



Vermilion Exploration & Production Ireland Ltd

Corrib Field P6 Flexible Flowline Installation 2020

Natura Impact Statement

660841

January 2020





RSK GENERAL NOTES

Project No.: 660841



Title: Corrib Field P6 Flexible Flowline Installation 2020 – Natura Impact Statement

Client: Vermilion Exploration & Production Ireland Limited (Vermilion)

Date: 24th January 2020

Office: Bristol

Status: Final

Authorised by:	 Andrew Bendell	Project Manager	Date:	24-1-2020
Authorised by:	 David Watson	Project QA Rep	Date:	24-1-2020

AB	DW/JN	24-1-2020	E	00	For issue
AUTHOR	CHECKED	DATE ISSUED	ISSUED POST / ELECTRONIC	REV	PURPOSE OF ISSUE

RSK Environment Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of RSK and the party for whom it was prepared.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION	2
2.1	Purpose of this document	2
2.2	The stages of Appropriate Assessment	3
2.3	Previously Assessed Activities	5
2.4	Alternatives	6
2.5	Consideration of significance	6
2.6	Consideration of integrity	7
3	PROPOSED ACTIVITIES	9
3.1	Background – an overview of the Corrib Gas Development	9
3.2	Work scope overview – Replacement of the flexible flowline at the P6 wellhead with the Corrib central manifold	11
3.3	Overview of equipment and materials	15
3.4	Location	18
3.5	Work scope programme	18
3.6	Detailed information on flowline replacement	21
3.7	Detailed information on navigation, positioning, communications and survey equipment	22
3.7.1	Navigation, positioning and communication equipment	22
3.7.2	As-Found and As-Left Surveys	22
4	EUROPEAN SITES	25
4.1	Introduction	25
4.2	European sites in the vicinity of the Corrib Development	25
4.3	Characteristics of European sites	49
4.3.1	Special Areas of Conservation (SAC)	49
4.3.2	Special Protection Areas (SPA)	59
5	APPROPRIATE ASSESSMENT SCREENING	72
5.1	Introduction	72
5.2	Potential Impacts on European sites	72
5.2.1	Physical presence of ROV support vessel, ROVs and equipment	72
5.2.2	As-Found and As-Left acoustic surveys and associated general vessel activity	74
5.2.3	Routine emissions and discharges during vessel operations	78
5.2.4	P6 flowline replacement works	79
5.2.5	Accidental events	80
5.2.6	AA Screening Conclusions	81
6	IMPACT ASSESSMENT IN SUPPORT OF STAGE 2: APPROPRIATE ASSESSMENT	82
6.1	Introduction	82
6.2	Potential impacts on European sites	82
6.2.1	Impacts of noise on key receptor species	82
6.2.2	Other potential impacts	92
6.3	Cumulative impacts	93
7	CONCLUSION	95
8	REFERENCES	96

TABLES

Table 3-1: Specifications of proposed ROV support vessel - Siem Spearfish.....	16
Table 3-2: Composition and use of proposed chemicals.....	17
Table 3-3: Acoustic equipment specifications and operating frequency ranges.....	24
Table 4-1: European sites in the vicinity of the proposed area of works	27
Table 5-1: Typical anthropogenic sound sources and received levels of sound in the marine environment (adapted from: Evans & Nice, 1996; Richardson et al., 1995, in IOSEA2 (ERT/Aqua-Fact International Services, 2007)).....	75

FIGURES

Figure 2-1: Stages of Appropriate Assessment.....	4
Figure 3-1: Location of Corrib Field and P6 wellhead	10
Figure 3-2: Corrib sub-sea overview and proposed P6 flowline replacement	13
Figure 3-3: Detailed location of existing flowline to be decommissioned, and potential locations of new flexible flowline.....	14
Figure 3-4: Proposed ROV support vessel (<i>Siem Spearfish</i>)	16
Figure 3-5: Step-by-step tie-in sequence illustration - Integrated Connection tool And ROV operated Underwater System (ICARUS).....	20
Figure 4-1: Pertinent European designated sites and their proximity to the proposed flexible flowline replacement works at the Corrib Field.....	48
Figure 6-1: Bottlenose dolphin and harbour porpoise hearing threshold audiogram.....	83
Figure 6-2: Audiogram for grey seal (Nedwell et al., 2004)	86

1 EXECUTIVE SUMMARY

This Natura Impact Statement provides an assessment of the potential environmental impacts of the installation of a new flexible flowline connecting the P6 wellhead with the Corrib central manifold at the Corrib Field in relation to European Protected Sites. The new flexible flowline will be shorter in length (158 m) than the existing flowline (1,560 m)¹ and will significantly reduce the unnecessary flow restrictions between the P6 wellhead and the Corrib central manifold.

