Irish Offshore Strategic Environmental Assessment (IOSEA) 5

Natura Impact Statement

Prepared for:
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Dublin, Ireland

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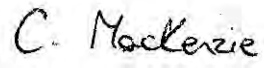
Date:
August 2015

Project or Issue Number:
UK18-20707

ENVIRON

Contract No:	UK18-20707
Issue:	3
Author (signature):	Katie Swale/Seran Davies (CMACS) pp 
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Date:	August 2015

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Version Control Record				
Issue	**Description of Status**	**Date**	**Reviewer Initials**	**Author Initials**
1	First issue to client and Steering Group	27/03/2015	JC	KS
2	Second issue to client	29/04/2015	IGP	KS
3	Final issue to client	07/08/2015	IGP / JC	KS

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Executive Summary

The Habitats Directive was transposed into Irish national law under the European Communities (Natural Habitats) Regulations 1997 which has subsequently been amended and consolidated in the European Communities (Birds and Natural Habitats) Regulations 2011. It is a requirement under Article 6(3) of the Directive that:

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives"

In order to comply with this regulation, when considering a plan or project and the potential nature conservation implications of the plan or project, either alone or in combination, a series of sequential tests and assessments are applied. Each step in the process precedes and provides a basis for the other stages of the process. When assessing plans or projects that are not directly connected with or necessary to the management of the site, it is necessary to consider the "Likely Significant Effect" (LSE) of the plan or project, either alone or in combination, on the features for which the site(s) was designated and their conservation objectives, in order to establish whether an Appropriate Assessment (AA) is required. This process is referred to as 'Appropriate Assessment Screening'.

In light of the conclusions of the assessment and subject to the provisions of Habitats Directive Article 6(4), the competent authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site/s concerned. This Natura Impact Statement (NIS) document includes the information necessary for the competent authority, in this case Minister for Communications, Energy and Natural Resources, to carry out an AA.

The Minister for Communications, Energy and Natural Resources has announced the details of the 2015 Irish Atlantic Margin Licensing Round, which is due to close in September 2015. In addition, it is the intention to continue with a policy of open-door licensing in the Irish Sea and Celtic Sea from 2015 to 2020. The petroleum activities occurring under licensing rounds in the Atlantic Margin Basins, as well as the award of licences in the Celtic and Irish Seas as laid out in the Plan, with regards to potential impacts on Natura 2000 sites have been considered in this NIS. The initial screening stage identified all potential impacts resulting from the plan, considering both individual and cumulative impacts, which might have an effect on a European Site. At this stage an initial list of all Natura 2000 sites which might be affected by the Plan was compiled including coastal sites on both the Irish coasts and also on the adjacent coastlines of England and Wales. The initial list of European sites has been analysed through an assessment of significance to consider which site(s) could be excluded from further assessment on the basis that it can be demonstrated that the Plan will have no LSE on the site(s) as defined by their status and conservation objectives.

A number of Natura 2000 sites were brought forward for further consideration based on the potential for significant effects from specific and identified elements of the Plan. Potential issues associated with acoustic disturbance from seismic survey activity, direct drilling impacts, and risks associated with accidental hydrocarbon spills were given consideration.

An AA will be performed based on this NIS and any other information considered necessary to ascertain whether the Plan will have an adverse effect on the integrity of the Natura 2000 site(s). This process and the conclusions will be clearly documented.

1 Background

1.1 Introduction

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, known as "The Habitats Directive", provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC).

Following the requirements of Article 6(3) of the Habitats Directive, implemented into national law under Regulation 31 of the Habitats Regulations SI 94/1997 and subsequently amended and consolidated in the European Communities (Birds and Natural Habitats) Regulations 2011, if a plan or project is not connected with, or necessary for, the management of a protected site and is likely to have a significant effect (LSE) on the qualifying interests of that site either individually or in combination with other plans or projects, an Appropriate Assessment (AA) is required to assess whether a plan or project will have any adverse effect on the integrity of Natura 2000 site(s). In Ireland, guidance[1] requires that the AA process is carried out in phases:

1. Appropriate Assessment Screening (AAS) - completed December 2014[2]:

   The screening stage identifies all potential impacts resulting from the plan, considering both individual and in combination impacts, which might have an LSE on a Natura 2000 Site.

2. Production of Natura Impact Statement (NIS):

   The guidance recommends that firstly a Natura Impact Statement (NIS) detailing the likely and possible impacts of the plan or project on Natura 2000 site(s) be prepared. AA guidance states:

   "Natura Impact Statement – i.e. a statement of the likely and possible impacts of the plan or project on a Natura 2000 site (abbreviated in the following guidance to "NIS") must be prepared. This comprises a comprehensive ecological impact assessment of a plan or project; it examines the direct and indirect impacts that the plan or project might have on its own or in combination with other plans and projects, on one or more Natura 2000 sites in view of the sites' conservation objectives. Secondly, the competent authority carries out the AA, based on the NIS and any other information it may consider necessary."

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[1] Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities, Department of Environment, Heritage and Local Government, 2009

[2] Irish Offshore Strategic Environmental Assessment (IOSEA) 5 Appropriate Assessment Screening Report, DCENR, 2014

3. Appropriate Assessment (AA):

   An AA is performed based on the NIS and any other information considered necessary to ascertain whether the plan will have an adverse effect on the integrity of the Natura 2000 site(s). This process and the conclusions should be clearly documented.

   In the light of the conclusions of the assessment of the implications for the site/s and subject to the provisions of Habitats Directive Article 6(4), the competent authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site/s concerned. This document is an NIS which includes the information necessary for the competent authority to perform an AA.

   Therefore, an AA is an impact assessment process, the concept of and the approach to be taken when performing an AA is set out in the Commission methodological guidance (2002)[3]. Further guidance was produced for AAs of plans and projects occurring in Ireland[4]. This is a plan level assessment which has been prepared following these guidance documents.

   When considering a plan the guidance further states:

   “In the case of a plan, both the NIS and the AA will normally be undertaken by the plan-making authority or consultants acting on its behalf.”

   “The competent authority may use the NIS and other information collected for the AA as the basis for consultations with internal and external experts, statutory bodies, and other stakeholders.

   In line with the guidance described above this NIS will be distributed for consultation and although its purpose is to inform the subsequent AA stage where effect on integrity with be assessed, preliminary conclusions are provided in relation to each identified potential impact on the conservation objectives of relevant interest features of designated sites. This is to provide consultees with an indication of the likely conclusions of the AA process whilst affording an opportunity to comment further if appropriate.

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[3] European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the ‘Habitats’ Directive 92/43/EEC and the European Commission Guidance ‘ Managing Natura 2000 Sites, 2002

[4] Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities, Department of Environment, Heritage and Local Government, 2009

2 Description of the Plan

2.1 Introduction

The Minister for Communications, Energy and Natural Resources has announced the details of the 2015 Irish Atlantic Margin Licensing Round, which is due to close in September 2015. In addition, it is his intention to continue with a policy of open-door licensing in the Irish Sea and Celtic Sea from 2015 to 2020.

The Irish Offshore Strategic Environmental Assessment 5 (IOSEA 5) is being undertaken on the basis of assumptions regarding the maximum amount of seismic and drilling activity likely to occur as a result of activities conducted under petroleum exploration and production authorisations in the IOSEA 5 area, including existing authorisations, in addition to any new authorisations awarded either in the current Atlantic Margin Licensing Round or via the open-door licensing in the Irish and Celtic Seas. An AA is being undertaken alongside the IOSEA 5 with the findings of the AA feeding into the IOSEA 5.

2.2 Irish 2015 Atlantic Margin Offshore Licensing Round

Ireland's major Atlantic basins are included in this Licensing Round which is aimed at building on the success of the 2011 Atlantic Margin Licensing Round. The Licensing Round includes 995 full blocks and 93 part blocks, covering an area of approximately 256,700 square kilometres.

For the purposes of this Licensing Round, the Atlantic Margin is divided into three regions with differing application limits. For the smaller Donegal Basin, Erris Basin and Slyne Basin Region, a four block limit applies. Applications for up to six blocks can be made for the Porcupine Basin and the Goban Spur Basin Region. For the Rockall Basin Region, the maximum area that may be applied for in a single application is up to ten blocks.

Two year Licensing Options are available and the Round will close in September 2015. The licensing terms are set out in the Department's Licensing Terms for Offshore Oil and Gas Exploration, Development & Production, which provide the operational framework for oil and gas exploration and production. In addition, Rules and Procedures for Offshore Petroleum Exploration and Production Operations apply to all petroleum exploration and development/production operations in the territorial waters of the State and in the designated areas of the continental shelf under Irish jurisdiction[5].

2.3 Open-Door Licensing in the Irish Sea and Celtic Sea

The Irish and Celtic Seas, as well as the Fastnet Basin, have been available for exploration licensing on an 'open door' basis since the Irish licensing regime was first introduced in 1975, and it is planned that this open door policy will continue until 2020 for operators wishing to apply for Licensing Options and Standard Exploration Licenses to explore for oil and gas. Operators will also be able to apply for a Lease Undertaking or a Petroleum Lease, as applicable, when a discovery is made.

[5] As detailed on DCENR website:
http://www.dcenr.gov.ie/Natural/Petroleum+Affairs+Division/Licensing+Applications/, accessed 23.03.2015

2.4 Existing Authorisations

Existing authorisations within the IOSEA 5 area are principally located in the Irish and Celtic Seas and the Fastnet Basin, as well as in the Porcupine Basin. Licences and Leases have also been awarded within the Slyne Basin and the eastern part of the Rockall Basin.

2.5 Assumptions for the Plan

The types of activity being considered, following the award of petroleum exploration and production authorisations, comprise 2D and 3D geophysical seismic surveying and exploration, appraisal and development/production drilling in the period 2015 to 2020. There is uncertainty regarding the degree of future activity; therefore, the maximum numbers assumed for seismic and drilling activities are higher than historic levels. These comprise the following:

- up to a maximum of 25,000 line km of 2D seismic survey per annum;
- up to a maximum of 20,000 km^2 of 3D seismic survey per annum; and
- drilling of up to a maximum of 10 wells per annum.

The above estimates of maximum levels of each activity have been made by the DCENR on the basis of historical experience and are shown in further detail in Table 2.1.

Table 2.1. Exploration and Production activities (i.e. seismic surveying, exploration, appraisal and development / production drilling)forecast in the IOSEA 5 area between 2015 and 2020

Type of activity	2015	2016	2017	2018	2019	2020
	Max	Max	Max	Max	Max	Max
2D seismic survey (km)	25000	25000	25000	25000	25000	25000
3D seismic survey (km^2)	20000	20000	20000	20000	20000	20000
Number of wells	10	10	10	10	10	10

Assumptions were made within IOSEA 4 in relation to the time required to complete the maximum levels of seismic survey proposed. A similar assumption has been extrapolated for IOSEA 5 based on the maximum 2D and 3D survey distances identified in Table 2.1. The assumptions are:

- A 2D survey vessel will complete 25 km of survey per day. To undertake a maximum of 25,000 km of 2D survey this amounts to 1,000 survey days each year.
- A 3D survey vessel will complete 30 km^2 of survey per day. To undertake a maximum of 20,000 km^2 this amounts to 666.7 survey days per year.

This results in a combined survey effort of 1,667 survey days per year. In IOSEA 4, it was assumed that 500 survey days could be performed using 2 vessels operating throughout the year or more vessels if the surveys are concentrated in the summer months. Similarly, it is assumed that 1,666.7 survey days could be met by 6 vessels operating throughout the year or 12 vessels if the surveys are concentrated in the summer months.

2.6 Alternative Options

As a means of testing or assessing Ireland’s offshore hydrocarbon resources in order to meet current and predicted energy requirements, few realistic alternatives to the proposed activities can be identified. However, the following alternative options for assessment have been identified:

- To proceed with licensing and permitting of petroleum activities according to the existing regulatory regime, up to the maximum levels specified by continuing with existing restrictions; or
- To proceed with licensing and permitting of petroleum activities up to the maximum levels specified, subject to modifications to the regulatory regime which may derive from the SEA process, e.g. restrictions in area licensed or restriction of timing of activities.

2.7 Summary of Elements of the Plan that could Impact on Natura 2000 Sites

Within the IOSEA 5 Scoping Report[6], a list of potential seismic survey and drilling activities have been identified and the potential effects associated with these activities are described in terms of their likely significance (see Chapter 6 and Annex F of the IOSEA 5 Scoping Report). The activities considered likely to have the potential for significant (major) impacts on ecology, and hence potentially on the features and conservation objectives of the identified designated sites are described below. No additional effects were identified in the scoping consultation process.

2.7.1 Seismic Survey Activities and Associated Impacts

Noise Generation from 2D/3D Seismic Operations

Offshore seismic surveys are typically conducted by a vessel towing acoustic sound sources (air guns) 5 to 10 m below the sea surface along pre-determined survey lines. The airguns emit high intensity and low frequency noise (under 200 Hz frequency band with a broad peak around 20-120 Hz and incidental sounds up to 22 kHz) into the surrounding water by the release of bubbles of compressed air, which produces a primary energy pulse and an oscillating bubble. The airguns contain different chamber volumes designed to generate an optimal tuned energy output of specific frequencies.

Sound energy propagates much more efficiently through the ocean than light and many marine animals consequently use hearing as their primary sense. Marine mammals, particularly cetaceans, make extensive use of sound in foraging, communication, reproduction, detection of predators and navigation (e.g. Weilgart, 2007a; Hildebrand, 2004). Anthropogenically-produced noise has the potential to disturb marine mammals and, at sufficient levels, cause physical harm.

Fish are also acoustically sensitive and there is potential for fish that are interest features of sites to experience disturbance effects as a result of underwater noise.

Physical Presence of Survey Vessels and Towed Equipment

Seismic surveys are conducted by a vessel towing long, neutrally buoyant streamers, which contain numerous hydrophones or geophones. These streamers are normally between 3 and 8 km long but can be up to 12 km long.

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[6] Irish Offshore Strategic Environmental Assessment (IOSEA) 5: Scoping Report, ENVIRON (December 2014)

A 2D seismic survey is the simplest form of seismic survey and consists of a single acoustic source and a single towed streamer. The resulting image of the seabed represents a two-dimensional profile in time beneath the survey line. It is normally the first type of seismic survey undertaken during exploration, with the results analysed and used to inform where a follow-up 3D survey should take place or where a potential drilling target may exist.

A 3D seismic survey is a more complex survey method involving more sophisticated equipment. At a basic level, a 3D seismic survey is a dense grid of 2D seismic lines. These surveys typically use multiple towed streamers, enabling the acquisition of many closely spaced 2D lines over a single sail line. The acquired data can then be used to create a 3D image or data volume of the subsurface rock. This provides a much more detailed view of the underlying geology and it is generally used to cover a specific geological target, as informed by the 2D survey.

There is the potential for disturbance and a risk of collision with animals that are qualifying species of a designated site, particularly marine mammals present as interest features of SACs.

Routine Vessel Discharges and Wastes (other than noise and air emissions) – Galley Waste Only

Routine vessel discharges are limited to galley waste, which comprises food waste which emanates from the vessel kitchen. Regulations for the Prevention of pollution by garbage from ships are contained in Annex V of MARPOL. The most recent revisions to Annex V (2012) now generally prohibits the discharge of all garbage into the sea, exceptions are however defined related to food waste, cargo residues, cleaning agents and additives. Exceptions to this also exist with respect to ensuring the safety of a ship and those on board and as a result of accidental loss.

There is the potential for effects on mobile species which are interest features of sites (e.g. birds, marine mammals).

Sea Node / Sea Bottom Cable Surveys

Sea node and sea bottom cable surveys are non-conventional seismic acquisition techniques with Ocean Bottom Cables or Ocean-Bottom Nodes – essentially a seismic source detached from the receivers. Nodes are attached to the seabed, to receive the seismic energy transmitted by vessels. Ocean-bottom cable (OBC) acquisition is deployed on the seafloor and connected by electrical wires. An assembly of geophones and hydrophones are connected by electrical wires deployed on the seafloor to record and relay data to a seismic recording vessel or recording buoy.

Ocean-bottom node (OBN) is also deployed on the seafloor; however, this comprises a set of autonomous seismic receivers/recorders deployed on the sea floor. These are self-contained with a rechargeable battery and generally not connected to other receivers by cable.

In addition, it is possible that electromagnetic (EM) survey may be undertaken – this can use an array of receivers deployed on the seafloor, with a towed electric dipole source. The survey system measures subsurface resistivity to assist in identifying hydrocarbon accumulations.

There is the potential for localised areas of seabed and associated benthos to be disturbed by this activity. Potential effects on the benthos include localised direct disturbance and damage through placement of equipment. Resettlement of disturbed sediment could lead to localised smothering.

Accidental Events

The risk of accidental events in relation to seismic survey activities is related to the following:

- accidental loss of tow equipment; and
- accidental spill of diesel fuel or other utility fluid during normal operations or through accidental damage to vessel or equipment as a result of collision with external factor (buoy, fishing equipment, other vessel).

An event such as the above would have the potential to directly impact features of designated sites should any spill reach these protected areas. Additionally, qualifying Annex II species of these sites which are mobile, such as grey seal, harbour seal, bottlenose dolphin, harbour porpoise, Atlantic salmon, lamprey and shad, maybe effected whilst outwith of the boundary of the sites of which they are qualifying features.

2.7.2 Drilling Activities and Associated Impacts

Physical Presence of the Rig and Vessels at Surface

The types of drilling rig that employed under licenses issued in accordance with the Plan would be Mobile Offshore Drilling Units (MODUs) as follows:

- Moored / anchored (e.g. semi-submersible rigs);
- Dynamically Positioned (DP) rigs, including drillships; or
- Jack-Up rigs (used in shallower waters).

At surface, there is the potential for disturbance and a risk of collision with animals that are qualifying species of a designated site, particularly marine mammals present as interest features of SACs.

