level at which a single exposure is estimated to cause onset of permanent hearing loss (PTS), by extrapolating from available data for TTS.

Southall *et al*. (2007) concluded that developing behavioural criteria was challenging, in part due to the difficulty in distinguishing a significant behavioural response from an insignificant, momentary alteration in behaviour. Consequently, they recommended that onset of significant behavioural disturbance resulting from a single pulse is taken to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (i.e. TTS-onset). These criteria for single pulses are an unweighted 224dB re 1μPa p-p and an M-weighted sound exposure level of 183dB re 1 $\mu Pa^2 \cdot s$ for three functional hearing categories of cetaceans, and 212dB re 1μPa (p-p) and 171dB re 1 $\mu Pa^2 \cdot s$ (M-weighted) for pinnipeds.

For multiple pulse and non-pulse (i.e. continuous) sources, Southall *et al*. (2007) were unable to derive explicit and broadly applicable numerical threshold values for delineating behavioural disturbance, and suggested that a context-based approach to deriving noise exposure criteria for behavioural responses will be necessary.

Based on the criteria developed by Southall *et al*. (2007), and the data reported by Lucke *et al*. (2009), indicative spatial ranges of injury and disturbance for cetaceans and pinnipeds may be calculated as indicated in Table 7.1 below. Calculated ranges for the Southall *et al*. (2007) criteria suggest that there is negligible risk of auditory damage to cetaceans, and a low to moderate risk of seals being within the required range (63m assuming modified cylindrical spreading) of seismic operations. Modified cylindrical spreading is usually considered to occur in water depths <1.5x range, i.e. spherical spreading (20logR) will occur to a range of 60m in a water depth of 40m.

Table 7.1: Indicative spatial ranges of various injury and disturbance indicators for cetaceans and pinnipeds

	Cetaceans seismic	**Pinnipeds** seismic
Nominal vertical source level (dB p-p)	260	260
Horizontal array correction	-15	-15
Effective horizontal source level	245	245
Injury sound pressure level (multiple pulses; dB p-p)	230	218
Required propagation loss	15	27
Deep water (20logR) distance (m)	**5.6**	**22.4**
Shallow water (15logR) distance (m)	**10.0**	**63.1**
Behavioural response sound pressure level (single pulse; dB p-p)	224	212
Required propagation loss	21	33
Deep water (20logR) distance (m)	**11.2**	**44.7**
Shallow water (15logR) distance (m)	**25.1**	**158.5**
MTTS (4kHz) response sound pressure level in porpoise (single pulse; dB p-p)	200	
Required propagation loss	45.3	
Deep water (20logR) distance (m)	**184**	
Shallow water (15logR) distance (km)	**1.05**	

Source: Southall et al. (2007), Lucke et al. (2009)

The ranges affected by potential auditory injury resulting from modelled seismic survey, which assume a much larger source level than will be used for proposed site survey in the Blocks, represent a small proportion of the marine areas used by seals (and cetaceans) associated with European Sites in the region. Larger proportions of the overall ranges may be affected by noise levels possibly associated with behavioural modification, although the ecological significance of such postulated effects have not been demonstrated. It is acknowledged here that injury and disturbance do not necessarily lead to an adverse impact on the integrity of a European site under the Habitats Directive, and indeed disturbance licences can be granted for certain levels of activity, without site integrity being compromised. Therefore, disturbance effects both within and beyond site boundaries are not expected to have consequent effects on site integrity.

Popper *et al*. (2006) suggested interim criteria for injury of fish exposed to pile driving operations, although note that the majority of the evidence base for such criteria is derived from studies of seismic and explosive noise sources. A peak sound pressure level of 208dB re 1µPa for single pulses is proposed. This is supported by the findings of Popper *et al*. (2005) who showed that TTS onset (physiological fatigue and not damage) in three species of fish exposed to seismic air-gun pulses occurred within the range of 205-210dB re 1 µPa (p-p). Popper *et al*. (2006) considered available data as too sparse to set clear-cut science-based criteria for behavioural disturbance of fish or auditory masking from pile driving.

Seismic exploration noise could potentially result in direct effects on seabirds through physical damage, or through disturbance of normal behaviour. Diving seabirds (e.g. auks) may be most at risk of physical damage. The physical vulnerability of seabirds to sound pressure is unknown, although McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic in little penguins would be high, hence only at short ranges would penguins be adversely affected. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. A study of seabird abundance in Hudson Strait (Atlantic Canada) during seismic surveys over three years (Stemp 1985) compared periods of shooting and non-shooting, found no significant difference in the abundance of fulmar, kittiwake and thickbilled murre (Brünnich's guillemot). Lacroix *et al*. (2003) in a study of long tailed ducks in the Beaufort Sea, found no difference in indices of site fidelity or diving intensity between the seismic area and two control areas although they could not discount subtle effects. It is therefore considered that offshore seismic noise will not result in significant injury or behavioural disturbance to seabirds in the general area.

7.3 Implications for relevant European Sites

As discussed above, it is considered that marine mammals and migratory fish are the only qualifying species which may potentially be affected (in terms of conservation status) by acoustic disturbance. It is noted that effects on fish which are also prey species (e.g. for marine mammals and birds), and may therefore result in the undermining of conservation objectives of qualifying species, are unlikely from noise sources associated with oil and gas activities, with noise levels suggested to cause injury to fish not extending beyond a few tens of metres around the noise source. Mandatory Habitats Regulations Assessment procedures will allow further consideration of the nature, timing and location of any planned activities and mitigation measures (see Section 7.5) deemed necessary to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). The screening process (Appendix B) identified the potential for acoustic disturbance in the following sites:

7.3.1 Cardigan Bay/Bae Ceredigion SAC

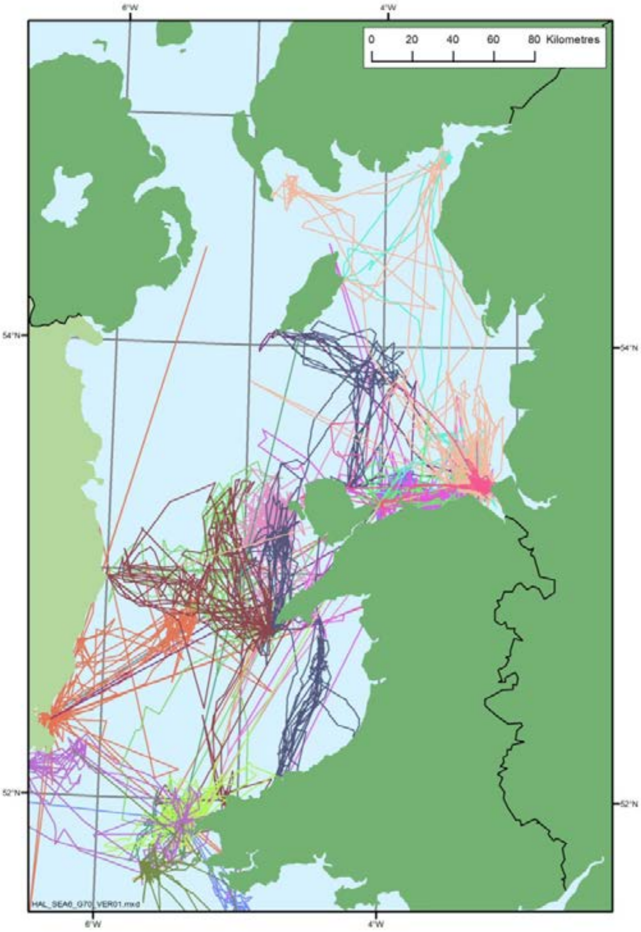
(Annex II species: bottlenose dolphin *Tursiops truncatus*; grey seal *Halichoerus grypus,* sea lamprey *Petromyzon marinus,* river lamprey *Lampetra fluviatilis*)

Extensive information on the distribution of British grey seals at sea is available from models of habitat preference derived from satellite telemetry data (McConnell *et al.* 1999, Matthiopoulos *et al.* 2004, Murphy *et al.* 2008). At sea, movements range from short-range return trips from haul-out sites to local foraging areas, to extended journeys between distant haul-out sites. Foraging trips from haul-out sites usually last between two and five days, with seals targeting localised areas generally within 50km of haul-out sites; these areas are typically characterised by gravel/sand seabed sediment, the preferred burrowing habitat of sandeels, an important component of grey seal diet. Moulting and resting haul-out sites are scattered along the SAC, though none are used by large numbers of seals, instead they generally haul-out singly or in small groups in undisturbed locations. The south-west Wales population is the most southerly in Europe of any significant size and is relatively isolated from those elsewhere in the UK. It forms around 4% of the UK population or about 3.5% European population. Seals tend to use secluded coves and caves for pupping instead of forming large 'rookery' congregations of pupping females on open sites as found elsewhere in the UK (CCW 2009a).

Satellite tagging of 19 grey seals at Irish Sea colonies from July to December 2004 provides some information of their distribution at sea. These data, in combination with counts of animals at haul-out sites in summer, forms the basis of models predicting marine usage by grey seals in the Irish Sea. The data show greater usage of coastal areas of Pembrokeshire and further to the north by grey seals than in the region of the Block (Figure 7.1).

Bottlenose dolphins occur in Cardigan Bay throughout the year, with numbers reaching a maximum in the summer, peaking in September and October with aggregations of up to 60 individuals. Around 100-200 individuals are estimated to be present, with population estimates varying from year to year. There appears to have been a rise in population between 2001 and 2007, though there is low confidence in some estimates. The same individuals have been observed with relative consistency for periods of five or six consecutive years, with others being apparently absent for some years before returning. Interaction with this population of dolphins and those from Ireland or south England is presently not well understood, nor are population trends in Cardigan Bay. Calving is known to take place, possible seasonally, in Cardigan Bay with observations of very young calves between April and September. The full range of individuals is not known and is likely to vary depending on prey distribution/sea conditions etc., though they are regularly seen to the north and south of the SAC boundary (e.g. a sizeable portion have been seen in North Wales in at least part of the winter 2007-08) and minimum inshore ranges vary from 160-774km^2 (CCW 2009a).

Figure 7.1: Grey Seal satellite tag tracks from SEA funded SMRU seal tagging



7.3.1.1 Consideration

Simple calculations of sound propagation can be made to estimate the likely maximum received sound levels at the boundaries of relevant European Sites should a typical seismic survey occur in the Block applied for (although none currently proposed); the results of these are presented in Table 7.2. Most environmental assessments of noise disturbance use simple spherical propagation models of the form SPL = SL – 20log(R), where SL = source level, R = source-receiver range, to predict sound pressure levels (SPL) at varying distances from source. Cylindrical spreading, SPL = SL – 10log(R), is usually assumed in shallow water, depth < R. However, several workers have measured or modelled additional signal modification and attenuation due to a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium (see SEA 4 Environmental Report). In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed). Attenuation of signal with distance is frequency dependent, with stronger attenuation of higher frequencies with increasing distance from the source. Frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal.

In the case of the Cardigan Bay SAC, the minimum direct linear range from the SAC boundary to Block 103/1 is approximately 60km, giving a propagation loss (assuming 15logR) of around 72dB[7], or a received sound level of 158dB re 1μPa p-p for a typical seismic survey. This level is lower than the injury criteria proposed by Southall *et al.* (2007) in cetaceans and pinnipeds for both pulsed and non-pulsed sounds, and also below those proposed for the onset of TTS (postulated as significant behavioural disturbance) for pulsed sounds.

Table 7.2: Estimated received sound levels in relevant European Sites associated with a typical seismic survey

Site	Relevant qualifying Annex II species	Minimum distance (km)	Received sound level (dB re 1μPa peak-to-peak)
Cardigan Bay/Bae Ceredigion SAC	Bottlenose dolphin, Grey seal	60	158
Pembrokeshire Marine/Sir Benfro Forol SAC	Grey seal	5	175
Saltee Islands SAC (RoI)	Grey seal	40	161

Seismic survey occurring in the proposed licence Block will be audible to seals and dolphins over a large area, characterised by moderate marine usage by foraging grey seals associated with the Cardigan Bay, Pembrokeshire Marine and Saltee Islands SACs and smaller adjacent haul-out sites. The exact effects which this may have are unknown, although available evidence suggests that significant effects at a population or individual level are unlikely.

Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source, and would therefore not propagate into the SAC and have very limited potential for spatial overlap with seals foraging beyond the boundary of the SAC. Furthermore, distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals (see Section 7.5). Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

If significant ecological effects on prey species were to occur, even at considerable distances from relevant SACs, these may influence the breeding population of the site. However, noise levels suggested to cause injury to fish (the primary prey species of seals and dolphins) would not extend beyond a few tens of metres around the noise source. The

[7] Assumes a source level of 250dB re 1μPa peak-to-peak, a correction factor of -20dB to compensate for horizontal array effects, and a propagation loss of 15log(R). Figure rounded to the nearest whole number.

range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that the extent of any such disturbance of prey species is highly unlikely to undermine the conservation objectives in relation to bottlenose dolphins and grey seals from Cardigan Bay/Bae Ceredigion SAC (e.g. long-term maintenance of population levels and the natural range of the population, and those habitats which help maintain these levels; an increase in the population of bottlenose dolphin).