The work scope includes the mobilisation of a Remotely Operated Vehicle (ROV) support vessel (*Siem Spearfish*) and two work class ROVs from a UK port to the installation location at the Corrib Field. Prior to arrival at the Corrib Field, verification of the dynamic positioning (DP) and ultra-short baseline (USBL) systems will be undertaken. Prior to the removal of the existing P6 flexible flowline, an As-Found survey will be undertaken, which will include underwater video/stills and a geophysical survey using multibeam echo sounder (MBES) equipment deployed from an ROV. The flowline replacement will be carried out by ROV, with the existing flowline decoupled from the Corrib central manifold and P6 wellhead and the terminations moved at either end to allow the new flexible flowline to be installed. The existing flowline will be capped and preserved in situ on the seabed for future use. Following completion of the installation works there will be reinstatement of the worksite and an As-Left survey will be undertaken. The vessel will then return to a UK port for demobilisation.

This document is a statutory requirement and has been prepared in accordance with Irish governmental guidance in order to support an Appropriate Assessment, should the competent authority decide that such an assessment is required. It is the opinion of the authors of this assessment that all impacts are however screened out of requiring an Appropriate Assessment.

An outline of the Appropriate Assessment (AA) process is provided in the introduction to this report, while Section 3 provides a background to the Corrib Gas development and outlines details of the proposed works.

The assessment considers a range of potential impacts (associated with the proposed activities) alongside the qualifying features (conservation objectives) of a number of relevant European Protected Sites in the Natura 2000 network.

¹ The existing flexible flowline was installed in 2014 and had an increased length to mitigate extreme low temperature gas from reaching the central manifold. As the reservoir pressure has dropped, the longer 'warm up' flowline is no longer required.

2 INTRODUCTION

2.1 Purpose of this document

This Natura Impact Statement (NIS) provides an assessment of the potential environmental effects of the installation of a new flexible flowline and decoupling and preservation of the existing flowline at the Corrib offshore gas field between the P6 wellhead and the Corrib central manifold, in relation to European protected ('Natura 2000') sites. The document provides the information necessary for the competent authority to undertake an Appropriate Assessment to assess the effects of the project against the qualifying features (conservation objectives) of nearby or relevant Natura 2000 sites.

This has been prepared in accordance with the Birds and Natural Habitats Regulations¹ (SI 477 of 2011) and current guidance of the National Parks and Wildlife Service (NPWS) as described in 'Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities (Department of Environment, Heritage and Local Government², 2009 (as revised February 2010))'.

The approach and methodology in assessing the environmental implications of the proposed activities for this NIS has been undertaken with due regard to the EPA 'Advice Notes for Preparing Environmental Impact Statements' (2015); EPA 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (2017); and the Chartered Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Coastal and Marine (CEEM, 2018).

The ecological characteristics of European sites in the vicinity of the proposed survey activities are described in Section 4 of this document, followed by an initial screening of impacts, and then an assessment of likely effects, and residual impacts on European sites in Section 6. Conclusions are set out in Section 7.

The document provides an initial impact screening assessment for the flexible flowline replacement works, including the As-Found and As-Left survey activities, followed by an assessment of impacts, which are scheduled to take place during the summer months of 2020. This document outlines the information required in order to assess whether or not the proposed activities, either when taken alone or in combination with any other offshore works, are likely to have a significant effect on a European site.

This assessment takes cognisance of the CJEU judgement in Case C-323/17 *People Over Wind & anor. v. Coillte*, which ruled that "*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project*"

By undertaking the impact assessment in a stepwise manner in relation to the habitats and species of these sites, together with their conservation objectives, this document seeks to inform the screening process required at the first stage of the process pursuant to Article 6.3 of the EU Habitats Directive and also to provide full and detailed information as required for the second stage, that of Appropriate Assessment should the competent

¹ SI 477 of 2011 European Communities (Birds and Natural Habitats) Regulations 2011

² As of 2016 the Department of Environment, Heritage and Local Government is known as the Department of Housing, Planning, Community, and Local Government

authority decide that such an assessment is required.

2.2 The stages of Appropriate Assessment

The requirement for appropriate assessment is set out in Article 6(3) of the EU Habitats Directive (92/43 EEC)³, which states:

‘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 the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.’