Presence of Subsea Equipment

The associated subsea equipment is likely to comprise the following:

- anchors, chains and wire (for a moored drilling unit only);
- wellhead and blowout preventer stack;
- marine riser;
- any Cuttings Transport System (CTS) or Riserless Mud Recovery (RMR) system, pumps, hoses, dispersion frames and hose skids; and
- Remotely Operated Vehicle (ROV).

Localised areas of seabed would be disturbed during installation and subsequent removal of the drilling rig, principally by manoeuvring and dragging of anchors and their chains in the case id non-DP Mobile Offshore Drilling Units (MODUs). Potential effects on benthos would include localised direct disturbance and damage through placement of anchors and chains. Resettlement of disturbed sediment could lead to smothering effects as described below for drilling discharges, but on a much smaller scale.

Potential Discharges from Normal Vessel Operations

As for seismic activity, routine discharges from normal vessel operations is limited to waste from normal survey vessel operations (galley waste, i.e. food waste which emanates from the kitchen).

Potential for effects due to ingestion or entanglement of discharges by faunal mobile species which are interest features of sites (e.g. birds, marine mammals).

Potential Discharges from Commissioning of Drill Rigs

As drill rigs are being brought on-line in preparation for drilling, some discharge of ballast water would occur.

Potential for direct contact or ingestion by mobile species which are interest features of sites (e.g. birds, marine mammals) and features of offshore sites.

Mud, Cement and Cuttings Release from Tophole Sections

The first step in the sequence of drilling activities is to drill a tophole section into the sea bed into which the conductor pipe is cemented, following which the well is drilled in successively smaller diameter sections until the hydrocarbon-bearing formation is reached. Once each well section is drilled, steel casing of appropriate diameter is inserted and cemented into place, to provide stability and a barrier between the wellbore and surrounding formations. In addition, the casing provides a firm anchorage for the blow out preventer (BOP) stack and structural integrity for subsequent drilling, testing and possible future production operations. Once the BOP is in place the marine riser, a large diameter pipe that connects the BOP stack to the drilling rig, is installed

Cuttings and particulate material from drilling mud (usually seawater with high viscosity bentonite sweeps) used to drill the top hole section(s) is normally deposited at the seabed close to the wellhead. A small quantity of the cement used to secure the first set of casing in the borehole is also deposited here. Most of the discharged material would end up deposited on the seabed, where the main potential for impact to the environment occurs. In addition, discharges from caissons create plumes of suspended fine sediment, which may cause localised chemical changes as sediment passes through the water column. There is the potential for impacts of drilling discharges on both the seabed and its associated fauna, and on marine organisms in the water column.

Well Testing

If hydrocarbons are found, well test flaring is typically required in order to test the productivity of a potential well and determine parameters such as pressure, flow rates and other reservoir rock and fluid characteristics.

The assumption that has been used within IOSEA 5 is that 50% of all wells drilled would require testing.

Flaring can have consequences for seabirds which are attracted to the light and suffer injury or death as a result of collisions or exhaustion from circling the light source (Wiese *et al.*, 2001).

Vertical Seismic Profile (VSP) / Checkshot Surveys, Including Underwater Noise Generation

Seismic data used to image subsurface geology are measured as a function of seismic traveltime, i.e. the elapsed time for a seismic wave to travel from its source to a given reflector and return to a receiver at the Earth’s surface. Borehole seismic surveys such as a checkshot survey or Vertical Seismic Profile (VSP) measure the seismic traveltime from the surface to a known depth in the borehole, thereby allowing the well data to be correlated with the seismic data.

Sound energy propagates much more efficiently through the ocean than does light and many marine animals consequently use hearing as their primary sense. Marine mammals, particularly cetaceans, make extensive use of sound in foraging, communication, reproduction, detection of predators and navigation (e.g. Weilgart, 2007a; Hildebrand, 2004). Anthropogenically-produced noise has the potential to disturb marine mammals and, at sufficient levels, to physically harm animals.

Fish are also acoustically sensitive and there is potential for fish that are interest features of sites to experience disturbance effects as a result of underwater noise.

Accidental Events

Given their unpredictable nature, it is difficult to define potential accidental events that may occur as a result of the Plan activities; however the following scenarios are considered:

- Low probability but large scale events such as a well blowout (a catastrophic loss of control of well pressure resulting in uncontrolled release of hydrocarbons from a well such as was the case with the Deepwater Horizon incident in Gulf of Mexico, 2010); through to
- Smaller scale events such as minor spills or collisions (diesel, hydraulic fluid, OBM).

Spilled oil and chemicals at sea can have a number of environmental and economic impacts, the most conspicuous of which are on seabirds and marine mammals; however, any spill reaching shore would impact directly upon habitats. During drilling activities, there is a risk of spillage of oil (fuel/crude), and spillage or leakage of chemicals. Additionally, there is the risk of shallow gas blowouts which could have major direct and indirect impacts on designated sites and associated features.

3 Appropriate Assessment Screening summary

The initial screening stage (Appropriate Assessment Screening[7]) identified all potential impacts resulting from the plan, considering both individual and in combination impacts, which might have LSE on a Natura 2000 site. At this stage an initial list of all sites which might be affected by activities associate with the Plan was compiled including coastal sites on both the Irish coasts and also on the adjacent UK coastlines and offshore sites. The initial list of sites has been analysed through an assessment of significance to consider which site(s) could be excluded from further assessment on the basis that it can be demonstrated that the Plan will have no LSE on the site(s) in view of the sites' conservation objectives. Where doubt exists about the risk of a significant effect, sites were included for consideration within the AA. Comments and issues raised during consultation are summarised below in Table 3.1 and an explanation on how and where these have been addressed provided.

Table 3.1: Issues Identified during Consultation

Consultee	Issue	Where / How this is addressed
DECC	DECC has undertaken a series of AAs for oil and gas licensing. AAs for Blocks applied for as part of the UK 27th Licensing Round in Northern Irish waters and within the Eastern Irish Sea (links provided) may be of relevance. A 28th Round HRA screening document was published in October 2014 and AAs are currently in preparation. For these, the freshwater pearl mussel (*Margaritifera margaritifera*) was considered relevant to the assessment due to the connection of its lifecycle to that of Atlantic salmon.	The DECC AA information was reviewed. In relation to *M. margaritifera* this species was not considered as a potential receptor in the absence of significant impacts upon salmonids being predicted.
Natural Resources Wales	The AA must take account of the Conservation Objectives for relevant European and international sites and their features. Conservation Objectives for Welsh sites are provided within site 'Core Management Plans' and, in the case of European Marine Sites, within CCW's 'Regulation 35' advice documents.	CO's for all sites including Welsh sites considered in the AA screening and NIS – AA still to be completed
	Harbour porpoise - no decision has yet been taken on the whether any further SACs will be designated for harbour porpoise. However, a robust assessment of the potential effects of the plan on harbour porpoise populations, together with measures to mitigate potential adverse effects as far as possible, will be required.	Harbour porpoise considered in AA process when designated feature, however; full consideration has been given to this species as an EPS in the Marine Mammal Assessment (IOSEA 5 Environmental Report, Annex C section 7) and mitigation measures considered

[7] Irish Offshore Strategic Environmental Assessment (IOSEA) 5 Appropriate Assessment Screening Report, DCENR, 2014

Table 3.1: Issues Identified during Consultation		
Consultee	**Issue**	**Where / How this is addressed**
	Marine Mammal Management units - For the 'grey seal' feature of Welsh SACs, the relevant Management Unit is South and West England and Wales, while for bottlenose dolphin the relevant Management Units are the Irish Sea and the Channel and South West England	Acknowledged
	SPA Designations - In October 2014, Welsh Ministers announced that Wales would be taking forward further marine SPAs. Evidence has identified possible draft sites for SPAs in Welsh waters for foraging terns, red throated, diver manx shearwater and puffin. The IOSEA 5 HRA may need to consider these sites.	All SPAs and pSPA's have been included, and these have as interest features all named species.
JNCC	JNCC notes that DCENR has considered the relevant Natura 2000 sites in UK offshore waters represented by sites of community importance (SCIs). Some of these sites such as: • East Rockall bank SCI; • Stanton Banks SCI; • Croker Carbonate Slabs SCI; • Haig Fras SCI; abut or are very close to the median line with Irish waters and may be therefore more susceptible to the effects of oil and gas exploration activities depending on the specifics of the project. We are unsure if, at this early stage, it is sensible to screen them out of the AA process and suggest that, while for noise, impacts on the conservation features can be excluded a residual risk might still be present for drilling activities and, depending on the type of hydrocarbon, oil spills with regard to impacts on Annex I habitats; this has particular relevance when assessing in combination with multiple drilling and other activities occurring in a certain area.	These sites have now been screened into the AA (Natura Impact Statement, Section 3)
DoE Northern Ireland	All Northern Ireland transboundary Natura 2000 sites sensitive to the proposed activities of the Plan have been screened into the Appropriate Assessment stage.	Noted
	More information about these and other designated sites in Northern Ireland may be found at http://www.doeni.gov.uk/niea/protected_areas_home http://jncc.defra.gov.uk/page-4	Acknowledged
	Please note that new important data sources may emerge during the drafting of IOSEA 5 such as a suite of potential UK marine SPAs.	Noted

There have been a few minor amendments made since the AA screening, these are explained below:

- Magilligan SAC now screened out due to absence of sensitive qualifying features.
- Maumturk Mountains SAC now screened out due to location.
- Harbour seal and reef added as qualifying features of Lambay Island SAC as these features were not previously captured although site was screened in due to presence of other sensitive features.
- Harbour seal feature added to Slaney River Valley SAC as not previously captured although site was screened in due to presence of other sensitive features.

After further consideration and acknowledging consultee comments (JNCC, Table 3.1) the following four transboundary offshore UK sites have now been screened into the assessment for potential seismic and drilling related impacts, due to being located immediately adjacent to the IOSEA 5 area (excluding impacts from noise generated by seismic airguns and VSP/Checkshot surveys):

- East Rockall Bank
- Stanton Banks
- Croker Carbonate Slabs
- Haig Fras

A total of 347 Natura 2000 sites were brought forward for further consideration based on their qualifying features being identified as having the potential to be receptors of significant impact from specific and identified elements (activities) of the Plan (see Tables A.1 & A.2, in Annex A). These impacts, in relation to the sites identified during the screening stage, are considered in this NIS.

4 Impacts on Natura 2000 Site Features

The following chapter considers the ecological impacts of the Plan, on its own or in combination with other plans and projects, on the identified Natura 2000 sites in view of the sites' conservation objectives.

Of the potentially significant impacts identified by this process (summarised in section 2.7), only those likely to have an effect on the features and conservation objectives of the identified Natura 2000 sites are considered. The main threat to coastal sites arises from the potential for an oil spill reaching the coast (in Ireland or elsewhere) and damaging any qualifying habitats or species.

The noise generated from both drilling and seismic activities also has the potential to cause disturbance to mobile species which are qualifying interest features of certain sites. Furthermore, although physical habitats are not directly sensitive to underwater noise at the levels expected, there is considered to be the low likelihood of landslides caused by pressure waves associated with noise generating activities which could impinge on such habitats, in this instance the Annex I habitat "Reef" has been identified as the potential receptor of these impacts (Table 2.1). Impacts to the seabed and associated benthos can result from the presence of subsea equipment (including wellhead, anchors, chains etc.) and the discharge of drill cuttings, cement and associated chemicals. These potential seabed impacts are therefore potentially relevant to the protection of offshore Natura 2000 sites.

Tables A.1 and A.2 (Annex A) summarise which Natura 2000 sites (SAC and SPA respectively) have been selected for further assessment (screened into AA) based on the potential impacts and their qualifying site features.

Table 4.1 below summarises the number of Irish and transboundary sites screened in for AA by impacts and qualifying features.

Table 4.1 Summary of number of sites screened in for AA by potential impacts and feature

Impacts	Site	Feature	Irish sites	Transbounday sites
From seismic activities	SAC/SCI/CSAC[8]	Reef	17	0
		Submarine structures made by leaking gas	N/A	0
		Bottlenose dolphin	2	2
		Harbour porpoise	3	1
		Grey seal	10	8
		Harbour seal	13	6
		Otter	6	N/A
		Salmon	15	8
		Lamprey	8	10
		Shad	5	5
	SPA/pSPA	N/A	N/A	N/A
From drilling activities	SAC/SCI/CSAC	Reef	17	0
		Submarine structures made by leaking gas	N/A	0
		Bottlenose dolphin	2	2
		Harbour porpoise	3	1
		Grey seal	10	8
		Harbour seal	13	6
		Otter	6	N/A
		Salmon	15	8
		Lamprey	8	10
		Shad	5	5
	SPA/pSPA	N/A	N/A	N/A
From Accidental Event	SAC/SCI/cSAC	• Sandbanks which are slightly covered by sea water all the time • Estuaries	122	70

[8] Site status explanation (source JNCC website):

Special Areas of Conservation (SAC's) are sites that have been adopted by the European Commission and formally designated by the government of each country in whose territory the site lies.
Sites of Community Importance (SCIs) are sites that have been adopted by the European Commission but not yet formally designated by the government of each country.
Candidate SACs (cSACs) are sites that have been submitted to the European Commission, but not yet formally adopted

Table 4.1 Summary of number of sites screened in for AA by potential impacts and feature

Impacts	Site	Feature	Irish sites	Transbounday sites
		• Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Large shallow inlets and bays • Reefs • Submarine structures made by leaking gases • Submerged or partially submerged sea caves • Annual vegetation of drift lines • Salicornia and other annuals colonising mud and sand • Spartina swards (*Spartinion maritim*ae) • Atlantic salt meadows (*Glauco Puccinellietalia maritimae*) • Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) • Vegetated sea cliffs of the Atlantic and Baltic coasts		
		Bottlenose dolphin	2	2
		Harbour porpoise	3	1
		Grey seal	10	8
		Harbour seal	13	6
		Otter	27	13
		Salmon	15	8
		Lamprey	8	10
		Shad	5	5
	SPA/pSPA	All features	98	46

5 Impact Assessment for Seismic Survey Activities

5.1 Introduction

Offshore seismic surveys are conducted by a vessel towing acoustic sound sources (air guns) 5 m to 10 m below the sea surface along pre-determined survey lines. The air guns generate energy by the release of bubbles of compressed air, which produce a primary energy pulse and an oscillating bubble. The airguns contain different chamber volumes designed to generate an optimal tuned energy output of specific frequencies. Airguns produce loud impulsive low frequency sounds at regular intervals which are usually around 226 dB re 1 µPa for a single airgun or 242 to 252 dB re 1 µPa for an array.

The generated sound waves travel to the sea bottom, both penetrating and reflecting off the seabed itself and successively deeper rock strata beneath. The reflected signals are detected by hydrophones towed in streamers behind the survey vessel. These streamers are towed at 5 or 6 m depth behind the noise source and are normally between 3 and 8 km long but can be up to 12 km long. Each streamer is constructed in sections comprising a central core containing the electronics, surrounded by a layer of cable oil (a light kerosene-type oil), and enclosed in a durable outer skin.

A 2D seismic survey is the simplest form of seismic survey and consists of a single acoustic source and a single towed streamer. The resulting image of the seabed represents a two dimensional profile in time beneath the survey line. It is normally the first type of seismic survey undertaken during exploration with the results analysed and used to inform where a follow-up 3D survey should take place or where a potential drilling target may exist.

A 3D seismic survey is a more complex survey method involving more sophisticated equipment. These surveys will use multiple towed streamers, which create a grid of hydrophones or geophones across the survey area. The resulting seabed image is 3D and contains a greater density of data points than a 2D survey, with a resultant cube of seismic data acquired. This provides a much more detailed view of the underlying geology and it is generally used to cover a specific geological target, as informed by the 2D survey.

The seismic survey effort estimated by the DCENR for the licensing area amounts to a likely maximum of 25,000 km of 2D and 20,000 km^2 of 3D survey per annum (Table 2.1). In terms of ship time at sea this amounts to approximately 1,000 days vessel time for 2D seismic surveys and 667 days vessel time for 3D seismic surveys per annum (see section 2.5).

It has been identified that the underwater noise generated from airguns during seismic data acquisition has the potential to impact on the following habitats and species that are qualifying features of the sites identified in Table A.1.

5.2 Protected Habitats and Associated Sites (Annex I)

Due to the offshore nature of the operations associated with the Plan and therefore the distance of the seismic activities from most coastal sites, in conjunction with the relatively low intensity of operations, the majority of Irish and transboundary Natura 2000 sites with marine habitat features (Table 6.1, AA Screening report) are not anticipated to be significantly impacted, either alone or in combination, by seismic activities associated with the Plan. For the purpose of this assessment only sites with qualifying vulnerable Annex I features that occur within the IOSEA 5 area or immediately adjacent/abutting the area are assessed for impacts.

The Annex I habitats that have been identified as potentially vulnerable to impacts from these activities and are present in Irish and adjacent Natura 2000 sites are:

- Reef
- Submarine structures made by leaking gases

Whilst these habitats are not directly sensitive to underwater noise at the levels expected, the potential for landslides caused by noise generated during seismic exploration which could impinge on benthic habitats has been considered. Figure 1 shows the location of the Natura 2000 sites that are located in the IOSEA 5 study area or immediately adjacent that have reef or submarine structures made by leaking gases (Croker Carbonate Slabs SCI only) habitats as qualifying features (also listed in Table A.1).

5.2.1 Potential Effect: Submarine Landslides Damaging Annex I Benthic Habitats

Gravity-induced submarine landslides may occur naturally in areas of relatively steep slope angles. The location, type and behaviour of such mass failure features is likely to have a considerable impact on the design, planning and location of seabed structures in the event of petroleum development and production in the region (Shannon *et al.*, 2001). Slope failure features are widespread along both the western and eastern margins of the Rockall Trough. A variety of such features, including various types of slides and slumps, have been identified on sidescan and multibeam sonar data. Many of these may be relatively recent geologically (well within the last 10,000 years), and they are often associated with canyon systems (Austin, 2002; Shannon *et al.*, 2001). Slope failure scarps are more common on the slopes of the Porcupine Bank than in areas further north on the eastern margin of the Rockall Tough, possibly due to the steeper slope gradients in this region (O'Reilly *et al.*, 2001). The deep water areas of the western Rockall Trough have been relatively sediment starved compared to those of the eastern Rockall Trough, and there are relatively few submarine landslides in these areas (Holmes, 2002 cited in Hartley Anderson, 2005). Austin (2002) suggested that detailed analysis is needed to assess the timing of major slope failure in the past and hence the significance of such activity in terms of the present day stability of the outer shelf and continental slope.