Qualifying fish species present include the migratory sea lamprey and river lamprey. Sea lamprey inhabit both shallow coastal and deep offshore waters, but migrate into fresh water to spawn. The River Teifi SAC is of high conservation value for spawning river lamprey which have also been recorded migrating up the River Aeron. Lamprey migrate through the waters of Cardigan Bay and are likely to spend some of their time in coastal waters during non-breeding stages of their lifecycle. Significant propagation of underwater noise into shallow enclosed and semi-enclosed bays and estuaries is not expected, therefore the potential for effects is restricted to sea lamprey occupying marine areas. Considering the low densities of sea lamprey which can be expected in offshore areas, their lack of a swim bladder, and the aforementioned limited range of significant effects of seismic survey on fish, significant effects on qualifying fish species are unlikely. Furthermore, the potential for impact can be mitigated through timing of seismic survey to avoid the period of lamprey entry into the rivers and consequently significant effects on this qualifying feature can be avoided.

The proposed work programme for the Block does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species at a population or individual level.

7.3.2 Pembrokeshire Marine/Sir Benfro Forol SAC

(Annex II species: grey seal *Halichoerus grypus*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *Alosa fallax,* otter *Lutra lutra*)

The characteristics of grey seal colonies in the Pembrokeshire Marine SAC are broadly similar to those described for Cardigan Bay, above, and Figure 7.1 and Table 7.1 are also relevant to the Pembrokeshire Marine SAC. The seals of Pembrokeshire Marine SAC are highly mobile, and are widely distributed in and beyond the site boundaries and throughout the open coast (CCW 2009b). Pupping takes place at suitable sites and there is high use of sea-caves by the south-west population which is unusual. Known winter moulting/non-moulting/resting haul-out sites are restricted to offshore islands and remote undisturbed and inaccessible rocky shores (CCW 2009b).

7.3.2.1 Consideration

Seismic survey occurring in the proposed licence Block will be audible to seals over a large area, characterised by moderate marine usage by foraging grey seals associated with the Pembrokeshire Marine SAC and smaller adjacent haul-out sites. The exact effects which this may have are unknown, although the distance of the SAC from the Block suggests that significant effects are unlikely.

Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source, and would therefore not propagate into the SAC and have very limited potential for spatial overlap with seals foraging beyond the boundary of the SAC. The SAC is approximately 5km from the Block, giving a propagation loss (assuming 15logR) of around

55dB[8], or a received sound level of 175dB re 1μPa p-p for a typical seismic survey. This level is lower than the injury criteria proposed by Southall *et al.* (2007) in pinnipeds for both pulsed and non-pulsed sounds, and also below those proposed for the onset of TTS (postulated as significant behavioural disturbance) for pulsed sounds. Furthermore, distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals (see Section 7.5). Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

If significant ecological effects on prey species were to occur, even at considerable distances from relevant SACs, these may influence the breeding population of the site. However, noise levels suggested to cause injury to fish (the primary prey species of seals and dolphins) would not extend beyond a few tens of metres around the noise source. The range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that the extent of any such disturbance of prey species is highly unlikely to have significant effects on relevant qualifying species.

Qualifying fish species present include the migratory river lamprey, sea lamprey and allis shad. Sea lamprey inhabit both shallow coastal and deep offshore waters, but migrate into fresh water to spawn, and though there is no information available for their range within the Pembrokeshire Marine SAC (CCW 2009b), it may be reasonably assumed that estuarine areas associated with rivers for which this is a qualifying species (e.g. Cleddau Rivers SAC) are either part of the migratory route for sea lamprey, or are more generally used by this species. Significant propagation of underwater noise into shallow enclosed and semi-enclosed bays and estuaries is not expected, therefore the potential for effects is restricted to sea lamprey occupying marine areas. Considering the low densities of sea lamprey which can be expected in offshore areas, their lack of a swim bladder, and the aforementioned limited range of significant effects of seismic survey on fish, significant effects on qualifying fish species are unlikely. Furthermore, the potential for impact can be mitigated through timing of seismic survey to avoid the period of lamprey entry into the rivers and consequently significant effects on this qualifying feature can be avoided.

Otters in coastal habitats may also experience acoustic disturbance from seismic exploration or construction piling. However, as they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited, and the Block in question is well offshore, effects are not predicted.

The proposed work programme for the Block does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species.

7.3.3 Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC

(Annex II species: Twaite shad *Alosa fallax*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, otter *Lutra lutra*)

---

[8] Assumes a source level of 250dB re 1μPa peak-to-peak, a correction factor of -20dB to compensate for horizontal array effects, and a propagation loss of 15log(R). Figure rounded to the nearest whole number.

7.3.3.1 Consideration

Qualifying fish species present include the migratory river lamprey, sea lamprey, twaite and allis shad. Though the range and habitat preference of sea and river lamprey in Carmarthen Bay is unknown, sea lamprey generally inhabit both shallow coastal and deep offshore waters, but migrate into fresh water to spawn. Given the presence of ammocoetes and juveniles in the rivers adjoining the SAC, it must be assumed that Carmarthen Bay is part of an important migration route for this species – fish from the Rivers Usk and Wye are also likely to use the inshore waters of the SAC (CCW 2009c). Considering the low densities of sea lamprey which can be expected in offshore areas, their lack of a swim bladder, and the aforementioned limited range of significant effects of seismic survey on fish, significant effects on qualifying fish species are unlikely. Furthermore, the potential for impact can be mitigated through timing of seismic survey to avoid the period of lamprey entry into the rivers and consequently significant effects on this qualifying feature can be avoided.

Shad migrate though the waters of Carmarthen Bay and Estuaries SAC to reach spawning sites in the River Tywi where counts of over 10,000 shad (*Alosa* spp.) have been made (CCW 2009c). The Taf-Tywi-Gwendraeth estuary is also an important nursery area for juveniles and it is likely that shad feed in the inshore waters of Carmarthen Bay.

Otters in coastal habitats may also experience acoustic disturbance from seismic exploration or construction piling. However, as they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited, and the Block in question is well offshore, effects are not predicted.

The proposed work programme for the Block does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species.

7.3.4 Saltee Islands SAC (RoI)

(Annex II species: grey seal *Halichoerus grypus*)

Seal populations around the south east coast of Ireland are small by comparison with those in Britain and there are small colonies along the Co. Wexford coast (Saltee Islands, Tuskar rocks, Hook Head peninsula) and Co. Waterford coasts (Dunmore East cliff caves, Tramore-Dungarvan cliffs) (Nairn *et al.* 1995). The population size and seasonal distribution of grey seals at principal haul-out sites in the central and southern Irish Sea were investigated in an INTERREG-funded study conducted between 1996 and 1998 by the National University of Ireland, Cork and the Wildlife Trust (Kiely *et al.* 2000) and more recently was assessed in Cadhla *et al.* (2005). Grey seals haul out to breed and moult on inaccessible beaches and caves on both the Welsh and Irish coasts. Sites on the south-east coast of Ireland contain significant numbers of grey seals throughout the year, peaking during the annual breeding (September-December) and moulting (November- March) seasons, with the most important site in the south east for grey seals being the Saltee Islands. The satellite tagging (Figure 7.1) showing the foraging range of individual grey seals in the Irish Sea and St George's Channel, and the estimates of received sound levels from seismic survey (Table 7.1) shown above are applicable to the Saltee Islands SAC.

7.3.4.1 Consideration

The SAC is over 30km from the Block and received sound levels within the site from a typical seismic survey would be well below injury criteria proposed by Southall *et al.* (2007)

in pinnipeds for both pulsed and non-pulsed sounds, and also below those proposed for the onset of TTS (postulated as significant behavioural disturbance) for pulsed sounds. Seismic survey occurring in the proposed licence Block will be audible to seals over a large area, characterised by moderate marine usage by foraging grey seals associated with the Saltee Islands SAC and smaller adjacent haul-out sites. The exact effects which this may have are unknown, although available evidence (see Section 7.2) suggests that significant effects at a population or individual level are unlikely.

Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source, and would therefore not propagate into the SAC and have very limited potential for spatial overlap with seals foraging beyond the boundary of the SAC. Furthermore, distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals (see Section 7.5). Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

If significant ecological effects on prey species were to occur, even at considerable distances from relevant SACs, these may influence the breeding population of the site. However, noise levels suggested to cause injury to fish (the primary prey species of seals) would not extend beyond a few tens of metres around the noise source. The range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that the extent of any such disturbance of prey species is highly unlikely to have significant effects on relevant qualifying species.

The proposed work programme for the Block does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species.

7.4 Riverine SACs

The potential for acoustic disturbance effects was identified for a number of riverine SACs including Afon Teifi/River Teifi, Afonydd Cleddau/Cleddau Rivers, River Barrow and River Nore, and Slaney River Valley. This was due to the presence of migratory Atlantic salmon and lamprey species as qualifying features. These species utilise estuarine, coastal and offshore marine areas for part of their life cycle. As stated in Section 5.3, salmonids play a critical role in the life cycle of the freshwater pearl mussel *Margaritifera margaritifera*, which is also a qualifying feature in the Slaney River Valley and River Barrow and River Nore SACs. Any potential impacts on viability of the Atlantic salmon population, its distribution or supporting habitats, should also be considered in the context of the freshwater pearl mussel.

Atlantic salmon leave rivers to enter the marine environment during spring-summer as smolts, before migrating to feeding areas in Nordic Seas and West Greenland. Following 1-3 years at sea, adult salmon return to their home rivers primarily during summer months. Due to their low densities and the highly localised range of noise levels likely to cause injury to fish, the potential for acoustic disturbance effects is restricted to disruption to their migration from, and principally to, the designated rivers. The potential for impact can be mitigated through timing of seismic survey to avoid the period of peak salmon entry into the rivers and consequently undermining the conservation objectives in relation to both Atlantic salmon, and by association, the freshwater pearl mussel, can be avoided.

The Slaney River Valley, River Teifi, Cleddau Rivers and River Barrow and River Nore SACs also maintain populations of sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* (both favourable maintained). Both the river lamprey and sea lamprey migrate up rivers to spawn and spend the larval stage buried in muddy substrates in freshwater. Once metamorphosis takes place, the adults migrate to the sea where they live as a parasite on various species of fish. Sea lampreys are thought to inhabit both shallow coastal and deep offshore waters, venturing further than river lampreys. Significant propagation of underwater noise into shallow enclosed and semi-enclosed bays and estuaries is not expected, and therefore the potential for effects is restricted to lamprey occupying marine areas. As with other qualifying anadromous species, the potential for impact can be mitigated through timing of seismic survey to avoid the migratory periods of lamprey entry into the rivers and consequently significant disturbance to this qualifying feature can be avoided.

The proposed work programmes for the Block does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species.

7.5 Regulation and mitigation

Both planning and operational controls cover acoustic disturbance resulting from activities on the UKCS, specifically including geophysical surveying and pile-driving. Application for consent to conduct seismic and other geophysical surveys is made using *Petroleum Operations Notice No 14* (PON14) supported by an Environmental Narrative to enable an accurate assessment of the environmental effects of the survey. Consultations with Government Departments and other interested parties are conducted prior to issuing consent, and JNCC may request additional risk assessment, specify timing or other constraints, or advise against consent. Any proposed activity with a potentially significant acoustic impact on a designated SAC or SPA would also be subject to the requirement for Appropriate Assessment.

The major operational control and mitigation over seismic surveys in the UK are through JNCC's *Guidelines for minimising the risk of disturbance and injury to marine mammals from seismic surveys* (August 2010 revision reflects amendments (2007 and 2009 amendments) to the *Conservation (Natural Habitats &c.) Regulations 1994* (Habitat Regulations, HR) for England and Wales and the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (Offshore Marine Regulations, OMR, as amended in 2009 and 2010). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (& 2007 Amendments) for oil and gas related seismic surveys that the JNCC Seismic Guidelines are followed. European Protected Species (EPS) disturbance licenses can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007*.

The guidelines require visual monitoring of the area by a dedicated Marine Mammal Observer (MMO) prior to seismic testing to determine if cetaceans are in the vicinity, and a slow and progressive build-up of sound to enable animals to move away from the source. Passive Acoustic Monitoring (PAM) may also be required. Seismic operators are required, as part of the application process, to justify that their proposed activity is not likely to cause a disturbance etc. under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended). This assessment should consider all operational activities including shooting during hours of darkness or in poor visibility.