Should a decision be reached to the effect that it cannot be said with sufficient certainty that the proposed flexible flowline replacement works is not likely to have significant effects on the Natura 2000 sites, then, as is stated above, it is necessary and appropriate to carry out an Appropriate Assessment of the implications of the proposed activity for the European sites in view of their conservation objectives.

The guidance for Appropriate Assessment (NPWS, 2009, revised February 2010) states:

*“AA is an impact assessment process that fits within the decision-making framework and tests of Articles 6(3) and 6(4) and, for the purposes of this guidance, it comprises two main elements. Firstly, a **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. The AA process encompasses all of the processes covered by Article 6(3) of the Habitats Directive, i.e. the screening process, the NIS, the AA by the competent authority, and the record of decisions made by the competent authority at each stage of the process, up to the point at which Article 6(4) may come into play following a determination that a plan or project may adversely affect the integrity of a Natura 2000 site”.*

The European Commission’s guidance promotes a four stage process, as set out in Box 1 below (Figure 2-1), to complete the Appropriate Assessment, and outlines the tests required at each stage. Stages 1 and 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or a necessary precursor for Stage 4.

³ Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, as amended by Council Directive 97/62/EC

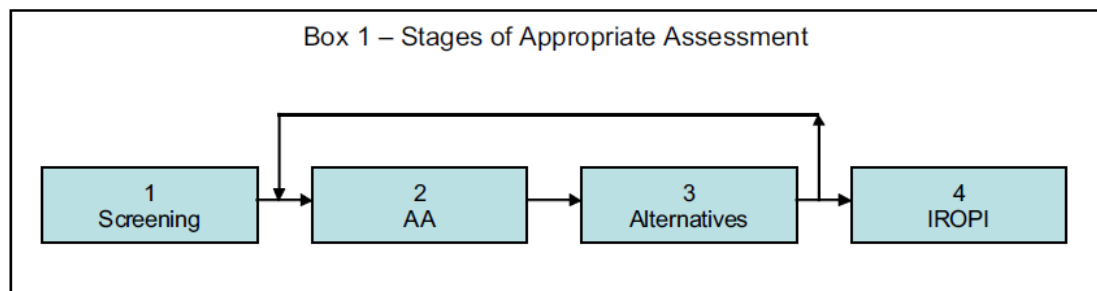


Figure 2-1: Stages of Appropriate Assessment

This NIS includes the ecological impact assessment and testing required under the provisions of Article 6(3) by means of the first stage of Appropriate Assessment, the screening process (as set out in the EU Guidance documents).

The NIS also provides the information required for the Competent Authority to complete the Appropriate Assessment (Stage 2) should this be necessary and appropriate in their opinion. Alternatives have been considered in order to demonstrate that the option to undertake the works with the least ecological impacts has been selected.

The first stage of an Appropriate Assessment is the screening exercise, which is undertaken to determine if it is necessary to proceed with further stages.

The Department of the Environment, Heritage and Local Government's⁴ guidance (2009) revised February 2010)) states:

"Screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3):

- *whether a plan or project is directly connected to or necessary for the management of the site; and*
- *whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a European site in view of its conservation objectives.*

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2 (AA). Screening should be undertaken without the inclusion of mitigation, unless potential impacts clearly can be avoided through the modification or redesign of the plan or project, in which case the screening process is repeated on the altered plan. The greatest level of evidence and justification will be needed in circumstances when the process ends at screening stage on grounds of no impact."

Section 5 comprises the required assessment as laid out in the screening sections and screening matrix of the guidance documentation⁵ (Stage 1 of the AA process). While Section 6 assesses the impacts (if any) on the integrity of Natura 2000 sites (Stage 2 of

⁴ As of 2016 the Department of Environment, Heritage and Local Government is known as the Department of Housing, Planning, Community, and Local Government

⁵ EC (2018): European Commission. Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, (21-11-18) C (2018) 7261 Final. Commission Notice Brussels

the AA process).

With regard to the screening process (Stage 1), EU Commission guidance⁶ states:

“This stage examines the likely effects of a project or plan, either alone or in combination with other projects or plans, upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. This assessment comprises four steps:

- *determining whether the project or plan is directly connected with or necessary to the management of the site;*
- *describing the project or plan and the description and characterisation of other projects or plans that in combination have the potential for having significant effects on the Natura 2000 site;*
- *identifying the potential effects on the Natura 2000 site;*
- *assessing the significance of any effects on the Natura 2000 site”.*

2.3 Previously Assessed Activities

Offshore and nearshore pipeline surveys have been assessed previously in the Offshore Supplementary Update Report (RSK, 2010) and have been undertaken as assessed and approved under the 2011 Section 40 Consent.