There appear to have been no recorded examples of seismic survey triggering underwater landslides in Irish waters, in spite of the volume of seismic survey work that has taken place since the 1960s. This suggests that such events, if they happen at all, are too small to be detected by earthquake recording systems.

Conclusion: Based on the information available and the very low likelihood of seismic noise from surveys triggering such an event, the direct or indirect impacts of seismic noise on seabed features, and specifically Annex I habitats within protected sites, are likely to be negligible and would not be anticipated to adversely affect the integrity of the Natura 2000 sites identified in Table A.1 in view of the conservation objectives of these sites.

5.3 Protected Species and Associated Sites (Annex II)

Protected sites within or adjacent to the IOSEA 5 area with qualifying species that have the potential to be affected, as listed in Table A.1, by seismic activities described in section 2.7.1 are typically coastal in nature and likely to be some distance from offshore seismic activities. However, some qualifying features of protected sites are highly mobile in nature and therefore could encounter effects at a closer range. Additionally, an animal that is affected by an activity occurring as part of exploration activity in the IOSEA 5 area may well cross boundaries into waters of other nations. However, since impacts within the IOSEA 5 region are likely to be short-term and non-significant, it follows that effects would be lower, or at worst the same outwith Irish waters. For the purpose of this assessment all Irish and UK transboundary sites with these features have been considered and are listed in Table A.1. Mobile species considered include cetaceans, pinnipeds and diadromous fish species. There are currently no Irish offshore protected sites for these species.

Figure 2 shows the locations of the Natura 2000 sites that are located in or adjacent to the IOSEA 5 area and UK sites that have mobile qualifying features with the potential to be impacted (also listed in Table A.1). Impacts from seismic activities that have the potential to affect these features arise predominantly from noise generation associated with airgun operations.

5.3.1 Potential Effect: Injury or Disturbance to Marine Animals Resulting from Noise

Sound is a much more efficient way to propagate energy through the ocean than light, and many marine animals, use hearing as their primary sense. Cetaceans, in particular, are heavily dependent on sound for food-finding, communication, reproduction, detection of predators, and navigation (Weilgart, 2007a; Hildebrand, 2004a).

The ocean is a naturally relatively high noise environment and cetaceans in particular evolved ears that function well within this context of high natural ambient noise and anatomical and behavioural studies suggest that whales and dolphins may be more resistant than many land mammals to temporary threshold shifts; however, these data also show that they are subject to disease and aging processes and therefore are not immune to hearing loss. Increasing ambient noise via human activities is a reasonable candidate for exacerbating or accelerating such losses (Ketten, 2004).

The introduction of additional (man-made) noise into the marine environment could potentially interfere with animal's ability to determine the presence of other individuals, predators, prey and underwater features and obstructions. This could therefore cause short-term behavioural changes and, in more extreme cases, cause auditory damage. In addition to marine mammals, underwater sound may also cause behavioural changes in other animals such as fish and turtles. Although there are many documented, clearly discernible responses of marine mammals to anthropogenic sound, these responses are often subtle. It remains unknown when, and how, these changes translate into biologically significant effects, i.e. effects that have repercussions for the animal and effects that have potential consequences on population level (NRC, 2005). Increased stress levels are some of the ways populations may be threatened by noise. Such population-level effects are, however, particularly hard to detect in cetaceans (Weilgart, 2007b). However, population level responses in marine mammals are long term effects that, by definition, will take a long time to detect, and cannot be observed until they have occurred. It is neither good management, nor ethically defensible, to allow population level effects to occur before identifying and addressing potential problems (Tyack *et al.*, 2004).

Marine Mammals

There is a growing awareness of the potential for man-made underwater noise to impact marine animals, particularly marine mammals. Available information on the effects of noise on marine mammals indicates that cetaceans and pinnipeds can react differently to the introduction of additional noise into the marine environment. Their reactions are attributable to sound source level, propagation conditions and ambient noise, as well as to animal type, age, sex, habitat, individual variation, and previous habituation to noise (e.g. Richardson *et al.,* 1995).

Even though there is great diversity in hearing and in the biological effects of noise among marine mammals, current knowledge supports an approach to categorise animals, based on certain functional and/or phylogenetic characteristics, in order to assess the impact of anthropogenic noise (Southall *et al.*, 2007). Marine mammals do not, however, hear equally well at all frequencies within these functional hearing ranges. Southall *et al* (2007) developed a set of injury criteria for individual marine mammals exposed to discrete noise events, such as seismic survey operations, for example. These criteria aim to set threshold values above which the continual exposure to significant sound levels, or brief sound pulses with extremely high noise levels, could create permanent hearing impairment in marine mammals. The sound thresholds for pulse sounds, when adjusted for the main low frequencies produced by airguns, are 230, 234 and 236 dB re 1 µPa for low- mid- and high-frequency cetaceans, respectively (Table 5.1). These threshold levels lie at the top end of the sound levels produced by large 2D or 3D seismic survey arrays which are in practice much lower in the near-field, than the typical theoretical point source level of 248 dB re 1 µPa indicates.

Table 5.1: Functional marine hearing in groups of marine mammals potentially present in the IOSEA 5 area (Southall et al., 2007)

Functional hearing group	Estimated auditory bandwidth	Species potentially present in the IOSEA 5 area
Low frequency cetaceans	7 Hz – 22 kHz	Fin whale, Blue whale, humpback whale, minke whale
Mid frequency cetaceans	150 Hz – 160 kHz	Common dolphin, bottlenose dolphin, Risso’s dolphin, white sided dolphin, white beaked dolphin, pilot whale, killer whale, Cuvier’s beaked whale, sperm whale
High frequency cetaceans	200 Hz – 180 kHz	Harbour porpoise
Pinnipeds in air	75 Hz - 30 kHz	Grey seal, harbour seal, walrus
Pinnipeds in water	75 Hz – 75 kHz	Grey seal, harbour seal, walrus

The complexity and uncertainties of marine mammal reactions to underwater noise, and the variability of the strength of noises in the marine environment, mean it is difficult to establish definite areas of influence around an anthropogenic sound source. However, several general zones of noise influence have been identified as follows:

Zone of audibility – the furthest reaching zone, in which marine mammals can hear anthropogenic noises, because they are louder than ambient noise. Although the animal can hear the noise, it is unlikely that the sound will have any deleterious effects at such large distances. The size of this zone can vary greatly as ambient noise fluctuates between the seasons and differs between locations.

Zone of responsiveness – a more localised area around a sound source, in which animal behavioural responses to noise are observed. The size of the zone is a combination of the sound source level, propagation conditions and ambient noise, in addition to animal age, sex, habitat, individual variation, and previous habitation to noise. In this zone individuals and even entire populations may show almost no signs of disturbance because of habituation or toleration of the sound, or the fact that the noise may be outside the hearing sensitivities of a particular animal. If noises produce a response then the effects can vary greatly between species and individuals. Marine mammals may become distracted, disturbed, annoyed, or even fearful of these noises which could cause potential physiological upset. Common marine mammal responses to noise are changes to dive behaviour, respiration and surfacing rates; quantifiable indicators which can be used to measure animal stress (Richardson *et al.*, 1995). Variation in responsiveness among different individuals, or for one individual at different times, may greatly affect the radius of responsiveness. In general, several physical and biological factors are known, or suspected, to affect the responsiveness, actual or apparent, of a given species of marine mammal to man-made noise. As a result, the maximum radius of responsiveness can vary widely among individuals, locations and over time. Thus the radius of responsiveness, even for a specific type of man-made sound and a particular species, is a variable, not a constant (Richardson *et al.*, 1995).

Zone of masking – an area in which faint noises produced by the animals are masked by anthropogenic noises of a similar frequency. Any increase in background noise, either man-made or naturally occurring, can interfere with an animal's ability to detect a sound signal, especially if the sound signal is weak relative to the total noise level (Richardson *et al.*, 1995). In general, (man-made) pulsed noise has a smaller potential for masking than temporally continuous noise. Furthermore, masking depends on the amount of energy that the call and the (man-made) noise share in the so-called critical frequency bands, which are characteristic of the animal's auditory capacity (Gisiner, 1998). Although little is known about the importance of low-level sounds in background noise to marine mammals, the fact that they have developed such sensitive hearing, and seem to be adept at detecting signals in background noise, suggests that this is an important ability for them (Gordon *et al.*, 2004).

Zone of discomfort or hearing loss – an area in which there is a possibility of auditory injury to an animal from underwater sound. The extent of this zone is somewhat speculative because of the scarcity of any direct measurements on marine mammal hearing systems, particularly in the wild. However, it is proposed that continual exposure to significant sound levels, or brief exposure to extremely high noise levels, could create permanent or temporary hearing impairment in marine mammals. Seismic surveying produces noise pulses that are intermittent but considerably more intense than the continuous noise emitted by most industrial pulses to damage the auditory systems of marine mammals *per se*. However, extensive information on the impacts of anthropogenic sound and zones of discomfort on marine mammals is available (e.g. Richardson *et al.*, 1995; Gordon *et al.*, 2004), including sound produced by seismic vessels. It is generally considered unlikely that marine mammals would remain for any length of time close to any noise source that causes discomfort.

Cetaceans

It is assumed that baleen whales have hearing sensitivity ranges between 10 Hz - 20 kHz, with greatest sensitivities usually below 1 kHz (Evans, 1998; Southall *et al.*, 2007). It is clear that this hearing range overlaps with the low frequency sounds produced by seismic surveys, which may mask long distance communication between whales and prevent the detection of other faint sounds (Evans & Nice, 1996). Nieukirk *et al.* (2004) for example recorded seismic survey sound travelling over 3,000 km when analysing low frequency sounds from an autonomous hydrophone array moored along the Mid-Atlantic Ridge. In fact, airgun sounds tended to dominate their recordings during the summer months. However, loud whale songs could generally still be detected during intense airgun activity, although there were occasions, when the array recorded airguns from more than one location, masking cetacean sounds.

Although it is unlikely that any seismic survey operations will cause injury, they may very well evoke some behavioural responses from any cetaceans in the vicinity of such operations. Modelling indicates that baleen whales and fish may show some form of avoidance reaction from anywhere between a few km to tens of km from the seismic operations. However, field research has indicated that these zones of avoidance behaviour could be reduced or extended depending on local conditions. Individual animals might leave or avoid this area, but may be expected to return soon after operations have ceased. Of the odontocetes, it appears that the smaller species in particular, i.e. the dolphins and porpoises, show a degree of avoidance behaviour up to a distance of a few km, and which is generally short lived (Weir, 2008; Stone & Tasker, 2006; Goold, 1996).

There are two coastal Natura 2000 sites within the IOSEA 5 region designated for cetacean species, Roaringwater Bay and Islands SAC (harbour porpoise) and Rockabill to Dalkey Island SAC (harbour porpoise).

Additionally, there are a number of Natura 2000 sites located along the coastlines of Ireland and the UK outside the IOSEA 5 boundary also designated for Annex II cetacean species (bottlenose dolphin and harbour porpoise) (see Figure 2).

The predominantly low frequency nature of the sound generated (which is less likely to affect the bottlenose dolphin and harbour porpoise - medium to high frequency auditory range) through the water column, coupled with the distance from the IOSEA 5 boundary of the majority of these sites will ensure that there is little or no discernible impact from the noise generated by the airguns within the IOSEA 5 area on key designating species of any Natura 2000 sites, whilst within the SAC boundaries (with the exception of Roaringwater Bay and Islands SAC and Rockabill to Dalkey Island SAC). However, within the context of known foraging patterns and observed avoidance behaviour in marine mammals, consideration is also given to the possible impact on foraging behaviour of cetacean features whilst outside the SAC boundaries for which they are designated.

Pinnipeds

There have been very few studies of the effects of airgun noise on pinnipeds (seals), even though they are known to have good underwater hearing and their feeding grounds often overlap with seismic survey areas (Gordon *et al.*, 2004). A review of the effects of seismic survey on marine mammals by Gordon *et al.* (2004) quotes one single study by Thompson *et al.,* (1998) on the research on behavioural and physiological responses of grey and harbour seals to (small) airguns. The study indicated that reactions observed in harbour seals included initial fright responses once the air guns were switched on, generally followed by strong avoidance behaviour, i.e. swimming rapidly away from the sound source. The seal ceased feeding during this time. It should be noted, however, that one seal showed no detectable response and approached to within 300 m of the airgun (source levels of the airgun were 215 - 224 dB re: 1 m Pa peak-to-peak). The behaviour of the harbour seals seemed to return to normal soon after the airguns were switched off. Similar avoidance responses were documented during the trials with grey seals, i.e. they changed from making foraging dives to v-shaped transiting dives moving away from the sound source. The grey seals returned to normal behaviour within 2 hours after switching off the airguns.

In addition to any direct response reactions, it has been shown that moderate levels of underwater noise can induce temporary reduction of hearing sensitivity (temporary threshold shift or TTS) in some marine mammals (including pinnipeds), provided that the exposure duration is relatively long (Kastak *et al.*, 2005). Although such individual exposure events are not likely to have dramatic long-term or fitness consequences (except for cases of extremely high exposure levels resulting in acoustic trauma), they may result in short-term impairment in the ability to communicate, navigate, forage and detect predators. Additionally, behavioural reactions to noise exposure such as startle responses or avoidance may interrupt ongoing behaviours as severe as mother-offspring separation (Kastak *et al.*, 1999).

Because of concerns about the cumulative 'dose' effects of repeated short term sound 'pulses' from activities such as seismic survey Southall *et al.* (2007) proposed a limit of 186dB re 1μPa^{2}s (summed energy for all pulses) by for pinnipeds in water (NB some authorities consider this latter threshold to be too low: Thompson and Hastie (2012)[9] have proposed a revised multiple pulse criterion of 198 dB re 1 μPa^{2}s (M_{pw})).

Grey seal distribution and movements have been extensively studied in the North Sea and off Scotland using satellite-linked telemetry. Movements generally describe two geographical scales: (i) long and distant travel (up to 2,100 km), and (ii) local, repeated trips to discrete offshore areas, generally considered to be foraging areas (McConnell *et al.*, 1999). Data from harbour seals utilising sites in the UK suggests that foraging trips generally occur within 40 km of haul-out sites (Thompson *et al.,* 1994). However, longer-distance trips to foraging areas more than 850 km from haul-out sites have also been recorded (e.g. Rehberg & Small, 2001). Thus far research in Ireland has largely focused on coastal haul-out and breeding sites and considerable efforts will be required to determine important ecological areas for both species within the waters of the IOSEA 5 area.

It is clear, therefore, that marine seismic exploration activity has the potential to impact upon both species of seal commonly residing in Irish and adjacent waters. The degree of impact within and adjacent to the IOSEA 5 area is as yet unknown.

Otter

The European otter is largely a freshwater mammal. Individuals occupying coastal territories tend to remaining within a 3 to 4 km area of coastline, where freshwater is also readily available for cleaning their fur after exposure to saltwater (Chanin, 2003). When diving, an otter closes both its nostrils and ears and is estimated to remain underwater for no more than 20 seconds for each dive.

Chanin (2003) also acknowledges unpublished observations which indicate that otters will rest under roads, in industrial buildings, close to quarries, and at other sites close to high levels of human activity. These observations suggest that otters are reasonably flexible in their behaviour and do not necessarily avoid 'disturbance' in terms of noise (or proximity to human activity). There is no available evidence specifically related to reaction of otters to seismic survey noise.

Based on these key characteristics of species behaviour and considered within the context of the temporary, short term and subsurface nature of seismic survey acoustics within the IOSEA 5 area, it is considered likely that only otter territories within the immediate IOSEA 5

[9] Thompson P & Hastie G (2012). Identification of appropriate noise exposure criteria for assessing auditory injury for pinnipeds using offshore wind farm sites. Moray Offshore Renewables Limited - Environmental Statement. Technical Appendix 7.3 E.

area are likely to experience any sort of acoustic influence from these activities, if conducted close to or within the SAC boundaries (see Table A.1 for list of sites to which this may apply).

Mitigation

Reducing the noise that enters the marine environment in the first instance is the main measure in minimising the impacts of seismic survey operations on marine mammals. Therefore, all seismic operations should use the lowest practicable acoustic source levels throughout the survey and only discharge pressure waves into the marine environment when strictly necessary.

Pursuant to the Rules and Procedures for Offshore Petroleum Exploration and Appraisal Operations (DCENR, 2010) applicants are required to submit an ‘Application for Approval’ to the DCENR to conduct any Geophysical or other Exploration Survey, Site Survey or Route Survey at least eight weeks prior to the planned commencement date of any activity. Operators are required to include information on the type of sources to be used and the specific impact mitigation and monitoring practices in relation to marine mammals that will be applied during the survey such that the possible impact may be determined. The application should also include a risk assessment of the impact of the proposed survey on Annex IV species (relating to the EU Habitats Directive) that takes account of area-specific cetacean sensitivities likely to be present, both in terms of timing and spatial extent. At the time of application DCENR procedures require that projects are subject to Appropriate Assessment and Environmental Impact Assessment (EIA) screening. If this screening should indicate that a full AA or EIA is required this will be completed as part of the project application processes. During all seismic, site and route surveys, the Operators must ensure that current best industry practices are applied with regard to impact mitigation and monitoring measures.