In their latest guidelines, JNCC (2010) advise that operators adopt mitigation measures which are appropriate to minimise the risk of an injury or disturbance offence[9] and stipulate, whenever possible, the implementation of several best practice measure, including:

- If marine mammals are likely to be in the area, only commence seismic activities during the hours of daylight when visual mitigation using Marine Mammal Observers (MMOs) is possible.
- Only commence seismic activities during the hours of darkness, or low visibility, or during periods when the sea state is not conducive to visual mitigation, if a Passive Acoustic Monitoring (PAM) system is in use to detect marine mammals likely to be in the area, noting the limitations of available PAM technology (seismic surveys that commence during periods of darkness, or low visibility, or during periods when the observation conditions are not conducive to visual mitigation, could pose a risk of committing an injury offence).
- Plan surveys so that the timing will reduce the likelihood of encounters with marine mammals. For example, this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for harbour seals or grey seals.
- Provide trained MMOs to implement the JNCC guidelines.
- Use the lowest practicable power levels to achieve the geophysical objectives of the survey.
- Seek methods to reduce and/or baffle unnecessary high frequency noise produced by the airguns (this would also be relevant for other acoustic energy sources).

Due to the importance of the area to marine mammals, DECC will expect that passive acoustic monitoring (PAM) will be routinely used as a mitigation tool.

In addition to marine mammal sensitivities, disturbance to populations of Atlantic salmon and other qualifying anadromous species can be mitigated through timing of seismic survey to avoid migratory periods and consequently significant disturbance can be avoided. In particular JNCC[10] highlight the sensitive post-smolt migration period for Atlantic salmon which takes place generally in spring to early summer (April and May), and that mitigation, including a presumption against seismic survey at this time, is considered.

7.6 Conclusions

Block 103/1 is at least several kilometres from the boundaries of SPAs, and direct significant effects on SPAs are not considered possible. Indirect mechanisms of effect, for example through disturbance of prey species, were also considered with the conclusion that these will not have an adverse effect on integrity (i.e. on population viability of qualifying bird species).

Significant effects arising from acoustic disturbance were only considered possible for SACs with marine mammals (specifically grey seal and bottlenose dolphin populations) and fish as qualifying features. Although seismic survey, drilling and other oil industry noise is detectable by marine mammals, waterbirds and their prey, there is no evidence that such noise presents a risk to the viability of populations in UK waters and specifically not within designated Natura 2000 sites. This would require direct mortality, behavioural response with implications for reproductive success (e.g. disturbance at fixed breeding locations) or reduced long-term ecological viability (e.g. sustained displacement from foraging grounds).

[9] Defined under Regulation 39 1(a) and 1(b) (respectively) of the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended) or Regulation 40 of The Conservation of Habitats and Species Regulations 2010 in territorial waters.
[10] JNCC's response to the 26th Seaward licensing Round.

In the localised areas of Natura 2000 sites designated for marine mammals, acoustic disturbance from seismic survey activity resulting from proposed licensing would be intermittent and there is no evidence that cumulative effects of previous survey effort have been adverse. Despite considerable scientific effort, no causal link, or reasonable concern in relation to population viability has been found.

In the case of Block 103/1, calculations considering the direct linear range to the SAC boundaries and the source level of a typical seismic survey suggest that received noise levels within all SACs will fall below relevant effects criteria as defined by Southall *et al*. (2007).

However, no seismic survey is proposed by the work programmes although rig site surveys may be required prior to locating a drilling rig. Should a rig site survey be proposed in the Blocks, further Habitats Regulations Assessment may be required to assess the potential for significant effects on site integrity once the area of survey, source size, timing and proposed mitigation measures are known and can form the basis for a definitive assessment.

Taking into account the information presented above and in the Appendices, it is concluded that activities which could arise from the proposed licensing of Block 103/1 will not cause an adverse effect on the integrity of the European Sites.

8 In-combination effects

8.1 Underwater noise

New seismic survey is not part of the work programme proposed for Block 103/1, but it cannot be ruled out. As this Block is distant from areas of existing hydrocarbon production (and hence e.g. seismic survey, drilling, vessel movements), any acoustic disturbance to marine mammals causing displacement from foraging areas will be short-term and infrequent. SMRU (2007) note that “The effects of repeated surveys are not known, but insignificant transient effects may become important if potentially disturbing activities are repeated and/or intensified”. Significant in-combination effects with hydrocarbon related activities in existing licensed blocks are not foreseen. There is the potential for cumulative noise impacts where concurrent and sequential activities result in long-term exposure to elevated noise levels within the wider area. However, the likelihood of this is low (because of technical interference) and subject to mitigation in the near future by measures introduced to achieve Good Environmental Status under the Marine Strategy Framework Directive.

Other noise producing activities which are likely to occur within the St George’s Channel include those associated with the development of marine renewable energy. Offshore wind energy is expected to undergo large-scale development in UK waters over the next 10 years, and the Bristol Channel Round 3 zone is the closest potential area of development to Block 103/1 and the conservation designations considered in this AA, and any development associated with this zone will be subject to EIA and HRA. Besides potential wind farm development, there is currently no infrastructure deployed in the region associated with the extraction of wave and tidal energy, and though no development zones (i.e. leasing areas) or projects are presently underway for the area in consideration, the tidal resource around the Pembrokeshire coast has the potential to be exploited by tidal stream technologies. As with any wind developments to be undertaken in proximity to the Natura 2000 sites considered here, these would be subject to EIA and their own HRA.

While the operation, maintenance and decommissioning of marine renewable energy developments will introduce noise into the marine environment, these are typically of low intensity. The greatest noise levels arise during the construction phase, and it is these which have the greatest potential for acoustic disturbance effects (see Faber Maunsell & Metoc 2007, DECC 2009b, DECC 2011). Pile-driving of mono-pile foundations is the principal source of construction noise, which will be qualitatively similar to pile-driving noise resulting from harbour works, bridge construction and oil and gas platform installation. Mono-pile foundations are the most commonly used for offshore wind farm developments at present. In relation to offshore pile-driving, standard conditions on consents for Round 2 (and anticipated for Round 3) offshore wind farms include various protocols to minimise the potential for acoustic disturbance of marine life, including the use of soft start, MMOs and PAM.

The “Statutory nature conservation agency protocol for minimising the risk of disturbance and injury to marine mammals from piling noise” (JNCC 2009) outlines a protocol for the mitigation of potential underwater noise impacts arising from pile driving during offshore wind farm construction.

In addition to those activities which may follow licensing of Block 103/1, and future marine renewable energy development, there are a variety of other existing (e.g. fishing, shipping, military exercise areas, aggregate extraction) and planned (e.g. gas exploration and production, energy generation from wave and tidal stream) noise-producing activities in overlapping or adjacent areas. Despite this, DECC is not aware of any projects or activities which are likely to cause cumulative or synergistic effects that when taken in-combination with the activities discussed above would adversely affect the integrity of the relevant European Sites. This is due to the presence of effective regulatory mechanisms in place to ensure that operators, DECC and other relevant consenting authorities take such considerations into account during activity permitting. In respect of oil and gas activities and other developments with the potential to affect Natura 2000 sites, these mechanisms also include project specific Habitats Regulations Assessments.

The Marine Strategy Framework Directive (2008/56/EC) (MSFD) requires that the European Commission (by 15 July 2010) should lay down criteria and methodological standards to allow consistency in approach in evaluating the extent to which Good Environmental Status (GES) is being achieved. ICES and JRC were contracted to provide scientific support for the Commission in meeting this obligation. A total of 10 reports have been prepared relating to the descriptors of GES listed in Annex I of the Directive.

Task Group 11 reported on underwater noise and other forms of energy (Tasker *et al*. 2010). The Task Group developed three possible indicators of underwater sound. In no case was the Task Group able to define precisely (or even loosely) when Good Environmental Status occurs on the axes of these indicators. This is partly to do with insufficient evidence and recognised scientific challenges but also to no fully accepted definition of when, for example, a behavioural change in an organism is not good.

DECC is cognisant of the ongoing MSFD Task Group 11 work to determine criteria for an indicator relating to high amplitude, low and mid-frequency impulsive anthropogenic sounds including those from pile driving, seismic surveys and some sonar systems. DECC will review the findings of this Task Group closely with respect to consenting of relevant activities which may result from the draft plan/programme, as well as other activities which generate noise in the marine environment. The establishment of noise criteria and the consenting of activities will require a coordinated approach across different industries and activities, possibly through the future marine planning system.

8.2 Other potential in-combination effects

Potential incremental, cumulative, synergistic and secondary effects from a range of operations, discharges, emissions (including noise), and accidents were considered in the Offshore Energy SEAs (DECC 2009b, 2011; see also OSPAR 2000, 2010).

8.2.1 Physical damage/change to features and habitats

Potential sources of physical disturbance to the seabed, and damage to biotopes, associated with oil and gas activities were identified by the OESEA2 as anchoring of semi-submersible rigs; wellhead placement and recovery; production platform jacket installation and piling; subsea template and manifold installation and piling; pipeline, flowline and umbilical installation and trenching and decommissioning of infrastructure (DECC 2011).

Of particular relevance would be any damage to shallow sandbank habitats (both within and outside designated areas such as the Cardigan Bay SAC) as these are potentially important foraging areas for bottlenose dolphins and other marine mammals.

In general, cumulative effects are likely to be dominated by trawling, with potential scour and physical damage from cable laying associated with potential offshore wind developments likely to be more important in the future. However, these developments will not be sited in areas where bottlenose dolphins are frequently recorded and therefore are unlikely to have a significant impact on foraging areas.

Given the forecast scale of activity, it is likely that there will be considerable spatial and temporal separation between disturbance "footprints" and a low probability of incremental overlap of affected areas. Recovery of affected seabed through sediment mobility, and faunal recovery and recolonisation is expected to be rapid (less than five years) where the source of effects is transient (e.g. anchoring).

8.2.2 Physical presence

Physical presence of offshore infrastructure and support activities may also potentially cause behavioural responses in fish, birds and marine mammals. Previous SEAs have considered the majority of such interactions resulting from interactions with offshore oil and gas infrastructure (whether positive or negative) to be insignificant; in part because the number of surface facilities is relatively small (of the order of a few hundred) and because the majority are at a substantial distance offshore. There are presently no offshore renewable energy zones in the vicinity of the Block which could contribute to future cumulative effects with regards to physical presence. Potential displacement and barrier effects will likely be an important consideration at the project level for any offshore wind, or other renewable technology developments that are planned for the region, and will likely form an important part of associated Habitats Regulations Assessments.

8.2.3 Marine discharges

As described in Section 6.3, most studies of produced water toxicity and dispersion, in the UK and elsewhere have concluded that the necessary dilution to achieve a No Effect Concentration (NEC) would be reached at <10 to 100m and usually less than 500m from the discharge point. Given the relatively low number and separation of existing oil and gas installations and the presumption against the discharge to sea of produced water from new developments, there is unlikely to be a cumulative effect from multiple produced water discharges.

Previous discharges of WBM cuttings in the UKCS have been shown to disperse rapidly and to have minimal ecological effects (Section 6.3). Dispersion of further discharges of mud and cuttings could lead to localised accumulation in areas where reduced current allows the particles to settle on the seabed. However, in view of the scale of the region, the water depths and currents, and probability of reinjection of drill cuttings from any major field development, this is considered unlikely to be detectable and to have negligible cumulative ecological effect (DECC 2011).

8.3 Conclusions

The competent authorities will assess the potential for in-combination effects during Habitats Regulations Assessments of project specific consent applications; this process will ensure that mitigation measures are put in place to ensure that subsequent to licensing, specific projects (if consented) will not result in adverse effects on integrity of European sites. Therefore, bearing this in mind, it is concluded that the in-combination effects from activities arising from the licensing of Block 103/01 with those from existing and planned activities in the St. George's Channel will not cause an adverse effect on the integrity of the relevant European Sites.

9 Overall conclusion

Taking account of all the matters discussed, the Secretary of State is able award a licence covering Block 103/1. This is because there is certainty, within the meaning of the ECJ Judgment in the *Waddenzee* case, that the granting of the licence will not adversely affect the integrity of relevant European Sites, taking account of the mitigation measures that can be imposed through existing permitting mechanisms on the planning and conduct of activities.

These mitigation measures are incorporated in respect of habitat, diadromous fish, bird and marine mammal interest features through the range of legislation and guidance (see https://www.og.decc.gov.uk/environment/environ_leg_index.htm and https://www.og.decc.gov.uk/regulation/pons/index.htm) which apply to developer activities which could follow plan adoption. These mitigation measures include, where necessary, project-specific Appropriate Assessments based on detailed project proposals which would be undertaken by the competent authority before the granting of a permit/consent. The competent authority needs to be satisfied that the proposed activity will not result in adverse effects on integrity of European sites.

Even where a site/interest feature has been screened out in the plan level assessment, or where a conclusion of no adverse effect on integrity has been reached at plan level, project level assessment will be necessary if, for example, new European sites have been designated after the plan level assessment; new information emerges about the nature and sensitivities of interest features within sites, new information emerges about effects including in-combination effects; or if plan level assumptions have not been met at the project level.

10 References

Baines ME & Earl SJ (1998). Breeding seabird survey of south-west Wales colonies 1996-1998. Report No. PR1FBC. CCW Sea Empress Contract Report, 74pp. plus appendix.