In order to meet the requirements of the EU Habitats Directive (92/43/EEC), Ireland, as for all other EU Member States, is required to establish a system of strict protection for a number of animal species, including all cetaceans. The NPWS has issued guidelines - “Guidance to manage the risk to marine mammals from man-made sound sources in Irish Waters” (2014) - that have been developed to assist in mitigating against potential impacts on marine mammals from seismic noise. It is a DCENR requirement (DCENR, 2011) that all Operators incorporate these into seismic survey plans. These guidelines highlight a number of measures that should be applied, including:

- The minimum source level required to achieve results should be used and frequencies chosen to minimise impacts on marine mammals;
- Qualified and experienced Marine Mammal Observers (MMOs) must be present on board all vessels conducting seismic surveys;
- MMOs operators must be engaged solely in monitoring the Operator’s implementation of these guidelines and conducting visual/acoustic observation of mammals during the survey;
- The MMO must submit a report to the relevant Licensing Authority;
- MMOs must scan/monitor for cetaceans 30 minutes before a soft start and there must be no cetaceans within 1km of the array. If animals are detected, the operation must be delayed until none have been sighted/detected within the 1 km zone for 30 minutes. If water depth exceeds 200 m then the watch period must last for 60 minutes; and

- The soft start should involve the power in the airguns being built up slowly over 20 - 40 minutes to give marine mammals adequate time to hear the noise and leave the vicinity. This 'soft' start process should be adopted every time airguns are used, even if no marine mammals are seen, and if airguns have stopped and not restarted after five minutes.

The NPWS guidelines are regularly reviewed, alongside other similar guidelines from other countries, as new data, technologies and approaches emerge in order to ensure their continuing status as embodying best practice. In addition, all means of assessing cetacean presence or absence in an area during seismic survey (e.g. passive acoustic monitoring (PAM) and other acoustic systems) should be assessed continuously through research programmes and workshops. Guidelines for offshore areas in other waters (e.g. UK, JNCC, 2010) raise the possibility of deploying PAM in addition to MMO. Such systems make use of hydrophones and software to provide real-time information on cetacean presence (based on vocalisations) to PAM operators onboard vessels. PAM can determine presence or absence of marine mammals in conditions where it may be difficult or impossible for MMOs to operate effectively, for example in heavy sea states or during hours of darkness. It may be that seismic contractors in the region adopt PAM to enhance mitigation measures (e.g. Hedgeland *et al.*, 2010). Parvin *et al.* (2007), however, state that the systems that have been fielded to date are of generally poor quality, have left-right ambiguity (i.e. cannot determine which side the signal is from) and have no range-finding ability, although they conclude that, for vocalising marine mammals, PAM generally offers a more reliable approach than might be expected using visual detection by MMOs alone.

In the event that there is a requirement for multiple surveys in the same area and at the same time, it is recommended a minimum separation distance be employed between surveys to minimise potential cumulative effects. Seismic surveys tend to interfere with each other if carried out simultaneously and within 100 km of each other, so the issue of survey co-ordination in this respect should also meet this concern.

In addition to the requirements outlined above, there are a number of additional measures that should be considered when planning a seismic survey. Importantly, the timing and location of cetacean calving and migration and pinniped breeding seasons should be considered and if possible such areas or time periods avoided. The likelihood of impact will have to be assessed during the planning stage of seismic surveys on a site specific basis but a review should make use of all available sightings data for the region in which the seismic survey is proposed.

Conclusion: Considering the mitigation measures described above and based on the information available, it is considered that significant effects are not anticipated for marine mammal features of the sites identified in Table A.1. However, any proposed survey activity within or adjacent to these sites must be subject to a project level site specific Appropriate Assessment, taking into account the seasonality and timings of planned activities, to ensure that a proposed project will not adversely affect the integrity of the Natura 2000 sites in view of the conservation objectives of these sites.

Diadromous Fish

It is also necessary to consider the impacts of elevated noise levels from seismic survey on the migratory fish species of the IOSEA 5 area such as salmon, shad and lamprey which are of relatively high importance due to national and international protected legislation afforded to them. Sudden elevated noise levels may cause physiological damage or possibly deflect these species from their migratory routes as a consequence of an avoidance reaction initiated through the sudden onset of seismic survey activity.

Shad are expected to exhibit a behavioural reaction of strong avoidance from the source of the noise generated from seismic survey due to their high sensitivity to underwater noise (resulting from their physiology of a close coupling between the inner ear and swim bladder). Salmon would also be expected to exhibit an avoidance reaction as they are hearing specialists but of a medium sensitivity as they possess a swim bladder but do not have the close coupling with the inner ear. However, seismic noise is intermittent in nature and upon cessation of the source noise or once beyond the range of influence of the effect, any impact is expected to cease.

Both river and sea lamprey lack a swim bladder and are considered as having relatively low sensitivity to disturbance from underwater noise. Significant behavioural effects such as disturbance to migration are not anticipated.

Mitigation

The mitigation proposed for potential effects of underwater noise from seismic survey on marine mammal receptors, including following best practice and soft-start for airguns, will also mitigate the impacts of underwater noise on fish.

Conclusion: Based on the information available, it is considered that overall significant effects are not anticipated for diadromous fish features of the sites listed in Table A.1, however, any proposed survey activity within or adjacent to these sites must be subject to a project level site specific Appropriate Assessment to ensure that a proposed project will not adversely affect the integrity of the Natura 2000 sites, in view of the site's conservation objectives.

6 Impact Assessment for Drilling Activities

Typically the first step in the sequence of drilling activities is to drill an exploration well, to see if hydrocarbons are present. The location of exploration wells will be guided by the results of the analysis of the seismic surveys, and the design, depth and dimension of the exploration well will be determined by the environmental characteristics of the locations and the location of the target geological horizon(s). This will also determine the type of drilling rig used (e.g. jackup, semi-submersible, drillship).

If hydrocarbons are found, a series of tests may be required to establish the nature of the hydrocarbons, their flow rates and other reservoir rock and fluid characteristics. Appraisal wells are drilled into a discovered hydrocarbon accumulation to further understand the extent and size of the accumulation. Thereafter, development/production wells are planned to exploit an accumulation of known hydrocarbons.

For the purposes of assessing the impact for drilling activities in the IOSEA 5 area, it has been assumed, based on information contained within the Plan, that the number of days for operations of drilling rigs will be 50 days per well per year (comm, ENVIRON), this would represent a maximum of 500 days drilling activity a year across the IOSEA 5 area.

The impacts associated with drilling activities are summarised in section 2.7.2.

6.1 Protected Habitats and Associated Sites (Annex I)

Due to the offshore nature of the operations associated with the Plan and therefore the distance of the drilling activities from most coastal sites, in conjunction with the relatively low intensity of operations, the majority of Irish and transboundary Natura 2000 sites with marine features, as listed in Table A.1, are not anticipated to be significantly impacted, either alone or in combination, by drilling activities associated with the Plan. For the purpose of this assessment only sites with qualifying vulnerable Annex I features that occur within the IOSEA 5 area or immediately adjacent/abutting the area are assessed.

The Annex I habitats that have been identified as potentially vulnerable to impacts from these activities and are present in Irish and adjacent Natura 2000 sites are:

- Reef
- Submarine structures made by leaking gases

(For sites with this qualifying interest feature see Figure 1)

This protected site habitat may be vulnerable to the deposition of drilling materials on the seabed or to direct disturbance from equipment related to drilling activities.

6.1.1 Potential Effect: Deposition on the Seabed Potentially Damaging and/or Smothering Protected Benthic Habitats.

Most discharged material from drilling operations will end up as deposits on the seabed, where the main potential for environmental impact occurs. The impacts of drilling discharges on both the seabed and its associated fauna, and on marine organisms in the water column, therefore need to be considered.

The cuttings and drilling fluids discharged from the riser-less top sections of the wells are expected initially to form small cuttings piles in the immediate vicinity of each wellhead, together with relatively small amounts of excess cement from setting the top hole sections.

They will then spread out gradually in the vicinity of the wellheads under the influences of gravity and the relatively strong seabed currents.

Biological effects on seabed communities from the discharge of WBM and associated cuttings are usually subtle or undetectable. Monitoring studies around well sites drilled with WBMs have rarely shown any effects to benthic infauna (at a community level) detectable beyond 50 m. Subtle impacts to the benthos were identified at up to 750 m from a production site developed using WBMs, but these were associated with hydrocarbon contamination (Hartley & Bishop, 1986).

As the cuttings and drilling fluids from the remaining well sections are discharged from near the sea surface, they are likely to disperse over a wider area. The deposition pattern tends to reflect the particle size distribution, with larger and heavier (cuttings) particles landing on the seabed relatively close to the discharge point, and small (mud) particles travelling much further before they reach the seabed. The area and depth of deposition is highly dependent on water depth and currents; in continental shelf areas a recognisable footprint may be detectable, whereas in deep water there may be no detectable deposition. Therefore discharges of cuttings and muds near the sea surface are expected to have a minor impact on both the water column and the seabed. The substantial water depths (increasing gradually from the shoreline), the tidal, current and wave regimes in the area enable good dispersion and dilution.

The net result can be expected to be a short-term reduction in productivity just after drilling, and medium-term change in the composition of the benthic community over a small area centred on the wellheads. Long-term effects can be expected to be minimal due to both the overall low toxicity of the WBM, and the currents close to the seabed that will enable (most of) the cuttings to disperse over a wide area so that any impacts are indistinguishable from natural background variation. No detectable effects on the benthic community are expected outside of the area affected by materials discharged at the wellheads.

As a result of their localised nature, the potential impacts associated with drilling discharges are not expected to affect any transboundary Natura 2000 designations. Potential for transboundary impacts as a direct result of drilling activity have therefore been discounted from further consideration.

Drilling operations are temporary activities, which will only occur for a relatively short time period, usually around 50 days per well. The majority of the protected sites in Ireland are close to the coast and consist of dynamic environments that readily recover from disturbance and damage. Considering the extensiveness of the IOSEA 5 area, the relatively low intensity of operations proposed under the Plan and the limited spatial extent of offshore protected sites within this area, the impact of these activities on the features of protected sites is not anticipated to be significant.

Mitigation

The following outlines existing mitigation measures:

- OSPAR have issued various Decisions, Agreements, Strategies and Recommendations relating to the use of chemicals and additives in Oil and Gas exploration, including the OSPAR Decision on the Harmonised Mandatory Control Scheme (HMCS) which includes a list of chemicals considered to pose little or no risk to the environment (PLONOR List), a List of Chemicals for Priority Action (LCPA) and list of Substances of Possible Concern.

- All chemicals used are regulated under the OSPAR HOCNF scheme and approved by use of a PUDAC. Selection of all chemicals that may be used in drilling the proposed wells should be based upon both their technical specifications and their environmental performance, and the use of all chemicals minimised where practicable.
- Mud and chemical usage must be monitored during drilling operations, and subsequently reported to the DCENR. On completion of drilling a mud audit will be prepared showing the quantity of mud brought to the offshore facility, the quantities returned to shore, the quantities left downhole and the quantities discharged.
- The discharge of cuttings contaminated with OBM or SBM to sea is prohibited. Cuttings shipped to shore for treatment and disposal will be dealt with under the local authority waste management plan.
- Best practice should be followed to minimise the amount of excess cement deposited on the seabed.
- Mud recovery systems should be used, thus minimising the amount of drill fluids eventually discharged.

Conclusion: Considering the existing mitigation described above and based on the information available, overall significant effects are not anticipated for Annex I habitat features of the sites listed in Table A.1, however, should it be proposed that drilling operations occur within or adjacent to these sites (particular consideration should be given to the offshore sites listed) then a project level site specific Appropriate Assessment will be performed to ensure that a proposed project will not adversely affect the integrity of the Natura 2000 sites, in view of the conservation objectives of these sites.

6.1.2 Potential Effect: Direct Disturbance to Annex I Habitats from Equipment

A degree of localised direct disturbance to the seabed is expected to occur from the use of subsea equipment and by scouring action from anchors and anchor chains as anchor lines may radiate several kilometres from a drilling rig with hundreds of metres of chain resting on the seabed.

Resettlement of disturbed sediment could lead to some minor smothering effects. Such impacts need to be assessed in the context of the nature of species and communities affected and the scale of the activities. The overall nature of the benthic environment in the IOSEA 5 area is dynamic, and impacts associated with the scraping and dragging of anchors and chains in most areas are likely to be minor with good potential for rapid recovery.

As the potential impacts from physical disturbance to the marine environment (from anchoring etc.) tend to be localised, of short duration and with generally good recovery potential, the risks of transboundary impacts from drilling on identified offshore Natura 2000 sites outwith the IOSEA 5 area are likely to be negligible. Potential impacts on the, these sites have therefore been discounted from further consideration.

Drilling operations are temporary activities, which will only occur for a relatively short time period, usually around 50 days per well. Considering the extensiveness of the IOSEA 5 area, the relatively low intensity of operation proposed under the Plan and the limited spatial extent of protected sites within this area, the impact of these activities on the features of protected sites is not anticipated to be significant.

Mitigation

- Site specific survey data could be used to inform location and extent of protected habitats for projects occurring within or adjacent to a protected site. This could be carried out as part of the site survey normally undertaken prior to all drilling activities and would inform the positing of the well and anchors to avoid protected features.
- Best practice should be followed in order to limit dragging of anchors and chains. This could include detailed best-fit anchor planning around protected features, minimisation of anchor wire/chain touchdown using flotation or heavier chain or anchors and pre-laying anchors using Remotely Operated Vehicles (ROV).
- Could include use of a dynamically positioned (DP) mobile offshore drilling unit. This means no anchoring required and physical interaction with the seabed limited to a small area around the wellhead.

Conclusion: Based on the information available, overall significant effects are not anticipated for Annex I habitat features of the sites listed in Table A.1. However, should it be proposed that drilling operations occur within or adjacent to these sites (particular consideration should be given to the offshore sites listed) then a project level site specific Appropriate Assessment will be performed to ensure that a proposed project will not adversely affect the integrity of the Natura 2000 sites, in view of the conservation objectives of these sites.

6.2 Protected Species and Associated Sites (Annex II)

Protected sites within or adjacent to the IOSEA 5 area with qualifying species that have the potential to be affected, as listed in Table A.1, by drilling activities described in section 2.7.2, are typically coastal in nature and likely to be some distance from offshore drilling activities, however, some qualifying features of protected sites are highly mobile in nature and therefore could encounter effects at a closer range. Additionally an animal that is somehow affected by an activity occurring as part of drilling activities in the IOSEA 5 area may well cross boundaries into waters of other nations. However, since impacts within the IOSEA 5 region are likely to be short-term and non-significant, it follows that effects would be lower, or at worst the same outwith Irish waters. For the purpose of this assessment all Irish and UK transboundary sites with these features have been considered. These mobile species are listed in Table A.1 and consist of cetaceans, pinnipeds and diadromous fish species. There are currently no Irish offshore protected sites for these species.

(For sites with these mobile qualifying interest features see Figure 2).

6.2.1 Potential Effect: Disturbance to Marine Animals Resulting from Noise

When considering noise generation associated with drilling activities the requirement for VSP/check-shot surveys is much less than for either 2D or 3D survey. Due to smaller airguns used, the small number and short duration of such surveys, and their point-source nature, the potential disturbance from these is vastly outweighed by the larger seismic surveys. Furthermore, stationary noises, such as drilling and production noises, outwith an immediate zone of discomfort to the animal, are believed to have a lesser effect in disturbing migration patterns and animal feeding, although data and observations are limited (Davis *et al*, 1990).Therefore potential impacts have not been considered separately from those of 2D and 3D surveys (see Section 5.2.1) and it is assumed conservatively that although effects would be lower, equivalent mitigation would apply.

7 Impact Assessment for Accidental Events

7.1 Seismic Activities

Oil may enter the marine environment during seismic operations as a result of accidental streamer rupture or collision with another vessel. In the unlikely event of this happening it will result in small spillages, i.e. several hundred litres of kerosene-like oil entering the environment from a streamer parting whilst deployed. The potential is exacerbated for vessels with numerous streamers deployed, although streamer design is now heading towards solid cables with no oil content. Accidental collision with another vessel and complete loss of fuel and streamer oil inventory would be the worst case scenario. The quantities of oil spilled into the marine environment would be relatively low in all but a worst case scenario involving vessel collision. The relatively low volumes of oil involved in most streamer accidents and light nature of the oil involved means that it would be expected to evaporate and disperse within a few hours.

Even when considering the comparatively high levels of routine shipping off the coasts of Ireland and, based on Irish Navy sightings data, relatively high commercial fishing effort over the IOSEA 5 area the risk of interaction or collision with another vessel in the IOSEA 5 area is considered to be low due. The increase in offshore vessel traffic due to seismic survey work resulting from the Plan will amount to the equivalent of six to twelve vessels per year.

7.2 Drilling Activities

The risk of accidental hydrocarbon and/or chemical spillage to the sea is one of the main environmental concerns associated with oil industry drilling activity, particularly after the explosion and loss of well control at the Macondo well in the Gulf of Mexico in 2010. Spilled oil and chemicals at sea can have a number of environmental and economic impacts, the most conspicuous of which are on seabirds and marine mammals. The actual impacts depend on many factors, including the volume and type of oil spilled, and sea and weather conditions. During drilling operations, there is a risk of spillage of oil (fuel/crude), and spillage or leakage of chemicals. Evidence of both gas and oil prospects have been recorded from within the IOSEA 5 licensing area.

Specific wildlife-related issues in the IOSEA 5 area include the vulnerability of seabirds, pinnipeds and cetaceans offshore, and in the coastal areas a large number of habitats and species of international and national conservation importance.

OSPAR (2010) provides a summary of the number and size of oil spills reported from offshore oil and gas activities between 1994 and 2008. During this period, only nine spills have been reported as occurring in Irish waters, although it should be noted that all but one of these spills have been estimated as less than 1 tonne. Only a very small number of installations, a maximum of seven per year, have been recorded as having discharges to sea in Irish waters.

Because the Irish industry is relatively limited in scale, statistics obtained from the UK oil and gas sector have instead been used to demonstrate the likelihood of hydrocarbon spill occurrence during drilling operations in the IOSEA 5 area. Analysis of the UK Continental Shelf (UKCS) historical data between 1975 and 2005 (UKOOA, 2006) shows that the majority of spills are small, i.e. less than 1 tonne. Historical data indicate that the probability of a large hydrocarbon spill from a mobile drilling unit (MODU) operating on the UKCS is very low. The most likely spills are small leaks (<1 tonne) arising from loading and bunkering oils between the drill rig and supply vessels. Crude oil spills have been the largest source of hydrocarbon spills during drilling operations on the UKCS, accounting for 75% of all hydrocarbons spilled between 1975 and 2005. Oil-based muds account for 14.8% of hydrocarbons spills within this period. The discharge of oil-based muds is not permitted in Irish waters. It should be noted that while there has been an increase in the number of reported oil spills from 1975 to 2005, since 1990 (with the exception of 1997) the overall volume of oil spilled has been substantially reduced.

Potential accidental causes of hydrocarbon spills include collision events with other vessels and well control incidents or 'blowouts'. Between 1980 and 2006 the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) database recorded a total of 63 blowout events on the UK and Norwegian continental shelves during drilling operations (SINTEF, 2010). During this period 13,762 wells were drilled which gives a risk of a blowout occurring once every 218 wells. The SINTEF database defines a blowout as an incident where formation fluid flows out of the well or between formation layers after all the predefined technical well barriers or the activation of the same have failed. The figures include a range of well control incidents from the loss of a few litres of hydrocarbon to major events. The chances of a major hydrocarbon blowout involving spillage of crude in any significant quantity are therefore very low. The amount of hydrocarbon released from a blowout varies widely and depends on the characteristics of the reservoir and also the reason for the loss of containment. In deeper water, flow rates for crude oil blowouts are limited by the hydrostatic pressure of overlying water.

The probability of a ship collision with a drilling rig is very low. Between 1990 and 2007 for the UK continental shelf, the mean incident frequency for all ship collision incidents with semi-submersible drilling rigs was 0.0134 incidents/year (one every 75 years; Oil & Gas UK, 2009). The frequency with which a collision will cause an oil spill will be even less.

Historically, most crude oil spills to the marine environment from drilling activity have been from hydrocarbon drop-out during flaring as a result of incomplete combustion of hydrocarbons during well testing. High efficiency burners are now used to maximise the combustion of hydrocarbons which, in turn, minimises the probability of hydrocarbon drop-out to the sea surface.

Diesel oil spills account for 4.2% of oil spilled on the UKCS and generally occur during bunkering operations. Diesel will be the main fuel for power generation on the drilling unit, and will therefore be the most significant hydrocarbon type stored on the rig whilst on station. As most diesel spills tend to occur during bunkering operations, the volumes spilled tend to be relatively small. The worst case scenario, complete loss of the diesel inventory, will only occur in the event of a major event, such as a catastrophic collision with a ship or explosion. The probability and frequency of such an event occurring is low.

7.2.1 Behaviour of Hydrocarbons at Sea

When oil is released into the marine environment it undergoes a number of physico-chemical changes, some of which assist in the degradation of the spill, while others may cause it to persist; these processes are commonly referred to as 'weathering'. These changes are dependent upon the type and volume of oil spilled, and the prevailing weather and sea conditions. Evaporation and dispersion are the two main mechanisms that act to remove oil from the sea surface. Following a hydrocarbon spill, evaporation is the initial predominant mechanism of reducing the mass of oil, as the light fractions (including aromatic compounds such as benzene and toluene) evaporate quickly. If the spilled oil contains a high percentage of light hydrocarbon fractions, such as diesel, a large part of the spilled oil will evaporate relatively quickly in comparison to heavier (crude) oil. The evaporation process will be enhanced by warm air temperatures and moderate winds and can produce considerable changes in the density, viscosity and volume of the spill.

After the light fractions have evaporated from the slick the degradation process slows down and natural dispersion becomes the dominant mechanism in reducing slick volume. This process is dependent upon sea surface turbulence which in turn is affected by wind speed. Water-soluble components of the oil mass will dissolve in the seawater, while the immiscible components will either emulsify and disperse as small droplets in the water column (an oil-in-water emulsion) or, under certain sea conditions, aggregate into tight water-in-oil emulsions, often referred to as 'chocolate mousse'. In practice, usually only one of the two processes will take place at any one time. The rate of this emulsification is dependent upon the oil type, sea state and the thickness of the oil slick. Thick (large) oil slicks tend to form water-in-oil emulsions, where thin (smaller) slicks tend to form oil-in-water emulsions that usually disappear by natural dispersion.

When a water-in-oil emulsion (chocolate mousse) is formed, the overall volume of such a water-in-oil emulsion increases significantly, as it may contain up to 70 or 80% water. This chocolate mousse will form a thick layer on the sea surface reducing slick spreading and inhibiting natural dispersion. By diminishing the surface area available for weathering and degradation, these chocolate mousses will be difficult to break up using dispersants. In their emulsified form, with drastically increased volume, they can cause difficulties for mechanical recovery devices as well.

Wind and surface current speed and direction are the main parameters involved in affecting where a slick travels. The slick will roughly travel at the same speed and direction as the surface water current. Additionally, the prevailing wind drives a slick downwind at 3 to 4% of the wind speed. The weathering behaviour of spilled oil influences the potential environmental impact of an oil spill.

Spill modelling in the oil and gas industry is undertaken as a matter of course as there is usually a requirement, prior to drilling, that an Oil Spill Contingency Plan (OSCP) is prepared (OSCP is a requirement in Ireland, and subject to approval by the Irish Coast Guard). A range of oil spill scenarios are modelled including both crude/condensate and diesel. Deterministic 'worst case scenario' modelling is used to determine the shortest beaching time using predetermined weather conditions. Single trajectory modelling for an instantaneous release of around 1,200 m^3 of diesel (a common standard roughly equivalent to the fuel inventory of a drilling rig) shows that, under a constant 30 knot wind, the released diesel would normally evaporate and disperse rapidly into the water column within eight hours. These calculations assume that there is no intervention of the slick although, in practice, oil spill response resources would be mobilised immediately, and do not take into account weather conditions that may enhance the dispersion process. As a result these calculations are conservative.

For crude oil spills, modelling has to be based on the expected characteristics of the crude i.e. heavy/light, which are determined by the reservoir the crude originated from. Therefore site-specific modelling should be undertaken where drilling is expected to take place in an oil-bearing formation. The OSCP produced for all drilling operations will specify the level of spill response equipment and facilities present both offshore and onshore.

Factors important in determining oil spill impacts and recovery rates include the type of oil, the thickness of shore deposits, climate and season, the biological and physical characteristics of the area, the relative sensitivity of species and communities and the type of clean-up response. The potential for environmental damage caused by an oil spill varies with different areas of the marine environment. Oil spills, being infrequent and relatively short-term events rarely cause much damage to organisms in deep water, but there can be severe and long term impacts on organisms living in shallow water near the shore.

Conclusion: On the basis of accidental events statistics compiled for offshore drilling activities, the risk of a major crude oil spill or gas blowout during exploration, appraisal and development drilling is considered to be very low. Historical data suggest that small diesel spills from rigs and vessels of less than one tonne represent the most likely oil spill scenario.

7.3 Protected Habitats and Species

Protected sites within or adjacent to the IOSEA 5 area with qualifying habitats and species that have the potential to be affected by accidental events, as listed in Tables A.1 & A.2, are typically coastal in nature and likely to be some distance from offshore seismic and drilling activities, however, the potential for a hydrocarbon spill to reach these sites exists and as such requires consideration. Offshore sites have also been considered for completeness. Transboundary impacts on the UK marine environment are considered to be the same or less than for Ireland. The IOSEA 5 area extends from the east and south coasts of Ireland out to the Ireland-UK international line which runs down the centre of the Irish Sea, the St Georges Channel and southwest across the Celtic Sea towards the edge of the continental shelf. The Pembrokeshire coastline in Wales lies approximately 36 km to the east of the IOSEA 5 area; the Isle of Man approximately 45 km to the northeast; and the Isles of Scilly and Land’s End approximately 99 km and 120 km to the southeast respectively. There are a number of SACs specifically designated for the protection of marine species which may be potentially sensitive to hydrocarbon spills including: cetaceans, pinnipeds, seabirds and otters, and/or are particularly designated for the protection of marine habitats. For these reason all Irish and UK transboundary sites with features that are possible receptors to impacts associated with these events have been considered. Figures 3 and 4 show the locations of SACs that are located in the IOSEA 5 area and adjacent areas including UK sites, that have Annex I habitat and Annex II species features respectively, with the potential to be impacted. Figure 5 shows the location of Irish and UK SPAs that have the potential to be impacted; either direct impacts on designated bird features or to important supporting habitats.

7.3.1 Potential Effects on Marine Mammals

Irish waters are some of the most important in Europe for a wide range of cetacean species. To date 24 cetacean species (or 28% of species described worldwide) have been recorded in Irish waters. Many are not known to breed in Irish waters but migrate annually along the western seaboard (Charif & Clark, 2000).

It has been rare for cetaceans to be affected following a spill; they may be able to avoid affected areas and are not believed to be susceptible to the physical impacts of oil and oil emulsion lowering their resistance to the cold. Contact with oil may cause irritation of the skin and mucus membranes. Volatile hydrocarbon fractions may also cause respiratory problems. Chronic ingestion of sub-toxic quantities of oil may have subtle effects which would only become apparent through long-term monitoring. The transfer of hydrocarbons through the mother’s milk to suckling young is another way oil affects cetaceans. It is also possible that oil pollution impairs cetacean immune systems and causes secondary bacterial and fungal infections.

The grey seal and harbour seal are native to Irish waters. Both species have established themselves in terrestrial colonies (or haul-outs) along all coastlines of Ireland and the UK. Seals are susceptible to oiling and the contamination of food sources, particularly in the coastal areas around their colonies, where their density is highest. While they come ashore throughout the year, the majority of grey seals remain close to shore during the breeding and moulting seasons; September to April. Harbour seals undergo a similar cycle between June and September, although they continue to forage at sea throughout their breeding season. New born pups are considered most at risk from oil coming ashore.

The potential for significant impact of hydrocarbon spills on seal populations is expected to be seasonal and limited to those periods of time when the population is close to shore, during breeding and moulting.

Otters are found on the shores of Ireland where the numerous rivers and estuaries that flow into the Atlantic, Celtic and Irish Seas provide a suitable habitat for them. There is little evidence of impact on European otters by oil spills, although food sources may be contaminated. However, thermoregulatory abilities of otters (and seals) can be impaired when their fur comes into contact with oil.

7.3.2 Potential Effects on Benthos and Coastal Habitats

Effects on the benthos and coastal habitats include smothering, acute toxicity and possible organic enrichment. However, since oil spills primarily affect the surface water layers, impacts to the seabed and benthos will be minimal offshore and influenced by water depth and local hydrography.

Coastal habitats listed in Table 4.1 may be vulnerable to the following impacts/effects:

- Physical smothering of organisms ;
- Penetration of oil into soft sediments potentially causing toxic conditions for resident species (worms, molluscs, crustaceans) with resultant impacts on viability of sediments as feeding grounds, affecting food source for bird and other species;
- Sub-lethal toxicological effects which may be magnified up the trophic levels;
- Direct oil contact affecting a range of species; bird species flight ability, thermoregulation capacity and resulting in potential toxicological and respiratory impacts; and
- Impacts on breeding success of designating species.

Based on data relating to hydrocarbon spill risks from both Irish and the adjacent UK oil and gas sectors, the probability of significant quantities of hydrocarbons reaching the Irish and UK coast and posing a threat to the integrity of European sites is small and is further reduced by mitigation measures (section 7.4) in place and by the requirements set out within the Oil Spill Contingency Plan (OSCP) which will be applied to each individual drilling activity.

7.3.3 Potential Effects on Birds

All SPAs along the adjacent Irish and UK Coastline have been identified for further consideration. Notwithstanding the very low likelihood of a hydrocarbon spill event occurring, the bird populations within the SPAs are considered vulnerable both to:

- direct physical effects of fouling affecting capacity for flight, thermo-regulation etc, impacting potentially large numbers of individual birds; and
- toxicological impacts of spilled hydrocarbons washing up onto the coastal zone creating a pathway for toxicity to enter the lower trophic levels supporting the designating bird assemblages.

Impact on SPA conservation objectives for many sites could also be expected to be seasonal in nature.

Any seabirds on the water surface would be potentially at risk from any spilled hydrocarbon, whether it is derived from the survey vessel or fluids in the airgun array. Furthermore, hydrocarbon spills due to shipping accidents could occur inshore in shallow waters, in which case a greater range of physical, biological and socio-economic receptors may be directly impacted thus assuming a greater significance.

Spills far offshore in winter would be less deleterious to seabirds than one occurring near the coast in late spring-early summer when seabirds have returned to land to breed. Any spills that occur would be small and localised and therefore would have at most a minor effect on seabird populations in the IOSEA 5 area.

A blowout, loss of hydrocarbons during bunkering or from a leak from a pipeline are by far the worst events that could occur at a drilling rig with respect to seabirds. It is not the quantity of oil that is spilled that is the most important factor, however, but the timing of the spill that is critical (Burger, 1993). Bird density, wind velocity and direction, distance to shore and temperature are important factors with regard to mortality resulting from a slick of spilled oil.

The worst case scenario for the IOSEA 5 area would be a leak of crude oil into the sea in early summer (late June/early July), with a strong onshore breeze. This would lead to oil being blown towards the coast when there are large numbers of breeding seabirds and recently fledged young (mainly auks) present in the area.

7.3.4 Potential Effects on Fish

Fish populations remain relatively unaffected by oil pollution in the offshore environment, as oil concentrations below the slick are generally low. There is also evidence that fish are able to detect and avoid oil-contaminated waters. This avoidance may cause disruption to migration or spawning patterns. Heavily contaminated sediments may have an adverse effect on local populations of demersal fish species, due to the impact it has on the food chain.

Fish eggs and larvae are more vulnerable to oil pollution than adults. In many fish species, these stages float to the surface where contact with spilt oil is more likely. However, as most fish species have extensive spawning grounds and produce large numbers of pelagic young, there is unlikely to be any effect on numbers in the adult populations. Stocks may be at risk from a spill if it is very large, coincides with spawning periods, or enters the grounds of species with restricted spawning areas.

There are increased risks to some species and life stages of fish in shallow nearshore waters. These foreshores are believed to function as essential feeding and "nursery" breeding grounds for many fish.

The potential for significant impact of hydrocarbon spills on designated fish species is therefore expected to be seasonal and limited to those periods of time when these species are in shallow, near-shore waters. Nursery breeding grounds for these designated fish species are identified in freshwater above the zone of tidal influence and therefore outwith the coastal zone considered most at risk of oil pollution from an oil spill at sea.

7.4 Mitigation

The following measures are already in place, either integral with good practice, or with regulatory systems, or both:

- Implementation of an Oil Pollution Emergency Plan (OPEP). The OPEP is designed to assist the decision-making process during an oil spill, indicate what resources are required to combat the spill, minimise any further discharges and mitigate its effects.
- Notification to fishing vessels and the Sustainable Energy Authority Ireland and Department for Communications, Energy and Natural Resources of the location and timing of seismic surveys.
- Avoid travelling along inshore routes where the potential for vessel accidents is higher
- Location data for all drilling infrastructure to be added to FishSAFE to reduce the likelihood of fishing vessel collision with installations
- Installation of Automatic Identification System (AIS) or radar systems on platforms to enable early detection of potential collisions. This is recommended by the International Association of Oil and Gas Producers (OGP, 2010).
- Compliance with all OSPAR Recommendations, Strategies, Decisions and Guidelines and MARPOL legislation relating to protection of the marine environment from the potential effects of discharges.
- To use best practice technologies to reduce the concentrations of chemicals discharged.
- Use of OSPAR approved chemical list in all drilling practices wherever possible.
- Zero discharge of chemicals on the OSPAR List of Chemicals for Priority Action (LCPA).
- To reduce usage by the best means practicable of chemicals on the OSPAR List of Substance of Possible Concern.
- Ensure compliance with Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).
- Utilisation of OBM or SBM to be kept to a minimum and all OBM or SBM to be collected through closed system and brought ashore for re-use, recycling or disposal.
- All operations where appropriate, shall apply best available technologies, best environmental practice and clean technology.
- Any oil spill must be reported immediately, however small. The level and manner of the required oil spill response will be overseen by the Irish Coast Guard, and determined by the volume and type of oil spilled, and the weather and sea conditions at the time.
- Any oil spill likely to have impacts in UK waters will be reported by the Irish Coast Guard to the relevant UK authorities. The Irish Coast Guard has a close working relationship with the UK Maritime and Coast Guard Agency (MCA) and the two have a draft Service Level Agreement for co-operation on search and rescue and oil spill response in place. The Irish Coast Guard and the UK MCA also regularly conduct joint search and rescue and oil spill response exercises.

- The crew of the drilling rig/ship should undergo environmental awareness and safety training. All equipment used on the rig/ship should have safety measures built in to minimise the risks of any oil spillage. All operations where appropriate, shall apply best available technologies, best environmental practice and clean technology. This is the aim of the requirement of DCENR (2011) for operators to have accredited and verified environmental management systems.
- A two-barrier well control policy should be implemented at all times as a minimum. Primary well control (i.e. mud hydrostatic) and secondary well control (blow-out preventers or BOPs) should be maintained throughout the drilling of a well. A full risk assessment should be performed as part of the planning phase of the well.
- As the highest risk of diesel spillage occurs during re-fuelling (bunkering) operations at sea, all bunkering should take place during suitable weather conditions, preferably in daylight hours, and a continuous watch should be posted during the operations. The bunkering hoses should be segmented and have pressure valves that, in the event of a drop in pressure within the line as a result of loss of diesel, will close, preventing the further release of diesel.
- An Oil Spill Contingency Plan (OSCP) is required under the Sea Pollution (Amendment) Act 1999, and this requirement is re-stated in the DCENR Rules and Procedures Manual (DCENR). The OSCP is designed to assist the decision-making process during an oil spill, indicate what resources are required to combat the spill, minimise any further discharges and mitigate its effects. The OSCP must be submitted to the Irish Coastguard for approval.
- The potential for shallow gas should be identified and minimised by site assessment prior to drilling.
- The BOP is installed to prevent gas blowout once drilling has progressed beyond the riserless stage.
- Gas detection systems are installed on mud shakers to give early indication of any potential for gas blowout.
- Training in safety awareness and response procedures for drilling crews will ensure that the risk of a blowout will be minimised, and that the appropriate responses will be made should one occur.
- All chemicals used on drilling units must have prior approval according to a system in which chemical formulation is continually reviewed and revised to eliminate or minimise harm to the environment through factors such as toxicity and bioaccumulation.