Banks AN, Sanderson WG, Hughes B, Cranswick PA, Smith LE, Whitehead S, Musgrove AJ, Haycock B & Fairney NP (2008). The *Sea Empress* oil spill (Wales, UK): Effects on common scoter *Melanitta nigra* in Carmarthen Bay and status ten years later. *Marine Pollution Bulletin* **56**: 895-902.

Berrow S, Holmes B & Goold J (2002). The distribution and intensity of ambient and point source noises in the Shannon estuary. Final report to the Heritage Council. http://www.shannondolphins.ie/downloads/Berrow_SourceNoisesShannonEstuary.pdf

Blackwell SB, Lawson JW & Williams MT (2004). Tolerance by ringed seals (*Phoca hispida*) to impact pipe-driving and construction sounds at an oil production island. *Journal of the Acoustical Society of America* **115**: 2346-2357.

Brandt MJ, Diederichs A, Betke K & Nehls G (2011). Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series* **421**: 205–216.

Cadhla Ó, Strong D, O'Keeffe C, Coleman M, Cronin M, Duck C, Murray T, Dower P, Nairn R, Murphy P, Smiddy P, Saich C, Lyons D & Hiby AR (2007). An assessment of the breeding population of grey seals in the Republic of Ireland, 2005. Irish Wildlife Manuals No. 34. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland, 60pp.

CCW (2009a). Cardigan Bay European Marine Site. Advice Provided by The Countryside Council for Wales in Fulfilment of Regulation 33 of The Conservation (Natural Habitats, &C.) Regulations 1994, February 2009. Countryside Council for Wales, 56pp.

CCW (2009b). Pembrokeshire Marine European Marine Site. Advice Provided by The Countryside Council for Wales in Fulfilment of Regulation 33 of The Conservation (Natural Habitats, &C.) Regulations 1994, February 2009. Countryside Council for Wales, 85pp.

CCW (2009c). Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd European Marine Site. Advice Provided by The Countryside Council for Wales in Fulfilment of Regulation 33 of The Conservation (Natural Habitats, &C.) Regulations 1994, February 2009. Countryside Council for Wales, 74pp.

Christian JR, Mathieu A, Thompson DH, White D & Buchanan RA (2003). Effect of seismic energy on snow crab (*Chionoecetes opilio*) 7th November 2003. Environmental Research Funds Report No. 144, Calgary, 106pp

Davis RA, Richardson WW, Thiele L, Dietz R & Johansen P (1991). State of the Arctic Environment report on underwater noise. Arctic Center Publications 2, Finland special issue. *The State of The Arctic Environment Reports*: 154-269.

De Groot SJ & Lindeboom HJ (1994). Environmental impact of bottom gear on benthic fauna in relation to natural resources management and protection of the North Sea. NIOZ Rapport 1994-11, Texel, The Netherlands.

DECC (2008). 25th Seaward Round Block Screening Assessment, November 2008. Department of Energy and Climate Change, 65pp.

DECC (2009a). Guidance notes to operators of UK offshore oil and gas installations (including pipelines) on Oil Pollution Emergency Plan requirements, 46pp.

DECC (2009b). Offshore Energy Strategic Environmental Assessment, Environmental Report. Department of Energy and Climate Change, UK, 307pp plus appendices. http://www.offshore-sea.org.uk/site/scripts/book_info.php?consultationID=16&bookID=11

DECC (2011). Offshore Energy Strategic Environmental Assessment 2, Environmental Report. Department of Energy and Climate Change, UK, 443pp plus appendices. http://www.offshore-sea.org.uk/site/scripts/book_info.php?consultationID=17&bookID=18

DFO (2004). Potential impacts of seismic energy on snow crab. DFO (Fisheries and Ocean Canada) Canadian Science Advisory Secretariat. Habitat Status Report 2004/003

Dixon T (2009). Annual survey of reported discharges attributed to vessels and offshore oil and gas installations operating in the United Kingdom pollution control zone 2008. Advisory Committee on Protection of the Sea (ACOPS). 80pp.

EC (1999). Interpretation Manual of European Union habitats. Version EUR 15/2. European Commission (DG Environment), Brussels, 121pp.

EC (2000). Managing NATURA 2000 Sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, 69pp.

EC (2001). Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and 6(4) of the 'Habitats Directive' 92/43/EEC, November 2001, 76pp.

Energy and Climate Change Committee (2011). Second report: UK deepwater drilling – Implications of the Gulf of Mexico spill. UK Government Select Committee report. http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/45002.htm

Engås A, Løkkeborg S, Ona E & Soldal AV (1996). Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). *Canadian Journal of Fisheries and Aquatic Sciences* **53**: 2238-2249.

Faber Maunsell & Metoc (2007). Marine renewables Strategic Environmental Assessment (SEA). Report to The Scottish Government. Faber Maunsell & Metoc, UK.

Gage JD, Roberts JM, Hartley JP & Humphery JD (2005). Potential impacts of deep-sea trawling on the benthic ecosystem along the northern European continental margin: a review. In: PW Barnes & JP Thomas Eds. *Benthic habitats and the effects of fishing*. American Fisheries Society, Symposium 41, Bethesda, Maryland. pp. 503-517.

Goold JC & Fish PJ (1998). Broadband spectra of seismic survey air-gun emissions, with reference to dolphin auditory thresholds. *Journal of Acoustical Society of America* **103**: April 1998

Goold JC (1996). Acoustic assessment of populations of common dolphin, *Delphinus delphis*, in conjunction with seismic surveying. *Journal of the Marine Biological Association of the UK* **76**: 811-820.

Gordon JCD, Gillespie D, Potter J, Frantzis A, Simmonds M & Swift R (1998). The effects of seismic surveys on marine mammals. In: ML Tasker & C Weir Eds. *Proceedings of the Seismic and Marine Mammals Workshop*, 23-25 June 1998, London.

Gundlach ER & Hayes MO (1978). Vulnerability of coastal environments to oil spill impacts. *Marine Technology Society Journal* **12**: 18-27.

Hammond PS, Northridge SP, Thompson D, Gordon JCD, Hall AJ, Murphy SN & Embling CB (2008). Background information on marine mammals for Strategic Environmental Assessment 8. Report to the Department for Business, Enterprise and Regulatory Reform. Sea Mammal Research Unit, St. Andrews, Scotland, UK, 52pp.

Harris RE, Miller GW & Richardson WJ (2001). Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. *Marine Mammal Science* **17**: 795-812.

Hassel A, Knutsen T, Dalen J, Skaar, K, Løkkeborg S, Misund OA, Øivind Ø, Fonn M & Haugland EK (2004). Influence of seismic shooting on the lesser sandeel (*Ammodytes marinus*). *ICES Journal of Marine Science* **61**: 1165-1173.

Hastings MC, Popper AN, Finneran JJ & Lanford PJ (1996). Effect of low frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. *Journal of the Acoustical Society of America* **99**: 1759-1766.

Hoskin R and Tyldesley D (2006). How the scale of effects on internationally designated nature conservation sites in Britain has been considered in decision making: A review of authoritative decisions. English Nature Research Reports, No 704.

IMO (International Maritime Organisation) GloBallast website (accessed March 2009) http://globallast.imo.org/

JNCC (2009). Annex A - JNCC guidelines for minimising the risk of disturbance and injury to marine mammals from seismic surveys. June 2009. Joint Nature Conservation Committee, Aberdeen, UK, 15pp.

JNCC (Joint Nature Conservation Committee) website (accessed August 2009) http://www.jncc.gov.uk/

Kaiser MJ, Collie JS, Hall SJ, Jennings S & Poiner IR (2002a). Impacts of fishing gear on marine benthic habitats. In: M Sinclair & G Valdimarsson Eds. *Responsible fisheries in the marine ecosystem*. CABI Publishing, Wallingford, pp.197-217.

Kaiser MJ, Collie JS, Hall SJ, Jennings S & Poiner IR (2002b). Modification of marine habitats by trawling activities: prognosis and solutions. *Fish and Fisheries* **3**: 114-133.

Kastak D & Schusterman RJ (1996). Temporary threshold shift in a harbour seal (*Phoca vitulina*). *Journal of the Acoustical Society of America* **100**: 1905-1908.

Kastak D, Schusterman RJ, Southall BL & Reichmuth CJ (1999). Underwater temporary threshold shift induced by octave-band noise in three species of pinnipeds. *Journal of the Acoustical Society of America* **106**: 1142-1148.

Ketten DR (2001). Marine mammal auditory systems: a summary of audiometric and anatomical data and its implications for underwater acoustic impacts. Woods Hole Oceanographic Institution Harvard Medical School. http://www.solcomhouse.com/auditory.htm

Kiely O, Lidgard D, McKibben M, Connolly N & Baines M (2000). Grey seals: Status and monitoring in the Irish and Celtic Seas. Maritime Ireland/Wales INTERREG Report No 3. 85pp.

Knudsen FR, Enger PS & Sand O (1994). Avoidance responses to low frequency sound in downstream migrating Atlantic salmon smolt, *Salmo salar*. *Journal of Fish Biology* **45**: 227-233.

Kober K, Webb A, Win I, Lewis L, O'Brien S, Wilson LJ & Reid J (2010). An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC Report 431. JNCC Peterborough

Lawson JW, Malme CI & Richardson WJ (2001). Assessment of noise issues relevant to marine mammals near the BP Clair Development. Report to BP from LGL Ltd., Environmental Research Associates and Engineering and Science Services.

Matthiopoulos J, McConnell B, Duck C & Fedack M (2004). Using satellite telemetry and aerial counts to estimate space use by grey seals around the British Isles. *Journal of Applied Ecology* **41**: 476-491.

McBreen F, Askew N, Cameron A, Connor D, Ellwood H & Carter A (2011). UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446.

McCauley RD (1994). Seismic surveys. In, Swan, JM, Neff, JM and Young, PC (Eds) Environmental implications of offshore oil and gas developments in Australia. The findings of an independent scientific review. Australian Petroleum Exploration Association, Sydney, NSW. 696pp.

McCauley RD, Fewtrell J & Popper AN (2003). High intensity anthropogenic sound damages fish ears. *Journal of the Acoustical Society of America* **113**: 638-642.

MMS (2004). Geological and geophysical exploration for mineral resources on the Gulf of Mexico Outer Continental Shelf. Final programmatic environmental assessment. Report no. MMS 2004-054. Report to the U.S. Department of the Interior Minerals Management Service, New Orleans, 487pp.
http://www.ocsbbs.com/2004-054.pdf

Moriyasu M, Allain R, Benhalima K & Claytor R (2004). Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat. Research Document 2004/126.

Murphy S, Gordon JCD, McConnell B, Matthiopoulos J, Isojunno S & Hammond PS (2008). Background information on marine mammals for Offshore Strategic Environmental Assessment. Report to the Department of Energy and Climate Change. SMRU Limited, St. Andrews, Scotland, UK, 130pp.

Nairn R, Partridge K, Moore J & Elliot R (1995). The south east coast of Ireland; An environmental appraisal. Published by Marathon Petroleum Ireland, Ltd, Cork, Ireland.

National Commission (2011). National Commission on the BP Deepwater Horizon Spill and Offshore Drilling. Deep water: The Gulf oil disaster and the future of offshore drilling: Report to the president. US Government report. 398pp.

Nedwell J (2005). The dBht(Species); a metric for estimating the behavioural effects of noise on marine species. Proceedings of Underwater Noise Measurement Seminar 13 October 2005, National Physical Laboratory, Teddington.

Nedwell JR & Needham K (2001). Measurement of drill rig noise. Subacoustech Ltd. Report No. 452R0102.

Nedwell JR, Edwards B & Needham K (2002). Noise measurements during pipeline laying operations around the Shetland Islands for the Magnus EOR project. Subacoustech Ltd. Report No. 473R0212.

Nedwell JR, Needham K & Edwards B (2001). Report on measurements of underwater noise from the Jack Bates Drill Rig. Subacoustech Ltd. Report No. 462R0202.

Nehls G, Betke K, Eckelmann S & Ros M (2007). Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms. Report to COWRIE Ltd. BioConsult SH report, Husum, Germany, 47pp.

Nowacek DP, Thorne LH, Johnston DW & Tyack PL (2007). Responses of cetaceans to anthropogenic noise. *Mammal Review* **37**: 81-115.

ODPM (2005a). Planning Policy Statement 9: Biodiversity and Geological Conservation. Office of the Deputy Prime Minister, UK, 13pp.

ODPM (2005b). Government circular: Biodiversity and geological conservation - statutory obligations and their impact within the planning system. ODPM Circular 06/2005. Office of the Deputy Prime Minister, UK, 88pp.

OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London. http://www.ospar.org/eng/html/qsr2000/QSR2000welcome3.htm

OSPAR (2010). Quality Status Report 2010. OSPAR Commission, London, 176pp.

Parry GD & Gason A (2006). The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. *Fisheries Research* **79**: 272-284.