7.5 Conclusion

Historical data suggest that small diesel spills from rigs and vessels of less than one tonne represent the most likely oil spill scenario. Impacts from diesel spills of this magnitude and frequency would be negligible. The risk of a major accident during seismic survey activity, such as a collision with another vessel, causing the loss of the streamer oil reservoir and/or diesel fuel from the vessel, is considered to be very low.

Whilst it is considered that the risk of a major hydrocarbon spill as a result of the Plan activities is considered to be very low, given the close proximity of the IOSEA 5 area to the sensitive coastlines, not only of Ireland but also to the UK western coastline, the consequence of a spill is unpredictable at this stage and should be subject to further specific oil spill risk assessment at individual project level. Taking into

account all the matters discussed, and provided that the above measures are implemented, it can be concluded that although unlikely, the residual impact of a worst case scenario major hydrocarbon spill affecting any or many Natura 2000 sites remains potentially significant, regardless of mitigation and continued assessment is required at individual project level to ensure that the proposed Plan will not adversely affect the integrity of any relevant Natura 2000 sites in view of the conservation objectives of these sites.

8 Potential In-combination Impacts

In-combination impacts may occur as a result of a number of activities, discharges and emissions combining or overlapping, potentially leading to a significant impact. Potential impacts could arise as a result of impacts from seismic and drilling activities interacting or combining with those from other activities taking place in the IOSEA 5 area. These may include, for example, seismic survey and exploratory drilling from the Plan interacting with marine scientific research, commercial fishing, shipping or military activities.

8.1 Potential Impact: Noise

Both seismic and offshore drilling operations contribute to anthropogenic sound in the marine environment, although the sound levels generated by the former are inherently more significant than the latter. Other sources of sound in the IOSEA 5 area that are not related to offshore oil and gas include merchant shipping, fishing, recreational, research and military activity and the developing offshore renewable energy industry which, at times, will all emit high levels of sound into the water column.

It is estimated that there could be up to 1667 days of 2D and 3D seismic activity annually (see section 2.5) and, as such, it is highly likely that a number of vessels will be operating. However, the timing of seismic survey is weather dependent and much of the activity is likely to be concentrated during the summer months when weather conditions will be most favourable. As a result, multiple seismic surveys could potentially take place in the IOSEA 5 area at the same time. This will add to existing noise levels from other sea users including shipping, the oil and gas industry, and offshore wind farm construction in the wider area. Seismic surveys would be offset by at least 50 km (approximately) to avoid mutual interference with data acquisition. Additional offset may be necessary but would need to be informed by site-specific noise modelling based on proposed array characteristics.

Simultaneously generated sound sources from different directions of a sufficiently high level, such as those generated by multiple seismic surveys or piling for offshore construction, have the potential to negatively affect marine mammal behaviour; noise emissions could result in disruption to marine mammal behaviour such that reproduction, migration and other important activities could be disrupted (JNCC, 2010). Gordon *et al*. (1998) suggest that marine mammal migratory pathways could be interrupted and feeding grounds disrupted if several seismic surveys occur at the same time; numerous marine mammals are sighted in the IOSEA 5 study area and evidence of both calving grounds and migratory routes exists.

Other users of the IOSEA 5 study area are many and varied and, in general, the sound levels emitted by these users are below those expected to cause injurious effects on marine mammals or other marine species. The transitory and temporary nature of noise from seismic and drilling exploration activities, as well as that from other sea users (mainly fishing and shipping which will pass by and then away from drilling and seismic activity), means that the in-combination impacts from these will be short-lived and consequently less likely to cause significant cumulative impacts.

Overall, the long term, cumulative impacts of sound emissions to the marine environment are poorly understood and firm conclusions cannot be made at this stage. As a result, the impact of the introduction of additional low frequency noise into the marine environment from seismic surveys and drilling activity in the IOSEA 5 area must be considered as a worst case and treated as having the potential to negatively affect some marine species. However, the relatively short duration of the individual seismic surveys and drilling operations and the directional character of most of the produced sound suggests that, with mitigation as described in section 5.3.1.1, any potential cumulative (in-combination) impacts will be minor.

8.1.1 Additional Mitigation

Project specific noise modelling to assess impacts of multiple, simultaneous seismic surveys occurring within the same geographic region, based on project characteristics.

8.2 Potential Impact: Discharge of Drill Cuttings and Disturbance to Seabed

The extent of any sea bed disturbance impacts which may potentially arise from the oil and gas industry will amount to a very small proportion of the IOSEA 5 area. In addition, the temporary nature of cuttings and anchoring impacts, the dynamic nature of much of the benthic environment, and the localised extent of impacts and low toxicity of inputs, lead to good recovery potential. However, the significance of any impact depends on the nature of the benthic environment at the sites concerned. There are six designated offshore protected sites within the IOSEA 5 area all of which are designated for reef habitat.

Other activities taking place within the IOSEA 5 area which lead to physical disturbance of the sea bed include commercial fishing for demersal or benthic species, telecommunications cable installation, and latterly a developing offshore wind and renewable energy industry. Near-shore sandbanks such as those off the Counties of Wexford, Wicklow and Cork have been exploited for some years by local authorities for beach replenishment and as infill for harbour developments. However, due to the depletion of onshore sources of aggregates, 11 potential offshore resource blocks for future marine aggregate extraction have been identified. Furthermore, the marine wind and renewable energy sector is mainly coastal in nature and, for the time being, the potential for interaction with the oil and gas industry situated further offshore is limited. The ‘seabed take’ for exploitation of marine and offshore resources is increasing and the potential for cumulative impacts lies in the almost imperceptible nibbling away of habitats and resources by many diverse interests. Apart from natural storm events and wave action, the main source of physical disturbance impacts on the seabed historically has probably been the demersal fishing sector. It is likely that the additional effect resulting from implementing the Plan would be relatively small.

Drilling activity will be taking place in an environment that has long been used for a variety of economic activities, some of which disturb the seabed. As the potential impacts from drilling discharges and physical disturbance to the marine environment tend to be localised, of short duration and with generally good recovery potential, the risks of cumulative (in-combination) impacts are considered to be low for this level of drilling activity.

8.3 Potential Impact: Accidental Events

The total activity forecast for the IOSEA 5 area Plan indicate a maximum of 50 exploration, appraisal and development wells will be drilled between 2015 and 2020. Based on the probabilities outlined above the incremental risk of a significant hydrocarbon spill is low.

The cumulative level of hydrocarbons entering the marine environment from spills associated with exploration, appraisal and development drilling is likely to be negligible when considered against other natural and anthropogenic sources. While the impacts from oil spills will differ from those of hydrocarbon inputs from rivers, sewage and shipping for example, even large oil spills associated with tanker accidents do not appear to have had long term chronic impacts on marine ecosystems.

In the area to the east of the IOSEA 5 study area, identified under UK legislation as the SEA 8 area, there is little interest in oil and gas extraction from offshore sources because no economic reserves have been shown to exist. This situation may change as a result of technological and economic changes. Coastal tourism is important throughout the SEA 8 area and is a major economic factor in these largely rural regions. A considerable portion of the SEA 8 coastline is listed as of either National or World Heritage Value. The recent threat to the coasts of south Devon and Dorset through pollution following the wrecking of the MV Napoli, and damage to the Bristol Channel coast following the Sea Empress grounding some years ago, highlights the vulnerability of coastlines in general. The scale and consequences of accidental environmental impacts in adjacent States resulting from implementing the Plan could be similar to those resulting from the same incidents in Irish waters.

The spill from the Macondo well in the Gulf of Mexico in 2010 has been a spur for governments in Europe to review regulatory frameworks for oil and gas exploration, and to reassess national contingency plans and provision for response and clean up following accidental events such as oil spills.

Cumulative impacts from a shallow gas blowout would be reservoir specific. Atmospheric emissions could potentially have cumulative effects, although they would be dependent on the type and volume of gas released into the atmosphere.

Conclusion: The degree of activity predicted to take place under the IOSEA 5 Plan, particularly when set against the oil and gas activity already taking place in Irish and UK offshore waters, is small. Statistics for accidental events indicate that spills and releases from seismic survey and drilling activities are minor and have control measures in place for clean-up and limiting impacts. Overall, therefore, the risk of significant cumulative (in-combination) impacts from accidental events is likely to be low.

9 Next Steps

This NIS forms part of IOSEA 5 and has been updated following the consultation on the draft NIS (6th May - 17th June 2015), to take into account comments received from statutory bodies and other consultees. In addition, the comments received have be used to inform an AA Statement, which comprises a separate document to the NIS.

The response to these comments will be documented in the SEA statement for IOSEA 5.

The NIS and AA Statement advise as to whether the Plan, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site with respect to the conservation objectives of each Natura 2000 site.

The response to these comments will be documented in the SEA statement for IOSEA 5.

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Annex A: Irish and Transboundary Natura 2000 Sites Screened in to Appropriate Assessment

Table A.1 Special Areas of Conservation screened into AA by impact and feature

Table A.2 Special Protection Areas screened into AA by impact and feature

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

Potential Impacts	**Site feature with potential to be impacted**	**SAC/cSAC/SCI potentially impacted (including offshore Sites – underlined**	
	Annex I features	**Irish Sites**	**Transboundary Sites**
Impacts from seismic activities: - Noise generation from airguns	Reefs Submarine structures made by leaking gas	Belgica Mound Province Carnsore Point Hook Head Hovland Mound Province Kenmare River Lady's Island Lake Lambay Island Lough Hyne Nature Reserve and Environs Northwest Porcupine Bank Porcupine Bank Canyon Roaringwater Bay and Islands Rockabill to Dalkey Island Saltee Islands Southeast Rockall Bank Southwest Porcupine Bank Valencia Harbour/Portmagee Channel Wicklow Reef	
	Annex II features	**Irish Sites**	**Transboundary Sites**
	Bottlenose dolphin (Tursiops truncatus)	Sites remote from the IOSEA 5 area: Lower River Shannon West Connacht Coast	Bae Ceredigion/ Cardigan Bay Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Sites within or immediately adjacent to the IOSEA 5 area: N/A	
	Harbour porpoise (Phocoena Phocoena)	Sites remote from the IOSEA 5 area: Blasket Islands Sites within or immediately adjacent to the IOSEA 5 area: Roaringwater Bay and Islands Rockabill to Dalkey Island	Skerries and Causeway
	Grey seal (Halichoerus grypus)	Sites remote from the IOSEA 5 area: Blasket Islands Duvillaun Islands Horn Head and Rinclevan Inishbofin and Inishshark Inishkea Islands Slieve Tooey/Tormore Island/Loughros Beg Bay Slyne Head Islands Sites within or immediately adjacent to the IOSEA 5 area: Lambay Island Roaringwater Bay and Islands Saltee Islands	Isles of Scilly Complex Lundy The Maidens Monach Islands Treshnish Isles Bae Ceredigion/ Cardigan Bay Pembrokeshire Marine/ Sir Benfro Forol Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau
	Harbour seal (Phoca vitulina)	Sites remote from the IOSEA 5 area: Ballysadare Bay	Murlough Strangford Lough

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Clew Bay Complex Cummeen Strand/Drumcliff Bay (Sligo Bay) Donegal Bay (Murvagh) Galway Bay Complex Glengarriff Harbour and Woodland Kilkieran Bay and Islands Killala Bay/Moy Estuary Rutland Island and Sound West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Kenmare River Lambay Island Slaney River Valley	Ascrib, Isay and Dunvegan Eileanan agus Sgeiran Lios mor Sound of Barra South East Isaly Skerries
	Otter (Lutra lutra)	Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Kenmare River Lower River Suir River Barrow and River Nore Roaringwater Bay and Islands Slaney River Valley N:B Sites remote to IOSEA 5 area with otter as a designated feature not assessed for these activities due to limited offshore	N/A (Sites remote to IOSEA 5 area with otter as a designated feature not assessed for these activities due to limited offshore movements)

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		movements	
	Salmon (Salmo salar)	Sites remote from the IOSEA 5 area: Castlemaine Harbour Connemara Bog Complex Glenamoy Bog Complex Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lough Melvin Lower River Shannon Mweelrea/Sheeffry/Erriff Complex Owenduff/Nephin Complex River Finn The Twelve Bens/Garraun Complex West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	River Eden River Dee and Lake Bala River Faughan and Tributaries River Foyle and Tributaries River Bladnoch Afon Teifi/River Teifi River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

	Sea lamprey (Petromyzon marinus) River lamprey (Lampetra fluviatilis)	Sites remote from the IOSEA 5 area: Castlemaine Harbour Cummeen Strand/Drumcliff Bay (Sligo Bay) Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lower River Shannon Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	River Eden Dee Estuary/ Aber Dyfrdwy Severn Estuary/ Môr Hafren Solway Firth Afon Teifi/River Teifi Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Bae Ceredigion/ Cardigan Bay Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy
	Allis shad (Alosa alosa) Twaite shad (Alosa fallax)	Sites remote from the IOSEA 5 area: Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	Severn Estuary/ Môr Hafren Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

Impacts from drilling activities: -Noise generation and vibration from VSP/Checkshot surveys	**Annex I features**	**Irish Sites**	**Transboundary Sites**
	Reefs Submarine structures made by leaking gas	Belgica Mound Province Carnsore Point Hook Head Hovland Mound Province Kenmare River Lady's Island Lake Lambay Island Lough Hyne Nature Reserve and Environs Northwest Porcupine Bank Porcupine Bank Canyon Roaringwater Bay and Islands Rockabill to Dalkey Island Saltee Islands Southeast Rockall Bank Southwest Porcupine Bank Valencia Harbour/Portmagee Channel Wicklow Reef	
	Annex II features	**Irish Sites**	**Transboundary Sites**
	Bottlenose dolphin (Tursiops truncatus)	Sites remote from the IOSEA 5 area: Lower River Shannon West Connacht Coast Sites within or immediately adjacent to the IOSEA 5 area: N/A	Bae Ceredigion/ Cardigan Bay Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

	Harbour porpoise (Phocoena Phocoena)	Sites remote from the IOSEA 5 area: Blasket Islands Sites within or immediately adjacent to the IOSEA 5 area: Roaringwater Bay and Islands Rockabill to Dalkey Island	Skerries and Causeway
	Grey seal (Halichoerus grypus)	Sites remote from the IOSEA 5 area: Blasket Islands Duvillaun Islands Horn Head and Rinclevan Inishbofin and Inishshark Inishkea Islands Slieve Tooey/Tormore Island/Loughros Beg Bay Slyne Head Islands Sites within or immediately adjacent to the IOSEA 5 area: Lambay Island Roaringwater Bay and Islands Saltee Islands	Isles of Scilly Complex Lundy The Maidens Monach Islands Treshnish Isles Bae Ceredigion/ Cardigan Bay Pembrokeshire Marine/ Sir Benfro Forol Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau
	Harbour seal (Phoca vitulina)	Sites remote from the IOSEA 5 area: Ballysadare Bay Clew Bay Complex Cummeen Strand/Drumcliff Bay (Sligo Bay) Donegal Bay (Murvagh)	Murlough Strangford Lough Ascrib, Isay and Dunvegan Eileanan agus Sgeiran Lios mor Sound of Barra

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Galway Bay Complex Glengarriff Harbour and Woodland Kilkieran Bay and Islands Killala Bay/Moy Estuary Rutland Island and Sound West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Kenmare River Lambay Island Slaney River Valley	South East Isaly Skerries
	Otter (Lutra lutra)	Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Kenmare River Lower River Suir River Barrow and River Nore Roaringwater Bay and Islands Slaney River Valley N:B Sites remote to IOSEA 5 area with otter as a designated feature not assessed for these activities due to limited offshore movements	N/A (Sites remote to IOSEA 5 area with otter as a designated feature not assessed for these activities due to limited offshore movements)
	Salmon (Salmo salar)	Sites remote from the IOSEA 5 area: Castlemaine Harbour	River Eden River Dee and Lake Bala

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Connemara Bog Complex Glenamoy Bog Complex Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lough Melvin Lower River Shannon Mweelrea/Sheeffry/Erriff Complex Owenduff/Nephin Complex River Finn The Twelve Bens/Garraun Complex West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	River Faughan and Tributaries River Foyle and Tributaries River Bladnoch Afon Teifi/River Teifi River Usk/ Afon Wysg River Wye/ Afon Gwy
	Sea lamprey (Petromyzon marinus) River lamprey (Lampetra fluviatilis	Sites remote from the IOSEA 5 area: Castlemaine Harbour Cummeen Strand/Drumcliff Bay (Sligo Bay) Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lower River Shannon Sites within or immediately adjacent to the IOSEA 5 area:	River Eden Dee Estuary/ Aber Dyfrdwy Severn Estuary/ Môr Hafren Solway Firth Afon Teifi/River Teifi Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Bae Ceredigion/ Cardigan Bay

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy
	Allis shad (Alosa alosa) Twaite shad (Alosa fallax)	Sites remote from the IOSEA 5 area: Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	Severn Estuary/ Môr Hafren Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy
Accidental event: -hydrocarbon spill	**Annex I features**	**Irish Sites**	**Transboundary Sites**
	Sandbanks which are slightly covered by sea water all the time Estuaries Mudflats and sandflats not covered by seawater at low tide Coastal lagoons	Achill Head Akeragh, Banna and Barrow Harbour Aran Island (Donegal) Cliffs Ardmore Head Baldoyle Bay Ballinskelligs Bay and Inny Estuary Ballyhoorisky Point to Fanad Head Ballymacoda (Clonpriest and Pillmore) Ballyness Bay Ballysadare Bay Ballyteige Burrow	Braunton Burrows Croker Carbonate Slabs Drigg Coast East Rockall Bank Exmoor Heaths Haig Fras Isles of Scilly Complex Lands End and Cape Bank Lizard Point Lundy Morecambe Bay