Peacock EE, Nelson RK, Solow AR, Warren JD, Baker JL, & Reddy CM (2005). The West Falmouth oil spill: 100 kg of oil persists in marsh sediments. *Environmental Forensics* **6**:273-281.

Popper AN, Carlson TJ, Hawkins AD, Southall BJ & Gentry RL (2006). Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper. Report to the Fisheries Hydroacoustic Working Group, California Department of Transportation, USA, 15pp.

Popper AN, Fewtrell J, Smith ME & McCauley RD (2003). Anthropogenic sound: Effects on the behavior and physiology of fishes. *Marine Technology Society Journal* **37**: 35-40.

Popper AN, Smith ME, Cott PA, Hanna BW, MacGillivray AO, Austin ME & Mann DA (2005). Effects of exposure to seismic airgun use on hearing of three fish species. *Journal of the Acoustical Society of America* **117**: 3958-3971.

Reddy CM, Eglinton TI, Hounshell A, White HK, Xu L, Gaines RB & Frysinger GS (2002). The West Falmouth oil spill after thirty years: the persistence of petroleum hydrocarbons in marsh sediments. *Environmental Science and Technology* **36**: 4754 -4760.

Richardson WJ, Greene CR Jr, Malme CI & Thomson DH (1995). *Marine Mammals and Noise.* Academic Press, San Diego, US, 576pp.

Richardson WJ, Greene CR, Hickie JP & Davis RA (1983). Effects of offshore petroleum operations on cold water marine mammals: a literature review. Report prepared for the American Petroleum Institute. API Report No. 4370. Washington, D.C.

SEEEC (1998). The environmental impact of the *Sea Empress* oil spill. Final report of the *Sea Empress* Environmental Evaluation Committee. The Stationery Office, London.

SEERAD (2000). Nature conservation: implementation in Scotland of EC directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds ("the Habitats and Birds Directives"). June 2000. Revised guidance updating Scottish Office circular no. 6/199.

Simmonds M, Dolman S & Weilgart L (2003). Oceans of Noise. A Whale and Dolphin Conservation Society Science Report.

Skalski JR, Pearson WH & Malme CI (1992). Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Science* **49**: 1343-1356.

Slotte A, Hansen K, Dalen J & Ona E (2004). Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. *Fisheries Research* **67**: 143-150.

SMRU (2007). Potential impact of oil and gas exploration and development on SACs for bottlenose dolphins and other marine mammals in the Moray Firth and Cardigan Bay/Pembrokeshire. Report to the DTI. Sea Mammal Research Unit, University of St Andrews, Scotland, 13pp.

Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Greene Jr. CR, Kastak D, Ketten DR, Miller JH, Nachtigall PE, Richardson WJ, Thomas JA & Tyack PL (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33: 411-522.

Stemp R (1985). Observations on the effects of seismic exploration on seabirds. In: Greene GD, Engelhardt FR & Paterson RJ (Eds) *Proceedings of the Workshop on Effects of Explosives Use in the Marine Environment*. Jan 29-31, 1985, Halifax, Canada.

Stone CJ & Tasker ML (2006). The effects of seismic airguns on cetaceans in UK waters. *Journal of Cetacean Research and Management* **8**: 255-263.

Stone CJ (2003). The effects of seismic activity on marine mammals in UK waters, 1998-2000. JNCC Report no. 323. Joint Nature Conservation Committee, Peterborough.

Swift RJ & Thompson PM (2000). Identifying potential sources of industrial noise in the Foinaven and Schiehallion region. Report prepared for BP Amoco Exploration, UK Operations, Farburn Industrial Estate, Dyce, Aberdeen, Scotland.

Tasker ML, Amundin M, Andre M, Hawkins A, Lang W, Merck T, Scholik-Schlomer A, Teilmann J, Thomsen F, Werner S & Zakharia M (2010). Underwater noise and other forms of energy: Marine Strategy Framework Directive Task Group 11 report, 64pp.

Teal JM & Howarth RW (1984). Oil spill studies: a review of ecological effects. *Environmental Management* **8**: 27-43

Teal JM, Farrington JW, Burns KA, Stegeman JJ, Tripp BW, Woodin B & Phinney C (1992). The West Falmouth oil spill after 20 years: fate of fuel oil compounds and effects on animals. *Marine Pollution Bulletin* **24**: 607-614.

Thompson D, Sjoberg M, Bryant ME, Lovell P & Bjorge A (1998). Behavioural and physiological responses of harbour (*Phoca vitulina*) and grey (*Halichoerus grypus*) seals to seismic surveys. Report the European Commission of BROMMAD Project.

Tyldesley & Associates (2010). Habitats Regulations Appraisal of Plans: Guidance for Plan-making Bodies in Scotland. Scottish Natural Heritage report no. 1739, 54pp.

UKOOA (2006). Report on the analysis of DTI UKCS oil spill data from the period 1975-2005. Report to the UK Offshore Operators Association. TINA Consultants. 32pp.

Weilgart LS (2007). The impacts of anthropogenic ocean noise on cetaceans and implications for management. *Canadian Journal of Zoology* **85**: 1091-1116.

Wiese FK, Montevecchi WA, Davoren GK, Huettmann F, Diamond AW & Linke J (2001). Seabirds at risk around offshore oil platforms in the North-west Atlantic. *Marine Pollution Bulletin* **42**: 1285-1290.

Williams JM, Tasker ML, Carter IC & Webb A (1994). Method for assessing seabird vulnerability to surface pollutants. *Ibis* **137**: 147-152.

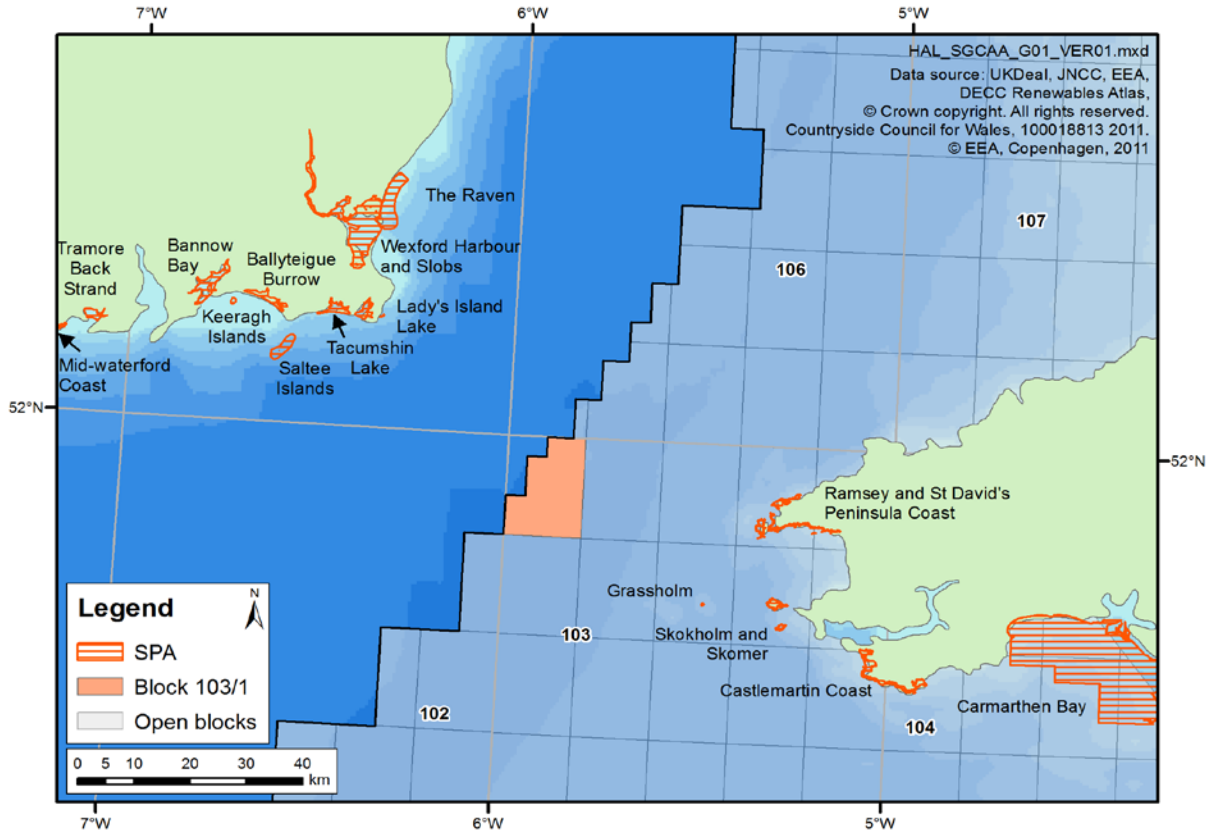
Witbaard R & Klein R (1993). A method to estimate the bottom trawl intensity independently from fisheries itself by using internal molluscan growth lines. *ICES CM 1993* **K:16**, 8pp.

Appendix A – The sites

The migratory and/or Annex I bird species for which SPAs are selected in the UK are listed in Box A.1, and the SPAs and their qualifying features are given in Table A.1 and their locations shown in the Map A.1.

A1 Coastal and Marine Special Protection Areas

Map A.1: Location of Special Protection Areas



Box A.1: Migratory and/or Annex I bird species for which SPAs are selected in the UK

Divers and grebes
Red-throated diver *Gavia stellata*
Black-throated diver *Gavia arctica*
Great northern diver *Gavia immer*
Little grebe *Tachybaptus ruficollis*
Great crested grebe *Podiceps cristatus*
Slavonian grebe *Podiceps auritus*

Seabirds
Fulmar *Fulmarus glacialis*
Manx shearwater *Puffinus puffinus*
Storm petrel *Hydrobates pelagicus*
Leach's petrel *Oceanodroma leucorhoa*
Gannet *Morus bassanus*
Cormorant *Phalacrocorax carbo carbo*
Shag *Phalacrocorax aristotelis*
Guillemot *Uria aalge*
Razorbill *Alca torda*
Puffin *Fratercula arctica*

Gulls, terns and skuas
Arctic skua *Stercorarius parasiticus*
Great skua *Catharacta skua*
Mediterranean gull *Larus melanocephalus*
Black-headed gull *Larus ridibundus*
Common gull *Larus canus*
Lesser black-backed gull *Larus fuscus*
Herring gull *Larus argentatus*
Great black-backed gull *Larus marinus*
Kittiwake *Rissa tridactyla*
Sandwich tern *Sterna sandvicensis*
Roseate tern *Sterna dougallii*
Common tern *Sterna hirundo*
Arctic tern *Sterna paradisaea*
Little tern *Sterna albifrons*

Crakes and rails
Spotted crake *Porzana porzana*
Corncrake *Crex crex*
Coot *Fulica atra*

Birds of prey and owls
Honey buzzard *Pernis apivorus*
Red kite *Milvus milvus*
Marsh harrier *Circus aeruginosus*
Hen harrier *Circus cyaneus*
Golden eagle *Aquila chrysaetos*
Osprey *Pandion haliaetus*
Merlin *Falco columbarius*
Peregrine *Falco peregrinus*
Short-eared owl *Asio flammeus*

Other bird species
Capercaillie *Tetrao urogallus*
Nightjar *Caprimulgus europaeus*
Woodlark *Lullula arborea*
Fair Isle wren *Troglodytes troglodytes fridariensis*
Reed warbler *Acrocephalus scirpaceus*
Aquatic warbler *Acrocephalus paludicola*
Dartford warbler *Sylvia undata*
Chough *Pyrrhocorax pyrrhocorax*
Scottish crossbill *Loxia scotica*

Waders
Oystercatcher *Haematopus ostralegus*
Avocet *Recurvirostra avosetta*
Stone curlew *Burhinus oedicnemus*
Ringed plover *Charadrius hiaticula*
Dotterel *Charadrius morinellus*
Golden plover *Pluvialis apricaria*
Grey plover *Pluvialis squatarola*
Lapwing *Vanellus vanellus*
Knot *Calidris canutus*
Sanderling *Calidris alba*
Purple sandpiper *Calidris maritima*
Dunlin *Calidris alpina alpina*
Curlew sandpiper *Calidris ferruginea*
Little stint *Calidris minuta*
Ruff *Philomachus pugnax*
Snipe *Gallinago gallinago*
Black-tailed godwit *Limosa limosa* (breeding)
Black-tailed godwit *Limosa limosa islandica* (non-breeding)
Bar-tailed godwit *Limosa lapponica*
Whimbrel *Numenius phaeopus*
Curlew *Numenius arquata*
Redshank *Tringa totanus*
Spotted redshank *Tringa erythropus*
Greenshank *Tringa nebularia*
Wood sandpiper *Tringa glareola*
Green sandpiper *Tringa ochropus*
Turnstone *Arenaria interpres*
Red-necked phalarope *Phalaropus lobatus*
Little egret *Egretta garzetta*

Waterfowl
Bewick's swan *Cygnus columbianus bewickii*
Whooper swan *Cygnus cygnus*
Bean goose *Anser fabalis*
Pink-footed goose *Anser brachyrhynchus*
Russian white-fronted goose *Anser albifrons albifrons*
Greenland white-fronted goose *Anser albifrons flavirostris*
Icelandic greylag goose *Anser anser*
Greenland barnacle goose *Branta leucopsis*
Svalbard barnacle goose *Branta leucopsis*
Dark-bellied brent goose *Branta bernicla bernicla*
Canadian light-bellied brent goose *Branta bernicla hrota*
Svalbard light-bellied brent goose *Branta bernicla hrota*
Shelduck *Tadorna tadorna*
Wigeon *Anas penelope*
Gadwall *Anas strepera*
Teal *Anas crecca*
Mallard *Anas platyrhynchos*
Pintail *Anas acuta*
Shoveler *Anas clypeata*
Garganey *Anas querquedula*
Pochard *Aythya ferina*
Tufted duck *Aythya fuligula*
Scaup *Aythya marila*
Eider *Somateria mollissima*
Long-tailed duck *Clangula hyemalis*
Common scoter *Melanitta nigra*
Velvet scoter *Melanitta fusca*
Goldeneye *Bucephala clangula*
Red-breasted merganser *Mergus serrator*
Goosander *Mergus merganser*

Table A.1: SPAs and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[11]
WALES				
Ramsey and St. David's Peninsula Coast SPA	845.63	Breeding: Chough Over winter: Chough	N/A	N/A
Grassholm SPA	10.72	N/A	Breeding: Gannet	N/A
Skokholm and Skomer SPA	427.71	Breeding: Chough Short-eared owl Storm petrel	Breeding: Lesser black-backed gull Manx shearwater Puffin	Breeding: Seabird
Castlemartin Coast SPA	1,122.32	Breeding: Chough Over winter: Chough	N/A	N/A
Bae Caerfryddin / Carmarthen Bay SPA	33,411.27	N/A	N/A	Wintering: Waterfowl
REPUBLIC OF IRELAND				
Saltee Islands SPA	871	Breeding: Chough Peregrine Over winter: Chough	Breeding: Lesser black-backed gull Manx shearwater Puffin Fulmar Gannet Cormorant Shag Herring gull Kittiwake Guillemot Razorbill	Breeding: Seabird
Lady's Island Lake SPA	478.81	Breeding: Marsh harrier Wood Sandpiper Sandwich tern Roseate tern Common tern Arctic tern Mediterranean gull Over winter: Whooper swan Golden plover Sandwich tern Roseate tern Common tern Arctic tern Mediterranean gull Ruff	Overwinter: Gadwall	Wintering: Waterfowl

[11] - A seabird assemblage of international importance. The area regularly supports at least 20,000 seabirds. Or
- A wetland of international importance. The area regularly supports at least 20,000 waterfowl.

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[11]
The Raven SPA	2,610.43	Overwinter: Greenland white-fronted goose Great northern diver Red-throated diver Bar-tailed godwit Golden plover Slavonian grede Breeding: Little tern	Overwinter: Wigeon Mallard Sanderling Dunlin Knot Ringed plover Oystercatcher Common gull Black-headed gull Common scoter Red-breasted merganser Curlew Cormorant Grey plover Great crested grebe Shelduck Lapwing	N/A
Ballyteigue Burrow SPA	660.53	Overwinter: Bar-tailed godwit Golden plover Breeding: Little tern	Overwinter: Pintail Mallard Teal Wigeon Dark-bellied brent goose Dunlin Ringed plover Oystercatcher Black-headed gull Black-tailed godwit Red-breasted merganser Curlew Grey plover Shelduck Redshank Lapwing	N/A
Tramore Back Strand SPA	459.78	Overwinter: Bar-tailed godwit Golden plover Breeding: Little egret	Overwinter: Teal Wigeon Dark-bellied brent goose Turnstone Dunlin Knot Oystercatcher Black-tailed godwit Red-breasted merganser Curlew Cormorant Grey plover Greenshank Redshank Lapwing	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[11]
Bannow Bay SPA	1,363.92	Overwinter: Bar-tailed godwit Golden plover	Overwinter: Pintail Mallard Teal Wigeon Dark-bellied brent goose Turnstone Dunlin Knot Oystercatcher Ringed plover Black-headed gull Red-breasted merganser Black-tailed godwit Curlew Cormorant Grey plover Turnstone Greenshank Redshank Lapwing	N/A
Wexford Harbour and Slobs SPA	5,996.11	Overwinter: Greedland white-fronted goose Short-eared owl Bewick's swan Whooper swan Bar-tailed godwit Golden plover Ruff Wood sandpiper Breeding: Little egret	Overwinter: Pintail Mallard Teal Wigeon Gadwall Shoveler Turnstone Pochard Tufted duck Scaup Dark-bellied brent goose Goldeneye Dunlin Knot Sanderling Ringed plover Oystercatcher Coot Black-headed gull Common gull Black-tailed godwit Red-breasted merganser Curlew Cormorant Grey plover Great crested grebe Turnstone Greenshank Redshank Lapwing Spotted redshank Green sandpiper	Over winter: Waterfowl

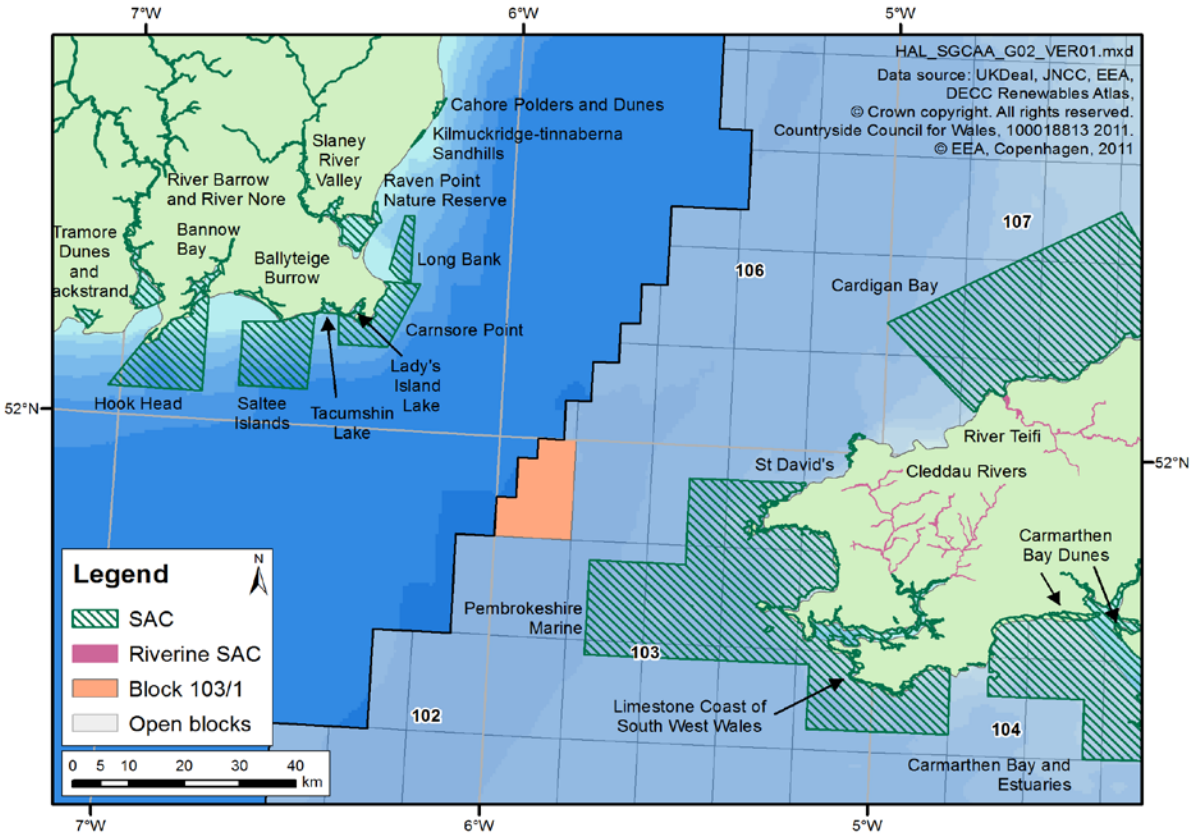
Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[11]
Tacumshin SPA	528.8	Breeding: Marsh harrier Overwinter: Greenland white-fronted goose Bewick's swan Whooper swan Ruff Golden plover Wood sandpiper	Breeding: Reed warbler Garganey Overwinter: Pintail Mallard Teal Wigeon Gadwall Shoveler Pochard Tufted duck Dark-bellied brent goose Dunlin Curlew sandpiper Little stint Coot Lesser black-backed gull Black-headed gull Black-tailed godwit Curlew Grey plover Shelduck Greenshank Redshank Spotted redshank Green sandpiper Lapwing	N/A
Keeragh Islands SPA	80.04	Breeding: Cormorant	N/A	N/A
Mid-waterford Coast SPA	941.53	Overwinter: Chough Peregrine Breeding: Chough Peregrine	Breeding: Cormorant Herring gull	N/A

A2 Coastal and Marine Special Areas of Conservation

This section includes coastal or nearshore marine (within 12nm boundary) Special Areas of Conservation (SAC) sites which contain one or more of the Annex I coastal habitats listed in Box A.2 (below) or examples of Annex II qualifying marine species. Riverine/freshwater SACs which are designated for migratory fish and/or freshwater pearl mussel are included on Map A.2 and considered in Section A4.

Abbreviations for the Annex 1 habitats used in SAC site summaries (Tables A.2 and A.3 and Map A.2) are listed in Box A.2.

Map A.2: Location of coastal, marine and offshore Special Areas of Conservation



Box A.2: Annex 1 Habitat Abbreviations Used in Site Summaries

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
Bogs	Active raised bogs * Priority feature Blanket bogs * Priority feature Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the *Rhynchosporion* Transition mires and quaking bogs
Coastal dunes	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) Coastal dunes with *Juniperus* spp. Decalcified fixed dunes with *Empetrum nigrum* Dunes with *Hippophae rhamnoides* Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) Embryonic shifting dunes Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature Humid dune slacks Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`)
Coastal lagoons	Coastal lagoons *Priority feature
Estuaries	Estuaries
Fens	Alkaline fens Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* * Priority feature Petrifying springs with tufa formation (*Cratoneurion*) * Priority feature
Forest	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) * Priority feature Old sessile oak woods with *Quercus robur* on sandy plains
Grasslands	Alpine and subalpine calcareous grasslands Calaminarian grasslands of the *Violetalia calaminariae* Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*) (important orchid sites) * Priority feature Species-rich *Nardus* grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) * Priority feature
Heaths	Alpine and Boreal heaths European dry heaths Northern Atlantic wet heaths with *Erica tetralix*
Inlets and bays	Large shallow inlets and bays

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
Limestone pavements	Limestone pavements * Priority feature
Machairs	Machairs
Mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide
Reefs	Reefs
Rocky slopes	Calcareous rocky slopes with chasmophytic vegetation
Running freshwater	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
Salt marshes and salt meadows	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) *Salicornia* and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*)
Sandbanks	Sandbanks which are slightly covered by sea water all the time
Scree	Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)
Scrub (mattoral)	*Juniperus communis* formations on heaths or calcareous grasslands
Sea caves	Submerged or partially submerged sea caves
Sea cliffs	Vegetated sea cliffs of the Atlantic and Baltic coasts
Standing freshwater	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. Natural dystrophic lakes and ponds Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*
Vegetation of drift lines	Annual vegetation of drift lines
Vegetation of stony banks	Perennial vegetation of stony banks

Table A.2 – Coastal and marine SACs and their Qualifying Features

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
WALES					
Cardigan Bay/Bae Ceredigion SAC	95,860.36	N/A	Sandbanks Reefs Sea caves	Bottlenose dolphin Tursiops truncatus	Sea lamprey Petromyzon marinus River lamprey Lampetra fluviatilis Grey seal Halichoerus grypus
St David's/Ty Ddewi SAC	935.47	Sea cliffs Heaths	N/A	Floating water-plantain Luronium natans	N/A
Pembrokeshire Marine/Sir Benfro Forol SAC	138,069.45	Estuaries Inlets and bays Reefs	Sandbanks Mudflats and sandflats Coastal lagoons Salt marshes and salt meadows Sea caves	Grey seal Halichoerus grypus Shore dock Rumex rupestris	Sea lamprey Petromyzon marinus River lamprey Lampetra fluviatilis Allis shad Alosa alosa Otter Lutra lutra Twaite shad Alosa fallax
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC	1,594.53	Sea cliffs Coastal dunes	Heaths Grasslands Caves Sea caves	Greater horseshoe bat Rhinolophus ferrumequinum Early gentian Gentianella anglica	Petalwort Petalophyllum ralfsii
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	66,101.16	Sandbanks Estuaries Mudflats and sandflats Large shallow inlets and bays Salt marshes and salt meadows	N/A	Twaite shad Alosa fallax	Sea lamprey Petromyzon marinus River lamprey Lampetra fluviatilis Allis shad Alosa alosa Otter Lutra lutra