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

	Large shallow inlets and bays Reefs Submarine structures made by leaking gases Submerged or partially submerged sea caves Annual vegetation of drift lines Salicornia and other annuals colonising mud and sand Spartina swards (Spartinion maritimae) Atlantic salt meadows (Glauco Puccinellietalia maritimae)	Bannow Bay Barley Cove to Ballyrisode Point Belgica Mound Province Bellacragher Saltmarsh Black Head - Poulsallagh Complex Blackwater Bank Sandbank Blackwater River (Cork/Waterford) Blasket Islands Boyne Coast & Estuary Bray Head Broadhaven Bay Buckroney-Brittas Dunes and Fen Bunduff Lough and Machair/Trawalua/ Mullaghmore Cahore Polders and Dunes Carlingford Shore Carnsore Point Carrowmore Dunes Carrowmore Point to Spanish Point and Islands Castlemaine Harbour Clare Island Cliffs Clew Bay Complex Clogher Head Clonakilty Bay Connemara Bog Complex	River Eden Shell Flat and Lune Deep Stanton Banks The Lizard Tintagel-Marsland-Clovelly Coast Dee Estuary/ Aber Dyfrdwy River Dee and Lake Bala Severn Estuary/ Môr Hafren Bann Estuary Magilligan Murlough North Antrim Coast Rathlin Island Red Bay River Faughan and Tributaries River Foyle and Tributaries Skerries and Causeway Strangford Lough The Maidens Ascrib, Isay and Dunvegan East Mingulay Eileanan agus Sgeiran Lios mor Firth of Lorn Loch Creran Loch Moidart and Loch Shiel Woods

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) Vegetated sea cliffs of the Atlantic and Baltic coasts	Courtmacsherry Estuary Croaghaun/Slievemore Cross Lough (Killadoon) Cummeen Strand/Drumcliff Bay (Sligo Bay) Dog's Bay Donegal Bay (Murvagh) Drongawn Lough Dunbeacon Shingle Dundalk Bay Durnesh Lough Duvillaun Islands Erris Head Farranamanagh Lough Galway Bay Complex Glenamoy Bog Complex Great Island Channel Gweedore Bay and Islands Helvick Head Hempton's Turbot Bank Sandbank Hook Head Hovland Mound Province Howth Head Inagh River Inishbofin and Inishshark Inisheer Island	Loch nam Madadh Loch Roag Lagoons Lochs Duich, Long and Alsh Reefs Luce Bay and Sands Moine Mhor Monach Islands Mull of Galloway North Uist Machair Obain Loch Euphoirt River Bladnoch Sound of Arisaig (Loch Ailort to Loch Ceann Traigh) Sound of Barra South East Isaly Skerries South Uist Machair St Kilda Sunart Treshnish Isles Solway Firth Afon Teifi/River Teifi Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Bae Cemlyn / Cemlyn Bay Bae Ceredigion/ Cardigan Bay Glannau Môn: Cors heli / Anglesey Coast:

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Inishmaan Island Inishmore Island Inishtrahull Ireland's Eye Kenmare River Kerry Head Shoal Kilkee Reefs Kilkeran Lake and Castlefreke Dunes Kilkieran Bay and Islands Killala Bay/Moy Estuary Kilpatrick Sandhills Kingstown Bay Lackan Saltmarsh and Kilcummin Head Lady's Island Lake Lambay Island Long Bank Lough Cahasy, Lough Baun and Roonah Lough Lough Hyne Nature Reserve and Environs Lough Swilly Lower River Shannon Lower River Suir Magharee Islands Magherabeg Dunes Malahide Estuary	Saltmarsh Glannau Ynys Gybi/ Holy Island Coast Kenfig / Cynfigg Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru Pembrokeshire Marine/ Sir Benfro Forol Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau Pen y Gogarth/ Great Orme’s Head River Usk/ Afon Wysg River Wye/ Afon Gwy St David`s / Ty Ddewi Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Mount Brandon Mullet / Blacksod Bay Complex Mulroy Bay Mweelrea/Sheeffry/Erriff Complex North Dublin Bay North Inishowen Coast Northwest Porcupine Bank Porcupine Bank Canyon Rathlin O'Birne Island Raven Point Nature Reserve Reen Point Shingle River Barrow and River Nore Roaringwater Bay and Islands Rockabill to Dalkey Island Rogerstown Estuary Rutland Island and Sound Saltee Islands Sheephaven Slaney River Valley Slieve League Slieve Tooey/Tormore Island/Loughros Beg Bay Slyne Head Islands Slyne Head Peninsula South Dublin Bay	

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Southeast Rockall Bank Southwest Porcupine Bank St. John's Point Streedagh Point Dunes Tacumshin Lake Termon Strand The Murrough Wetlands Three Castle Head to Mizen Head Tory Island Coast Tralee Bay and Magheree Peninsula, West to Cloghane Tramore Dunes and Backstrand Tranarossan and Melmore Lough Valencia Harbour/Portmagee Channel West of Ardara/Maas Road Wicklow Reef	
	Annex II features	**Irish Sites**	**Transboundary Sites**
	Bottlenose dolphin (Tursiops truncatus)	Sites remote from the IOSEA 5 area: Lower River Shannon West Connacht Coast Sites within or immediately adjacent to the IOSEA 5 area: N/A	Bae Ceredigion/ Cardigan Bay Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau
	Harbour porpoise (Phocoena Phocoena)	Sites remote from the IOSEA 5 area: Blasket Islands	Skerries and Causeway

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Sites within or immediately adjacent to the IOSEA 5 area: Roaringwater Bay and Islands Rockabill to Dalkey Island	
	Grey seal (Halichoerus grypus)	Sites remote from the IOSEA 5 area: Blasket Islands Duvillaun Islands Horn Head and Rinclevan Inishbofin and Inishshark Inishkea Islands Slieve Tooey/Tormore Island/Loughros Beg Bay Slyne Head Islands Sites within or immediately adjacent to the IOSEA 5 area: Lambay Island Roaringwater Bay and Islands Saltee Islands	Isles of Scilly Complex Lundy The Maidens Monach Islands Treshnish Isles Bae Ceredigion/ Cardigan Bay Pembrokeshire Marine/ Sir Benfro Forol Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau
	Harbour seal (Phoca vitulina)	Sites remote from the IOSEA 5 area: Ballysadare Bay Clew Bay Complex Cummeen Strand/Drumcliff Bay (Sligo Bay) Donegal Bay (Murvagh) Galway Bay Complex Glengarriff Harbour and Woodland	Murlough Strangford Lough Ascrib, Isay and Dunvegan Eileanan agus Sgeiran Lios mor Sound of Barra South East Isaly Skerries

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Kilkieran Bay and Islands Killala Bay/Moy Estuary Rutland Island and Sound West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Kenmare River Lambay Island Slaney River Valley	
	Otter (Lutra lutra)	Sites remote from the IOSEA 5 area: Castlemaine Harbour Clew Bay Complex Connemara Bog Complex Galway Bay Complex Glengarriff Harbour and Woodland Gweedore Bay and Islands Kilkieran Bay and Islands Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lough Melvin Lough Swilly Lower River Shannon Mullet / Blacksod Bay Complex Mulroy Bay Mweelrea/Sheeffry/Erriff Complex	River Eden River Faughan and Tributaries Loch Moidart and Loch Shiel Woods Loch nam Madadh Moine Mhor South Uist Machair Sunart Afon Teifi/River Teifi Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Pembrokeshire Marine/ Sir Benfro Forol Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		North Inishowen Coast Owenduff/Nephin Complex River Finn Slieve Tooey/Tormore Island/Loughros Beg Bay The Twelve Bens/Garraun Complex Tralee Bay and Magheree Peninsula, West to Cloghane West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Kenmare River Lower River Suir River Barrow and River Nore Roaringwater Bay and Islands Slaney River Valley	
	Salmon (Salmo salar)	Sites remote from the IOSEA 5 area: Castlemaine Harbour Connemara Bog Complex Glenamoy Bog Complex Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lough Melvin Lower River Shannon	River Eden River Dee and Lake Bala River Faughan and Tributaries River Foyle and Tributaries River Bladnoch Afon Teifi/River Teifi River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

		Mweelrea/Sheeffry/Erriff Complex Owenduff/Nephin Complex River Finn The Twelve Bens/Garraun Complex West of Ardara/Maas Road Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	
	Sea lamprey (Petromyzon marinus) River lamprey (Lampetra fluviatilis)	Sites remote from the IOSEA 5 area: Castlemaine Harbour Cummeen Strand/Drumcliff Bay (Sligo Bay) Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Lower River Shannon Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	River Eden Dee Estuary/ Aber Dyfrdwy Severn Estuary/ Môr Hafren Solway Firth Afon Teifi/River Teifi Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Bae Ceredigion/ Cardigan Bay Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.1: List of Special Areas of Conservation (SAC) identified as having features that may be receptors of impacts arising from activities associated with the Plan

Sites are listed against their potentially vulnerable designated features

	Allis shad (Alosa alosa) Twaite shad (Alosa fallax)	Sites remote from the IOSEA 5 area: Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Sites within or immediately adjacent to the IOSEA 5 area: Blackwater River (Cork/Waterford) Lower River Suir River Barrow and River Nore Slaney River Valley	Severn Estuary/ Môr Hafren Bae Caerfyrddin ac Aberoedd/ Carmathen Bay and Estuaries Pembrokeshire Marine/ Sir Benfro Forol River Usk/ Afon Wysg River Wye/ Afon Gwy

Table A.2 List of Special Areas of Protection (SPA) identified as having features that may be receptors of impacts arising from activities associated with the Plan.

Sites are listed against their potentially vulnerable designated features (See AA screening matrix for breakdown of features of each site)

Potential Impacts	Site feature with potential to be impacted	SPA/pSPA potentially impacted	
		Irish Sites	Transboundary Sites
Impacts from seismic activities	All qualifying features	All sites screened out for these impacts	All sites screened out for these impacts
Impacts from drilling activities	All qualifying features	All sites screened out for these impacts	All sites screened out for these impacts
Accidental event including hydrocarbon spill associated with a blowout event	All qualifying features	Ardboline Island and Horse Island Aughris Head Baldoyle Bay Ballyallia Lough Ballycotton Ballymacoda Ballysadare Bay Ballyteige Burrow Bannow Bay Beara Peninsula Bills Rocks Blacksod Bay/Broadhaven Blackwater Estuary Blasket Islands Boyne Estuary Cahore Marshes	Duddon Estuary Isles of Scilly Mersey Estuary Morecambe Bay Ribble and Alt Estuaries The Mersey Narrows and North Wirral Foreshore Liverpool Bay / Bae Lerpwl Severn Estuary The Dee Estuary Belfast Lough Belfast Lough Open Water Carlingford Lough Copeland Islands Killough Bay Larne Lough

Table A.2 List of Special Areas of Protection (SPA) identified as having features that may be receptors of impacts arising from activities associated with the Plan.

Sites are listed against their potentially vulnerable designated features (See AA screening matrix for breakdown of features of each site)

Potential Impacts	Site feature with potential to be impacted	SPA/pSPA potentially impacted	
		Irish Sites	**Transboundary Sites**
		Carlingford Lough	Outer Ards
		Castlemaine Harbour	Rathlin Island
		Clare Island	Strangford Lough
		Cliffs Of Moher	Lough Foyle
		Clonakilty Bay	Ailsa Craig
		Cork Harbour	Bridgend Flats, Islay
		Courtmacsherry Bay	Canna and Sanday
		Cregganna Marsh	Cape Wrath
		Cross Lough (Kiladoon)	Flannen Isles
		Cruagh Island	Gruinart Flats, Islay
		Cumeen Strand	Handa
		Dalkey Islands	Inner Clyde Estuary
		Deenish Island and Scariff Island	Laggan, Islay
		Dingle Peninsula	Loch of Inch and Torrs Warren
		Donegal Bay	Mingulay and Berneray
		Drumcliff Bay	North Colonsay and Western Cliffs
		Dundalk Bay	North Uist Machair and Islands
		Dungarven Harbour	Rum
		Duvillaun Islands	South Uist Machair and Lochs
		Greers Isle	St Kilda
		Helvick Head to Ballyquin	The Shiant Isles
		High Island, Inishshark and Davillaun	Treshnish Isles

Table A.2 List of Special Areas of Protection (SPA) identified as having features that may be receptors of impacts arising from activities associated with the Plan.

Sites are listed against their potentially vulnerable designated features (See AA screening matrix for breakdown of features of each site)

Potential Impacts	Site feature with potential to be impacted	SPA/pSPA potentially impacted	
		Irish Sites	**Transboundary Sites**
		Horn Head to Fanad Head Howth Head Coast Illancrone and Inishkeeragh Illanmaster Illaunnanoon Illaunonearaun Inishbofin, Inishdooey and Inishbeg Inishduff Inishglora and Inishkeeragh Inishkea Islands Inishkeel Inishmore Inishmurray Inishtrahull Inner Galway Bay Ireland's Eye Iveragh Peninsula Keeragh Islands Kerry Head Killala Bay/Moy Estuary Lady's Island Lake Lambay Island	Upper Solway Flats and Marshes Bae Caerfyrddi/Carmarthen Bay Burry Inlet Dyfi Estuary / Aber Dyfi Glannau Aberdaron and Ynys Enlli/ Aberdaron Coast and Bardsey Island Skokholm and Skomer Traeth Lafan/ Lavan Sands, Conway Bay Ynys Feurig, Cemlyn Bay and The Skerries Ynys Seiriol / Puffin Island

Table A.2 List of Special Areas of Protection (SPA) identified as having features that may be receptors of impacts arising from activities associated with the Plan.

Sites are listed against their potentially vulnerable designated features (See AA screening matrix for breakdown of features of each site)

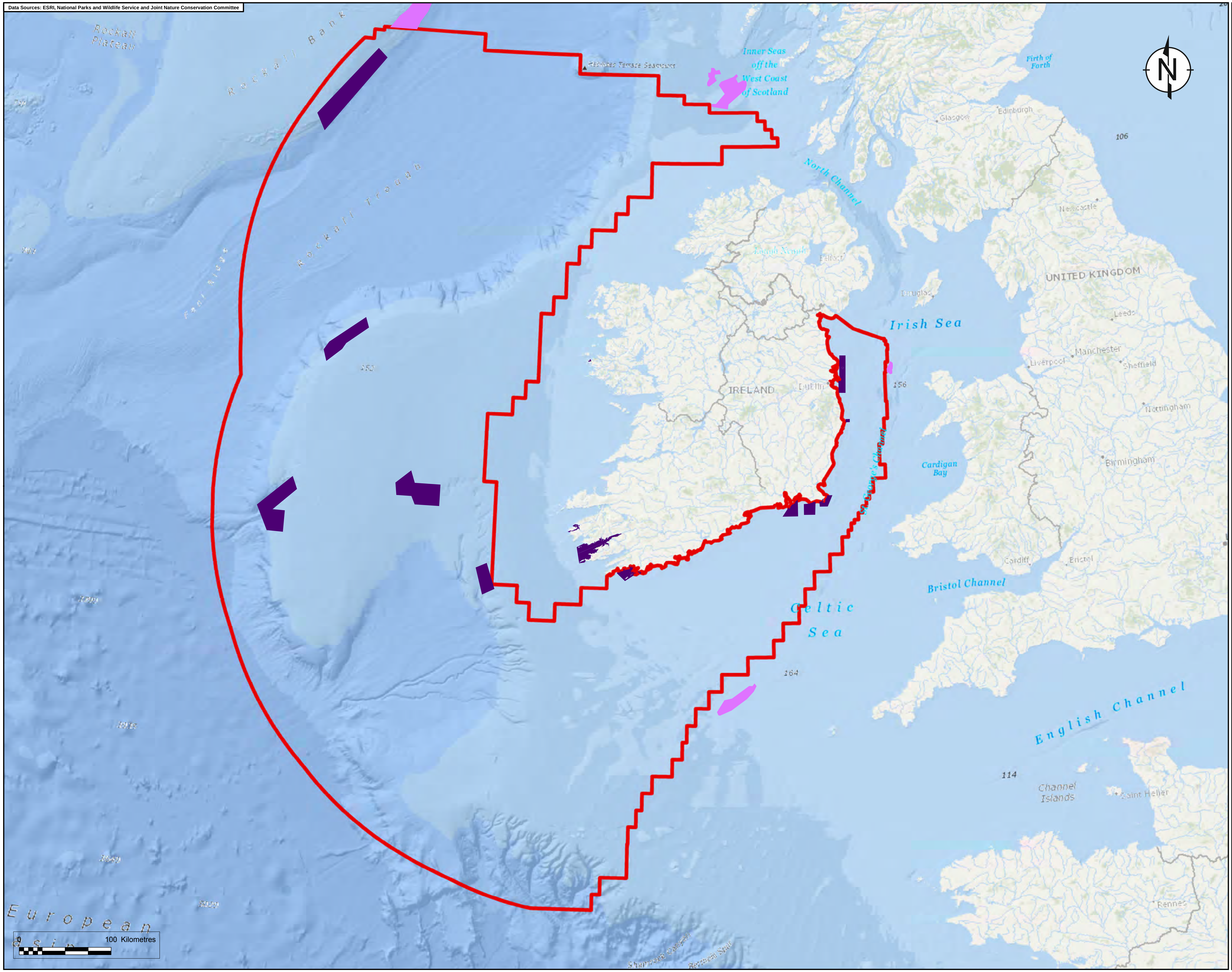
Potential Impacts	Site feature with potential to be impacted	SPA/pSPA potentially impacted	
		Irish Sites	**Transboundary Sites**
		Loop Head Lough Foyle Lough Swilly Magharee Islands Malahide Estuary Mid-Clare Coast Mid-Waterford Coast North Bull Island Old Head of Kinsale Puffin Island Rathlin O'Birne Island River Nanny Estuary and Shore River Shannon and River Fergus Estuaries Roaninish Rockabill Rogerstown Estuary Saltee Islands Sheep’s Head to Toe Head Sheskinmore Lough Skelligs Skerries Island	

Table A.2 List of Special Areas of Protection (SPA) identified as having features that may be receptors of impacts arising from activities associated with the Plan.