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	1,206.32	Coastal dunes	N/A	Narrow-mouthed whorl snail Vertigo angustior Petalwort Petalophyllum ralfsii Fen orchid Liparis loeselii	N/A
REPUBLIC OF IRELAND					
Tramore Dunes and Backstrand SAC	752.82	Coastal dunes Vegetation of drift lines Mudflats and sandflats Salt marshes and salt meadows Vegetation of stony banks	N/A	N/A	N/A
Ballyteigue Burrow SAC	703.40	Coastal dunes Coastal lagoons	Vegetation of drift lines Mudflats and sandflats Vegetation of stony banks Salt marshes and salt meadows Estuaries	N/A	N/A
Bannow Bay SAC	1,325.70	Estuaries Mudflats and sandflats	Vegetation of stony banks Salt marshes and salt meadows Vegetation of drift lines Coastal dunes	N/A	N/A

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Cahore Polders and Dunes SAC	264.88	Coastal dunes Vegetation of drift lines	N/A	N/A	N/A
Lady's Island Lake SAC	540.31	Coastal lagoons	Vegetation of stony banks Reefs	N/A	N/A
Saltee Islands SAC	15,809.17	Reefs	Mudflats and sandflats Inlets and bays Sea caves Sea cliffs	N/A	Grey seal Halichoerus grypus
Tacumshin Lake SAC	558.82	Coastal lagoons	Coastal dunes Vegetation of drift lines Vegetation of stony banks	N/A	N/A
Raven Point Nature Reserve SAC	594.52	Coastal dunes	Vegetation of drift lines Mudflats and sandflats	N/A	N/A
Hook Head SAC	16,940.17	Reefs	Sea cliffs Inlets and bays	N/A	N/A
Slaney River Valley SAC	6,020.48	Estuaries	Mudflats and sandflats Running freshwater Forest	N/A	Freshwater pearl mussel Margaritifera margaritifera Sea lamprey Petromyzon marinus River lamprey Lampetra fluviatilis Allis shad Alosa alosa Otter Lutra lutra Twaite shad Alosa fallax Atlantic salmon Salmo Salar
Kilmuckridge-Tinnaberna Sandhills SAC	85.74	Coastal dunes	N/A	N/A	N/A
Long Bank SAC	3,372.37	Sandbanks	N/A	N/A	N/A

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Carnsore Point SAC	8,735.86	Reefs	Mudflats and sandflats	N/A	N/A

A3 Riverine Special Areas of Conservation

In addition to the mapped SACs, the following riverine SACs designated for migratory fish and/or the freshwater pearl mussel are also considered.

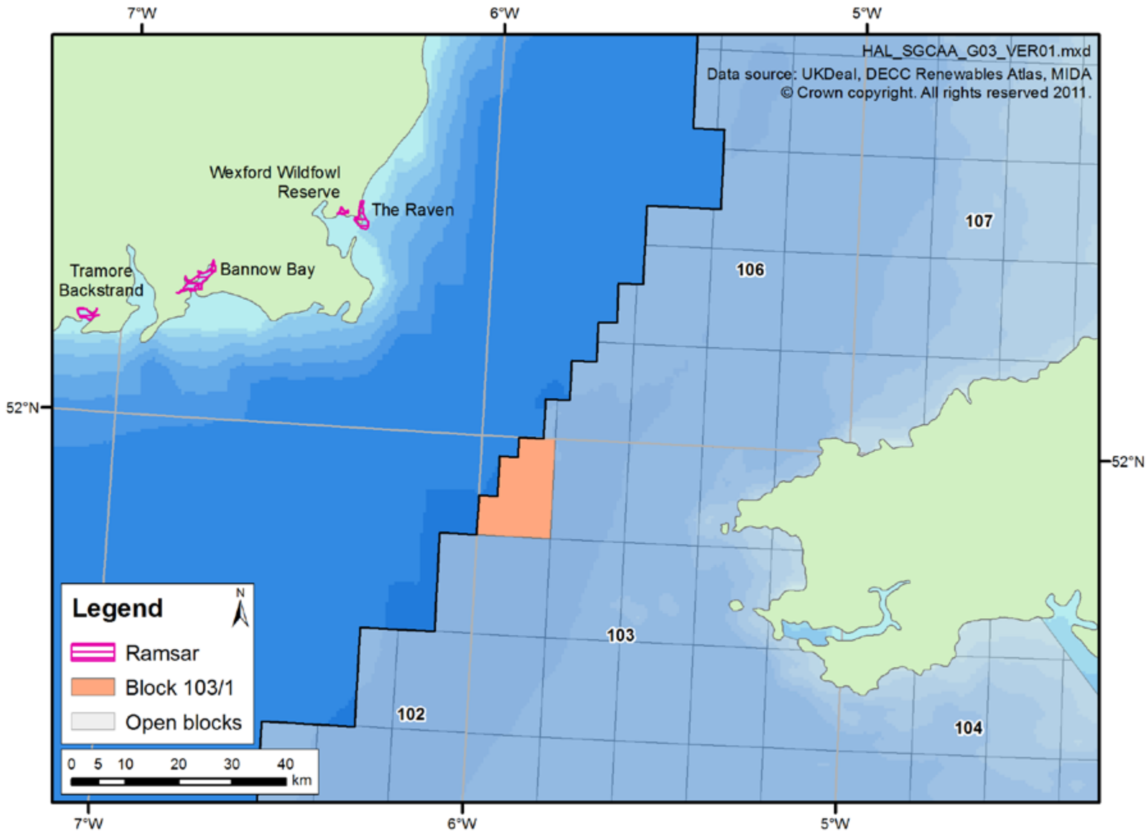
Table A.3: Relevant riverine SACs designated for migratory fish and/or the freshwater pearl mussel

Site Name	Freshwater pearl mussel *Margaritifera margaritifera*	Migratory fish[1]
Afon Teifi / River Teifi		AS, RL, SL
Afonydd Cleddau / Cleddau Rivers		RL, SL
River Barrow and River Nore	✓	AS, RL, SL
Slaney River Valley	✓	AS, RL, SL

[1] *SL - Sea lamprey Petromyzon marinus, RL - River lamprey Lampetra fluviatilis, AS - Atlantic salmon Salmo salar*

A4 RAMSAR Sites

Map A.3: Location of coastal Ramsar sites



All the coastal Ramsar sites are also SPAs and/or SACs (although site boundaries are not always strictly coincident and a Ramsar site may comprise one or more Natura 2000 sites), see tabulation below.

Table A.4: Coastal Ramsar sites and corresponding Natura 2000 site

Ramsar Name	SPA Name	SAC Name
Bannow Bay	Bannow Bay	Bannow Bay
Raven, The	The Raven	Raven Point Nature Reserve
Tramore Backstand	Tramore Back Strand	Tramore Dunes and Backstrand
Wexford Wildfowl Reserve	Wexford Harbour and Slobs	Raven Point Nature Reserve

Appendix B – Screening tables for the identification of likely significant effects on the sites

B1 Coastal and marine Special Protection Areas

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
WALES								
Ramsey and St David's Peninsula Coast	✓	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills (see Section 5.2) could theoretically affect the site, though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4). Qualifying feature (breeding and over-wintering chough) unlikely to be affected because although cliff-nesting, their general habitat and prey is terrestrial based.
Grassholm	✓	-	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect the qualifying feature (gannet) when foraging within the SPA and in adjacent areas beyond the site boundaries. Mitigation is possible in terms of slick dispersal at sea (see Section 5.4). Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.

Site name	Features present[1] Breeding	Wintering	Passage	Vulnerability to effects[2] Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
Skokholm and Skomer	✓	-	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect the qualifying features (storm petrel, lesser black-backed gull, Manx shearwater, puffin) when foraging within the SPA and in adjacent areas beyond the site boundaries. Mitigation is possible in terms of slick dispersal at sea (see Section 5.4). Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Castlemartin Coast	✓	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect the site, though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4). Qualifying feature (breeding and over-wintering chough) unlikely to be affected because although cliff-nesting, their general habitat and prey is terrestrial based.
Carmarthen Bay/Bae Caerfryddin	-	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect the site, though it is relatively distant from the Block, the predominant direction of winds and currents around the Block would likely disperse any spill to the north-east, and as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.

Site name	Features present[1] Breeding	Wintering	Passage	Vulnerability to effects[2] Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
REPUBLIC OF IRELAND								
Saltee Islands	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (lesser black-backed gull, Manx shearwater, puffin, fulmar, gannet, kittiwake, guillemot, razorbill), though others such as chough, nest at cliff locations but forage at terrestrial sites. Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Lady's Island Lake	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (breeding terns, gulls and waterfowl) within the site or foraging in adjacent waters out with the site boundaries, though as the area is a gas province, the potential for large spills is greatly reduced (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
The Raven	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering geese and waterfowl, breeding terns), though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the

Site name	Features present[1] Breeding	Wintering	Passage	Vulnerability to effects[2] Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
								project plans are known.
Ballyteigue Burrow	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering geese and waterfowl, breeding terns) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Tramore Back Strand	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermoned by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering/breeding waders and wintering waterfowl) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Bannow Bay	-	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering waterfowl and waders) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.

Site name	Features present[1] Breeding	Wintering	Passage	Vulnerability to effects[2] Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
Wexford Harbour and Slobs	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering/breeding waders and wintering waterfowl) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Tacumshin	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (overwintering/breeding waders and wintering waterfowl, breeding marsh harrier) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Keeragh Islands	✓	-	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (breeding cormorant) though as the area is a gas province, the potential for such spills is largely negated (see Section 5.2). However, mitigation would be possible (see Section 5.4) and cormorants predominantly feed on inland rivers and lakes. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Mid-Waterford Coast	✓	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions

Site name	Features present[1] Breeding	Wintering	Passage	Vulnerability to effects[2] Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
								or discharges from routine operations. Hydrocarbon discharges from accidental spills could theoretically affect the site and its qualifying features, though the site is distant from Block 103/1, and as the area under consideration is a gas province, the potential for large spills is greatly reduced (see Section 5.2). Mitigation is possible in terms of slick dispersal at sea (see Section 5.4), though such mitigation would be defined by subsequent Habitats Regulations Assessment once the project plans are known. The qualifying feature, breeding and over-wintering chough, is unlikely to be affected because although cliff-nesting, their general habitat and prey is terrestrial based. The breeding cormorant similarly predominantly feeds in terrestrial habitats (inland rivers and lakes).

Notes: 1 ✓ denotes feature present; [2] ✓ denotes vulnerability to effect

B2 Coastal and marine Special Areas of Conservation

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
WALES							
Cardigan Bay/Bae Ceredigion	✓	✓	✓	-	✓	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance (see 7.1) to the species features (bottlenose dolphin, grey seal, lampreys), although effects on long-term conservation status are unlikely (see Section 7.3). Hydrocarbon discharges from accidental spills could theoretically affect qualifying features (bottlenose dolphin, grey seal, sea lamprey and river lamprey), although mitigation would be possible (see Section 5.4), and as the area is a gas province, the potential for large spills is greatly reduced (see Section 5.2).
St David's/Ty Ddewi	✓	✓	-	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting development in this Block would affect the qualifying features (sea cliffs, heaths), and the features are not considered particularly sensitive to spills and mitigation would be possible (see Section 5.4).
Pembrokeshire Marine/Sir Benfro Forol	✓	✓	✓	-	✓	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Accidental hydrocarbon spills could affect qualifying features (e.g. estuaries, mudflats and sandflats, salt marshes and salt meadows, inlets and bays, otter, lamprey, adult shad), though as the area is a gas province, the potential for large spills is greatly reduced (see Section 5.2). Other qualifying features including reefs, coastal lagoons and sea caves are not considered to be particularly sensitive to spills (see Section 5.3). Certain activities (i.e. seismic survey) however could cause temporary acoustic disturbance to

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							species features (lampreys, shad), outside the site boundary (see Sections 7.3 and 7.5). Mitigation would be possible (e.g. see Section 7.5) and mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Limestone Coast of South West Wales/Arfordir Calchfaen De Orllewin Cymru	✓	✓	✓	✓	-	-	Certain activities in, or related to the block, could potentially undermine site conservation objectives through physical damage or loss from the installation of infrastructure and cables (particularly if there are terrestrial components). Site conservation objectives would not be undermined by emissions or discharges from routine operations. Routine and accidental events are unlikely to affect the qualifying feature, greater horseshoe bat. Mitigation of any accidental event would be possible (see Section 5.4) and mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd	✓	✓	✓	-	✓	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Accidental hydrocarbon spills could affect qualifying features (e.g. mudflats and sandflats, salt marshes and salt meadows, otter, lamprey, adult shad) though as the area is a gas province, the potential for large spills is greatly reduced (see Section 5.2). Certain activities (i.e. seismic survey) however could cause temporary acoustic disturbance to species features (lampreys), outside the site boundary (see Section 7.3 and 7.4). However, mitigation would be possible (see Sections 5.4 and 7.5) and mitigation measures would be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Carmarthen Bay Dunes/Twyni Bae Caerfyrddin	✓	✓	-	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill

Site name	Features present[1] Habitats	Species	Effects[2] Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
							resulting development in this Block would affect the qualifying feature (coastal dunes), largely due to the nature of the expected hydrocarbons (gas), the likely inventory of other hydrocarbons associated with development (e.g. diesel – see Section 5.2), and the feature is not considered particularly sensitive to spills and mitigation would be possible (see Section 5.3).
REPUBLIC OF IRELAND							
Tramore Dunes and Backstrand	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Accidental hydrocarbon spills could affect qualifying features (e.g. mudflats and sandflats, salt marshes and salt meadows), though coastal dunes and vegetation of stony banks are not considered particularly sensitive to spills and mitigation would be possible (see Sections 5.3 and 5.4), to be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Ballyteigue Burrow	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting development in this Block would affect certain qualifying features (coastal dunes, lagoons, vegetation of stony banks) due to the nature of the expected hydrocarbons, and those which could theoretically be spilled (e.g. diesel – see Section 5.2), and the features are not considered particularly sensitive to spills (see Section 5.3). Estuaries and vegetation of drift lines lying at mean-high water are potentially vulnerable to spills though mitigation is possible (see Section 5.4), and should be defined at a project level Habitats Regulations Assessment once definitive development plans are known.
Bannow Bay	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Accidental hydrocarbon spills could

Site name	Features present[1] Habitats	Species	Effects[2] Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	Consideration
							affect qualifying features (e.g. estuaries, mudflats and sandflats, salt marshes and salt meadows), though spills are likely to be restricted in quantity and type (e.g. diesel inventories – see Section 5.2), though coastal dunes and vegetation of stony banks are not considered particularly sensitive to spills and mitigation would be possible (see Sections 5.3 and 5.4), to be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Cahore Polders and Dunes	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting development in this Block would affect the qualifying feature (coastal dunes), and the feature is not considered particularly sensitive to spills (see Section 5.3) and mitigation would be possible (see Section 5.4).
Lady's Island Lake	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying features (coastal dunes, reefs, vegetation of stony banks), and these features are not considered particularly vulnerable to spills (see Section 5.3). Mitigation would be possible (see Section 5.4), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Saltee Islands	✓	✓	✓	-	✓	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. Accidental hydrocarbon spills could affect certain qualifying features (e.g. inlets and bays, mudflats and sandflats, grey seal), though others are less likely to be affected (e.g. reefs, sea caves and cliffs) – see Section 5.3. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species feature, grey seal – see Sections 7.2 and 7.3. Mitigation would be possible (see Section 7.5), to be defined by subsequent Habitats Regulations Assessment once the project plans are known.
Tacumshin Lake	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying features (coastal lagoons, coastal dunes, vegetation of stony banks), and these features are not considered particularly vulnerable to spills (see Section 5.3). Mitigation would be possible (see Section 5.4), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.
Raven Point Nature Reserve	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying feature, coastal dunes, and this feature is not considered particularly vulnerable to spills (see Section 5.3). Accidental hydrocarbon spills could affect qualifying feature, mudflats and sandflats though mitigation would be possible (see Section 5.4), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.
Hook Head	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying features (reefs, sea cliffs), and these features are not considered particularly vulnerable to spills (see Section 5.3). Accidental hydrocarbon spills could affect qualifying feature, inlets and bays, though mitigation would be possible (see Section 5.4), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.
Slaney River Valley	✓	✓	✓	-	✓	-	Site conservation objectives are unlikely to be undermined by discharges or from routine operations or accidental spills. Certain activities (i.e. seismic survey) however could cause temporary acoustic disturbance to species features (Atlantic salmon, lampreys), outside the site boundary (see Section 7.2 and 7.3). Accidental hydrocarbon spills could affect certain qualifying features (e.g. estuaries, mudflats and sandflats, otter, lamprey, adult shad), though due to the nature of the expected hydrocarbons, and those which could theoretically be spilled (e.g. diesel – see Section 5.2), this is unlikely to be able to affect the long-term conservation status of the site. Mitigation would be possible (see Sections 5.4 and 7.5), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.
Kilmuckridge-Tinnaberna Sandhills	✓	-	-	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying feature (coastal dunes), and this feature is not considered particularly vulnerable to spills (see Sections 5.3 and 5.4).
Long Bank	✓	-	-	-	-	-	Site conservation objectives would not be undermined by emissions or

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							discharges from routine operations. It is unlikely that a hydrocarbon spill resulting from development in this Block would affect the qualifying feature (sandbanks), and this feature is not considered particularly vulnerable to spills (see Sections 5.3 and 5.4).
Carnsore Point	✓	-	✓	-	-	-	Site conservation objectives are unlikely to be underlined by discharges or from routine operations or accidental spills. Accidental hydrocarbon spills could affect the qualifying feature, mudflats and sandflats, though long-term effects on conservation status are unlikely due to the nature of the expected hydrocarbons, and those which could theoretically be spilled (e.g. diesel – see Section 5.2). The reefs feature is not considered particularly vulnerable to spills (see Section 5.3). Mitigation would be possible (see Section 5.4), and would most appropriately be defined at a project level Habitats Regulations Assessment once the project plans are known.

Notes: [1] ✓ denotes feature present; [2] ✓ denotes vulnerability to effect; [3] including diesel and/or lube oil

B3 Riverine Special Areas of Conservation

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Afon Teifi / River Teifi	✓	✓	-	-	✓	-	Site is remote from block and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species features (Atlantic salmon, river and sea lamprey) outside of the site boundaries (see Section 7.3), although mitigation would be possible (see Section 7.5). Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Afonydd Cleddau / Cleddau Rivers	✓	✓	-	-	✓	-	Site is remote from block and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species features (river and sea lamprey) outside of the site boundaries (see Section 7.3), although mitigation would be possible (see Section 7.5). Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
River Barrow and River Nore	✓	✓	-	-	✓	-	Site is remote from block and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species features (Atlantic salmon, river and sea lamprey) outside of the site boundaries (see Section 7.3), although mitigation would be possible (see Sections 7.5). Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.

Notes: [1] ✓ denotes feature present; [2] ✓ denotes vulnerability to effect; [3] including diesel and/or lube oil

Appendix C – Detailed information on Natura 2000 sites where the potential for effects have been identified

C1 Coastal and marine Special Protection Areas

Site Name: Grassholm SPA	
Location	Grid Ref: SM598093 (central point) Latitude 51º43'51"N Longitude 05º28'47"W
Area (ha)	10.72
Summary	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. Grassholm is of major importance as a breeding site for Gannet *Morus bassanus*. The seabirds feed outside the SPA in nearby waters, as well as more distantly elsewhere in the Irish Sea.
Qualifying features for which the site is designated:	
Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: **During the breeding season:** Gannet *Morus bassanus*, 33,000 pairs representing at least 12.5% of the breeding North Atlantic population (Count as at 1994/5)	
Conservation objectives:	
Gannet The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • The population will not fall below 30,000 pairs in three consecutive years • It will not drop by more than 25% of the previous year's figures in any one year • There will be no decline in this population significantly greater than any decline in the North Atlantic population as a whole **Performance Indicators** The first two point above also outline the performance indicators for feature condition. Indicators for factors affecting the feature are listed below. Note that no operational limits for these have been set. **Pollution**: Oil spills and other pollution episodes may cause damage. **Litter**: Marine litter, especially plastic, can result in wounding and/or death of individual gannets that become entangled. This may, for example, occur during feeding at sea, when entanglement can cause drowning, or because plastic or nylon line, together with other persistent litter is often used as a nesting material, causing entanglement on the nest of both adults and young. **Human disturbance**: Human disturbance from visitors has been significantly reduced since landings on the island by the public were stopped in 1997. Tourist boats now circumnavigate the island, and there is a code of conduct agreed with tourist boat operators to minimise disturbance from the sea. There is still the potential for private boats to cause disturbance, although the remote nature of the island tends to deter all but the most intrepid visitors. Disturbance by RAF aircraft has occurred on occasion in the past, but there has been an agreement with the RAF in place since 1998 regarding air avoidance areas, which are avoided except in emergencies. **Fisheries management**: Changes in the availability of food due to changes in fisheries policy or fishing methods are likely to have a significant impact on the population.	

C2 Coastal and marine Special Areas of Conservation

Site Name: Pembrokeshire Marine/Sir Benfro Forol SAC	
Location	Grid Ref: SM503093 (central point) Latitude 51º 43'35"N Longitude 05º 36'57"W
Area (ha)	138069.45
Summary	Pembrokeshire Marine SAC covers the entire Pembrokeshire coast and islands, extending up to several kilometres offshore at certain points. It includes several estuaries, inlets and bays and reef areas, in addition to a variety of other important intertidal and subtidal habitats. The site is occupied by important numbers of grey seal, shore dock, several species of fish and otter.

Qualifying features for which the site is designated:

Annex 1 Habitat

Primary features: Estuaries, Large shallow inlets and bays and Reefs

Secondary features: Sandbanks which are slightly covered by seawater all the time, mudflats and sandflats not covered by seawater at low tide, Coastal lagoons, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), submerged or partially submerged sea caves

Annex 2 Species

Primary features: Grey seal *Halichoerus grypus*, shore dock *Rumex rupestris*

Secondary features: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, Allis shad *Alosa alosa*, Twaite shad *Alosa fallax*, Otter *Lutra lutra*

Conservation objectives:

For Annex I Habitats

The following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status:

Range

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

For the **inlets and bays** feature these include:

- The embayment of St.Brides Bay
- The ria of Milford Haven
- Peripheral embayments and inlets

For the **coastal lagoons** feature this is subject to the requirements for maintenance of the artificial impoundment structure and maintenance of the lagoons for the original purpose or subsequent purpose that pre-dates classification of the site

Structure and Function

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded. Important elements include:

- geology
- sedimentology
- geomorphology
- hydrography and meteorology
- water and sediment chemistry
- biological interactions

This includes a need for nutrient levels in the water column and sediments to be:

- at or below existing statutory guideline concentrations
- within ranges that are not potentially detrimental to the long term maintenance of the features species populations, their abundance and range

Contaminant levels in the water column and sediments derived from human activity to be:

- at or below existing statutory guideline concentrations
- below levels that would potentially result in increase in contaminant concentrations within sediments or biota
- below levels potentially detrimental to the long-term maintenance of the features species populations, their abundance or range

Site Name: Pembrokeshire Marine/Sir Benfro Forol SAC

As part of this objective it should be noted that; **the Milford Haven waterway complex** would benefit from restorative action, for example through the removal of non-natural beach material, and the removal, replacement or improved maintenance of rock filled gabions. There is also need for some restoration of the populations of several typical species of the Milford Haven waterway complex that are severely depleted with respect to historical levels as a consequence primarily of human exploitation.

In the **Milford Haven waterways complex** inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC.

For the lagoons feature this is subject to the requirements for maintenance of the artificial impoundment structures of **coastal lagoons** and maintenance of the **lagoons** for their original purpose or subsequent purpose that pre-dates classification of the site.

Typical species
The presence, abundance, condition and diversity of typical species are such that habitat quality is not degraded. Important elements include:

- species richness
- population structure and dynamics
- physiological heath
- reproductive capacity
- recruitment
- mobility
- range

As part of this objective it should be noted that:

- populations of typical species subject to existing commercial fisheries need to be at an abundance equal to or greater than that required to achieve maximum sustainable yield and be secure in the long term
- the management and control of activities or operations likely to adversely affect the habitat feature is appropriate for maintaining it in favourable condition and is secure in the long term

For the **inlets and bays** features this includes the need for some restoration of the populations of several typical species which are severely depleted with respect to historical levels as a consequence, primarily of human exploitation.

In the **Milford Haven waterways complex** inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC.

For Annex II Species

Populations
The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are population size, structure, production, and condition of the species within the site.

As part of this objective it should be noted that for **otter** and **grey seal**:

- Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression

For **grey seal,** populations should not be reduced as a consequence of human activity.

Range
The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

As part of this objective it should be noted that for **otter** and **grey seal:**

- Their range within the SAC and adjacent inter-connected areas is not constrained or hindered
- There are appropriate and sufficient food resources within the SAC and beyond
- The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing

Supporting habitats and species
The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond

Site Name: Pembrokeshire Marine/Sir Benfro Forol SAC
the site is stable or increasing. Important considerations include: • distribution • extent • structure • function and quality of habitat • prey availability and quality As part of this objective it should be noted that: • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term. • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour • For **otter** there are sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing In the **Milford Haven waterways complex** inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC. As part of this objective it should be noted that for the **otter,** populations should be increasing.

Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.decc.gov.uk
URN 11D/900