Sites are listed against their potentially vulnerable designated features (See AA screening matrix for breakdown of features of each site)

Potential Impacts	Site feature with potential to be impacted	SPA/pSPA potentially impacted	
		Irish Sites	**Transboundary Sites**
		Slyne Head to Ardmore Point Islands South Dublin Bay and River Tolka Estuary Sovereign Islands Stags of Broadhaven Tacumshin Lake Termoncarragh Lake and Annagh Machair The Bull and The Cow Rocks The Murrough The Raven Tory Island Tralee Bay Complex Tramore Back Strand Trawbreaga Bay West Donegal Coast West Donegal Islands Wexford Harbour and Slobs Wicklow Head	

Figures



Key

- IOSEA5_Study_Area
- RoI cSAC/SACs
- UK SCIs

Title

Figure 1. Location of Natura 2000 sites with an Annex I habitat as a qualifying interest feature that has the potential to be impacted by seismic and/or drilling activities.

Project No.	UK18-20707
Site	Irish Alantic Margin Basins
Client	Irish DCENR
Date	March 2015
Scale	1:3,800,000@ A3
Issue	A
Drawn by	[PC]

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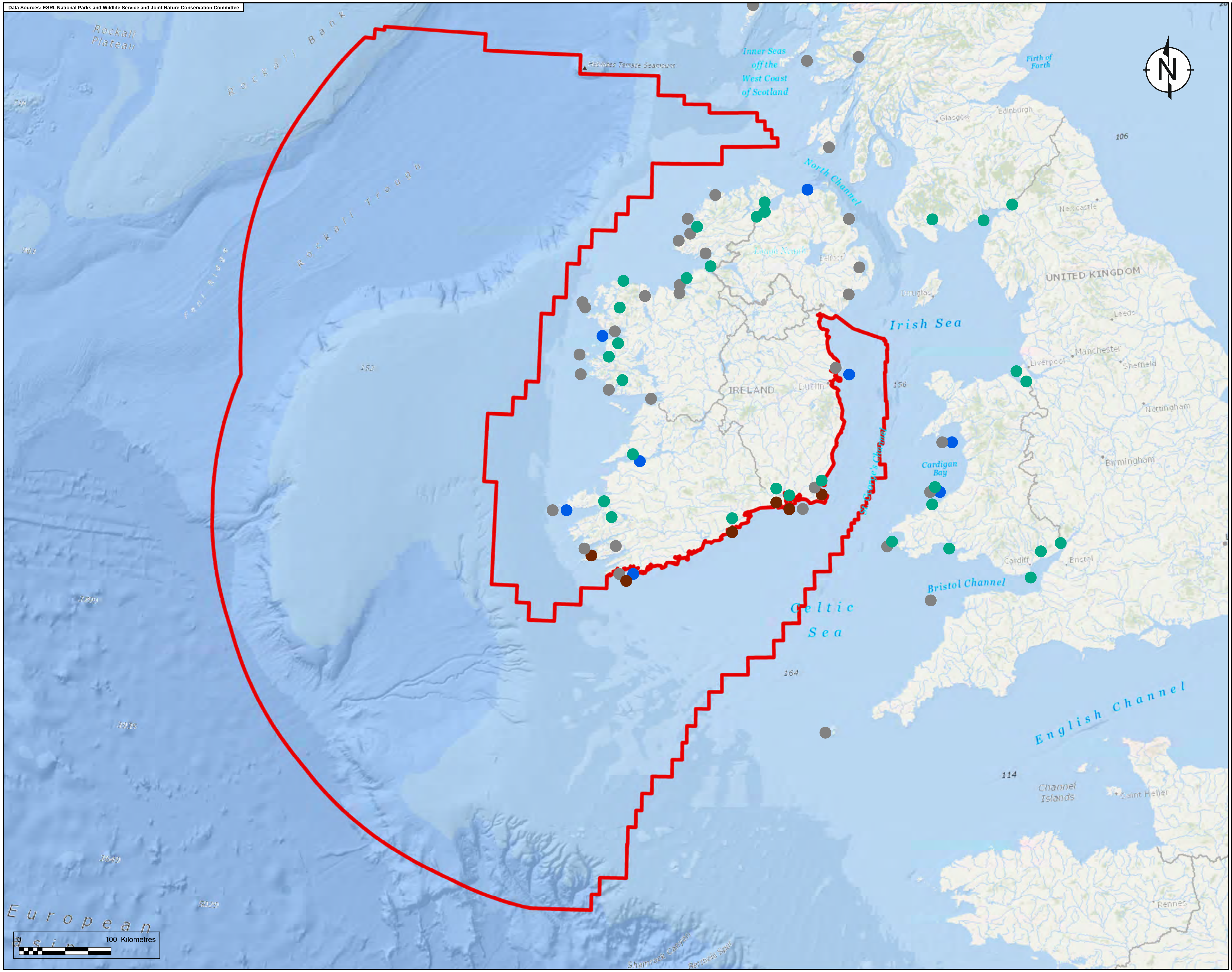

Key

- IOSEA5_Study_Area
- Cetaceans
- Pinnipeds
- Otter
- Diadromous Fishes

Title
Figure 2. Location of Natura 2000 sites by qualifying mobile species with the potential to be impacted by seismic and/or drilling activities

Project No.	UK18-20707
Site	Irish Alantic Margin Basins
Client	Irish DCENR
Date	March 2015
Scale	1:3,800,000@ A3
Issue	A
Drawn by	[PC]

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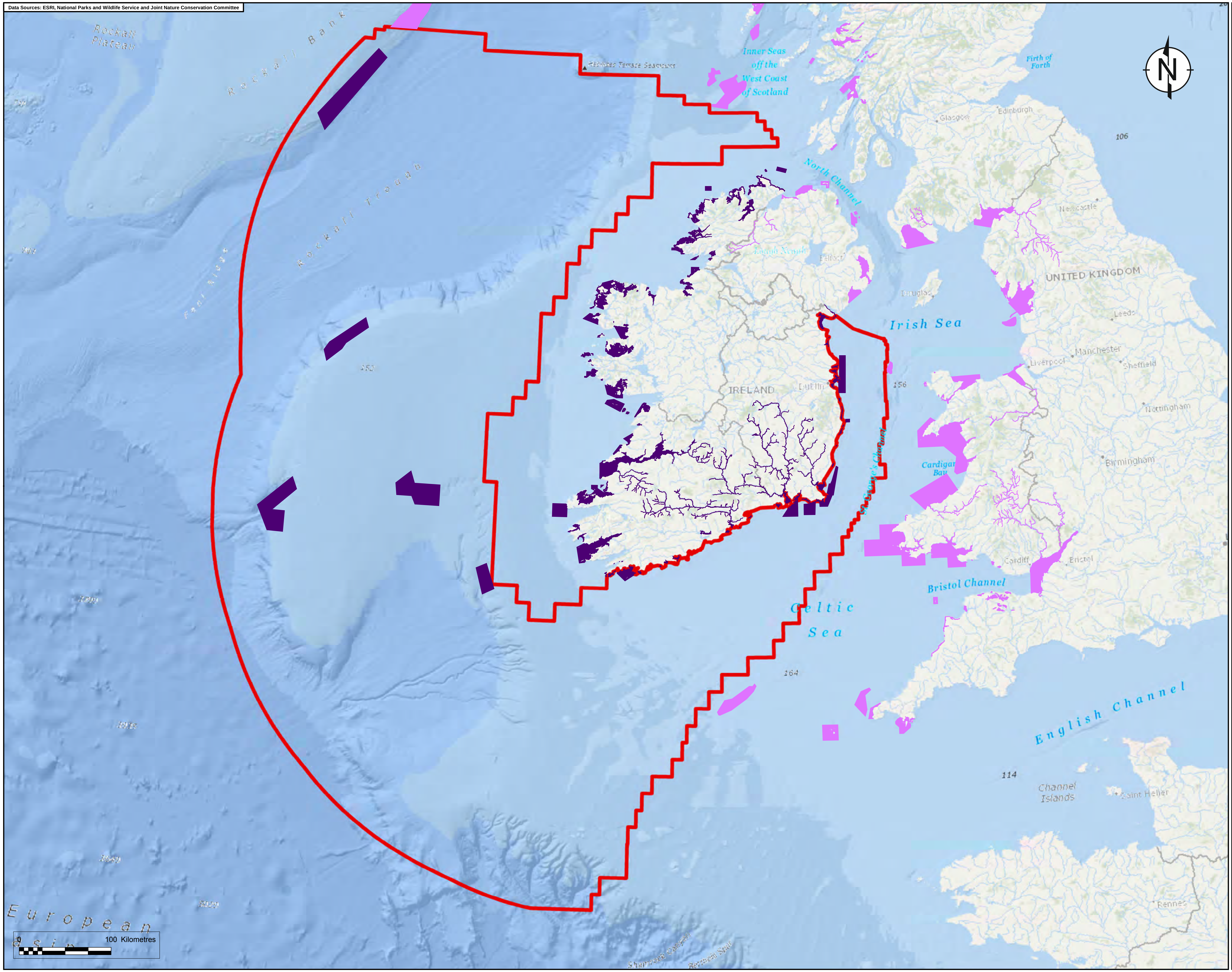

Key

- IOSEA5_Study_Area
- RoI cSAC/SACs
- UK SCI/cSAC/SACs

Title
Figure 3. Location of Special Areas of Conservation with qualifying Annex I habitats with the potential to be impacted by accidental events.

Project No.	UK18-20707
Site	Irish Alantic Margin Basins
Client	Irish DCENR
Date	March 2015
Scale	1:3,800,000@ A3
Issue	A
Drawn by	[PC]

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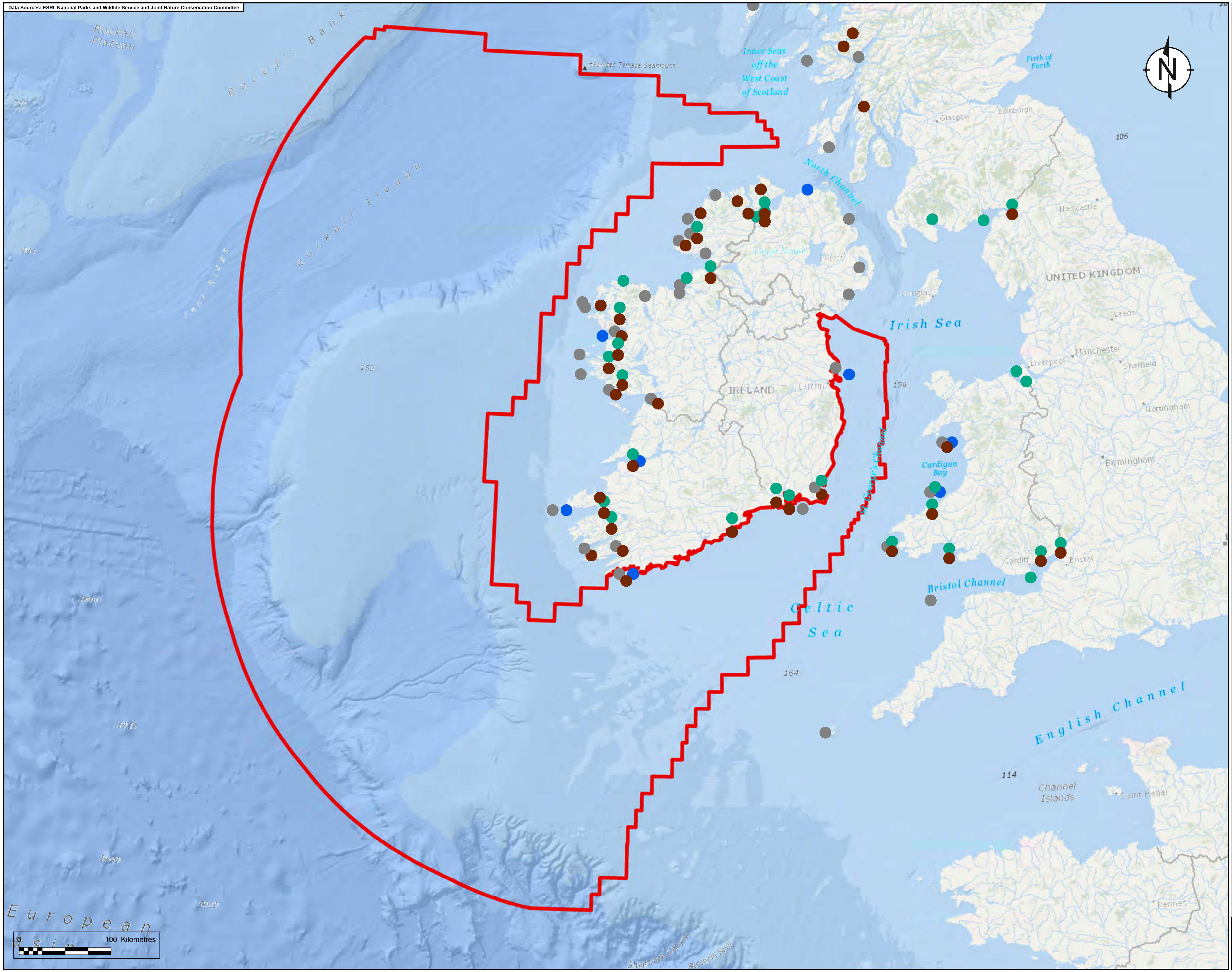

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Key

- IOSEA5_Study_Area
- Cetaceans
- Pinnipeds
- Otter
- Diadromous Fishes

Title

Figure 4. Location of Special Areas of Conservation with qualifying Annex II species with the potential to be impacted by accidental events.

Project No.	UK18-20707
Site	Irish Alantic Margin Basins
Client	Irish DCENR
Date	March 2015
Scale	1:3,800,000@ A3
Issue	A
Drawn by	[PC]

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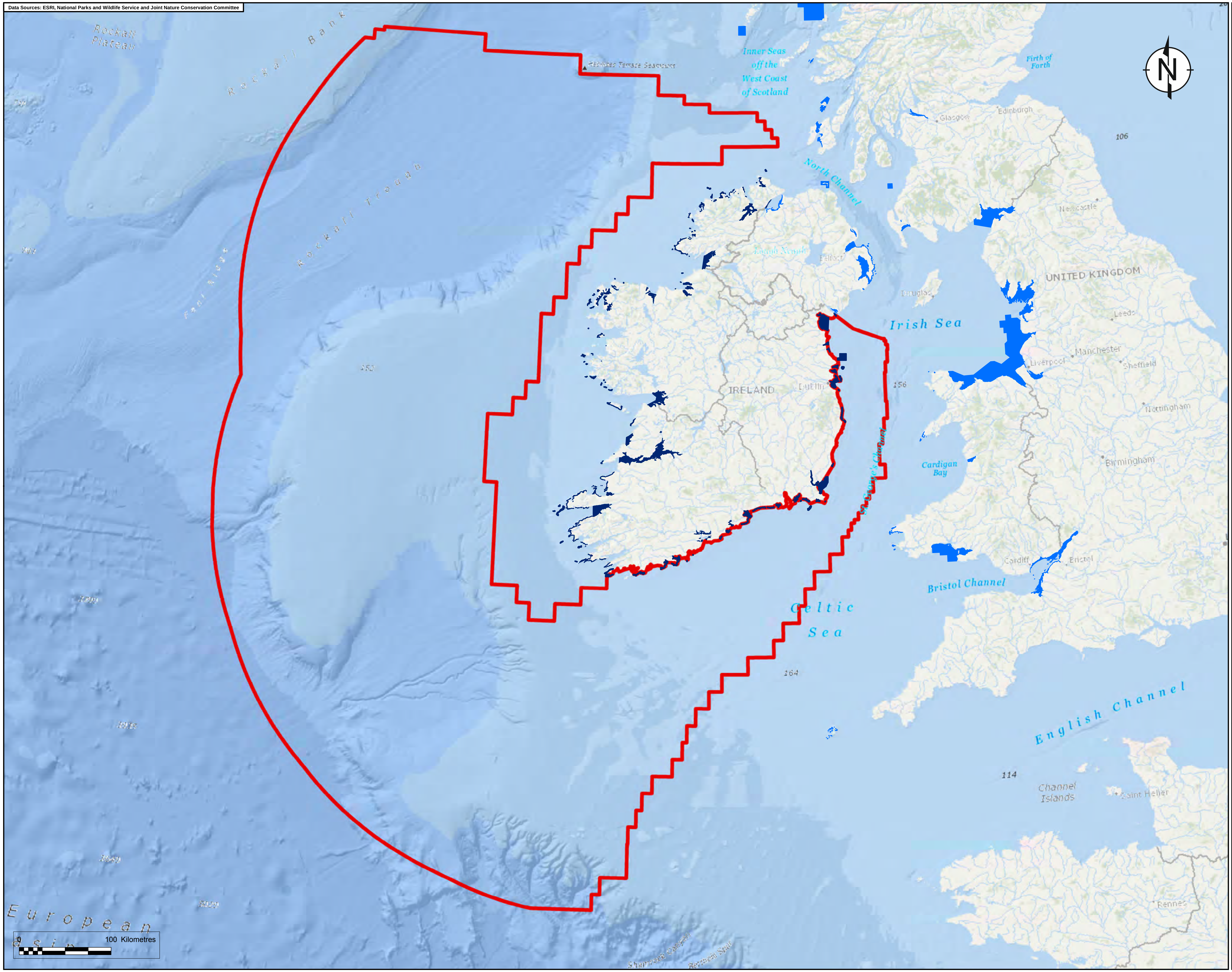

Key

- IOSEA5_Study_Area
- RoI SPAs
- UK SPAs

Title

Figure 5. Location of Special Protection Areas with the potential to be impacted by accidental events.

Project No.	UK18-20707
Site	Irish Alantic Margin Basins
Client	Irish DCENR
Date	March 2015
Scale	1:3,800,000@ A3
Issue	A
Drawn by	[PC]

ENVIRON

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