A Natura Impact Screening Statement (NISS, EACS, 2015) was submitted as part of the Consent to Operate application in 2015. This considered the future activities associated with the offshore pipeline and concluded that “the operation of the Corrib Pipeline when taken either individually or in combination with other plans of projects is not likely to have any significant effect on any European site”. The conclusion concurred with those of previous assessments and approvals were given by the Minister following his Department’s consultations with prescribed bodies and assessment by external consultants. The previous assessments included those submitted between 2013 and 2019 when a number of Natura Impact Screening Statements (NISS) and a Natura Impact Statement (NIS) were submitted to the Department of Communications, Energy, and Natural Resources (DCENR⁷) (from 2016 these were submitted to the Department for Communications, Climate Action and the Environment (DCCAE) for the approval of offshore surveys. The most recent submission (2019) was an NIS for annual inspection, maintenance and renewal surveys of the Corrib offshore pipeline route corridor and in-field flowlines (RSK, 2019) which was approved by the DCCAE on the 26th November 2019 subject to review by the Petroleum Affairs Directorate (PAD). These NISS and NIS reports took into consideration the potential impacts on the West Connacht Coast SAC, the designation of which was notified (2012) subsequent to the 2011 Section 40 Consent, as well as other European sites in the wider locality, with the potential to be affected by the survey activities.

Marine mammal monitoring carried out in relation to offshore activities subsequent to the Offshore Supplementary Report (RSK, 2010) and the 2011 Section 40 Consent is

⁶ Paragraph 3.1 of ‘Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological Guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (Nov. 2001)

⁷ From 2016 the DCENR is known as the Department of Communications, Climate Action and the Environment (DCCAE)

described in four marine mammal monitoring reports describing the annual monitoring undertaken by the Coastal and Marine Research Centre (CMRC) of University College Cork (Anderwald et al., 2011; 2012, Haberin et al., 2013, Culloch et al., 2014).

In addition to the NISS and NIS reports (described above) submitted in support of applications for surveys of the offshore pipeline and other seabed infrastructure for the Corrib Project, a Natura Impact Statement was submitted for an Ocean Bottom Cable (OBC) seismic exploration survey of the Corrib Field (to support the Appropriate Assessment process for the West Connacht Coast SAC) (2013).

Vermilion is committed to the reduction of environmental impacts throughout the Corrib Development and will implement best practice with respect to marine mammals during any activities at the Corrib Field (including in the vicinity of the West Connacht Coast SAC). The procedures implemented for their protection are in compliance with all requirements imposed on the Corrib Development by the statutory agencies.

Furthermore, Article 42 of S.I 477 of 2011 European Communities (Birds and Natural Habitats) Regulations 2011 stipulates that screening for Appropriate Assessment of a plan or project not directly connected with or necessary to the management of a European Site shall be carried out by the competent authority to assess, in view of best scientific knowledge and in view of the conservation objectives of the site, if that plan or project, individually or in combination with other plans or projects is likely to have a significant effect on the European site.

2.4 Alternatives

The primary objectives of the proposed scope of works is to replace the existing flexible flowline at the P6 wellhead with a new one of considerably shorter length and leaving the decommissioned flowline in situ on the seabed and preserved for future use. In addition, As-Found and As-Left surveys will be conducted, utilising video / still underwater imagery and geophysical survey techniques to inspect the area of works before and after installation of the new flexible flowline. The works will aim to be carried out over as small an area as possible and over as short timescale in order to minimise limit disturbance. Only one ROV support vessel will be utilised and two ROVs. The methodology for the proposed installation works, and As-Found and As-Left surveys has been selected following the evaluation of a number of alternatives from different prospective contractors.

The techniques and equipment that have been selected are based on their performance and reliability to be able to undertake the work scope over as short timescale and a minimal spatial extent as possible. The survey equipment proposed has been selected based on data acquisition performance and low ecological impact. The overall replacement works scope has been developed in order to comply with statutory requirements for offshore working. These will be discussed further in the assessment of likely effects (Sections 5 and 6).

2.5 Consideration of significance

In terms of significance, the NPWS Guidance (2010) uses an EC definition as follows:

"... any element of a plan or project that has the potential to affect the conservation objectives of a Natura 2000 site, including its structure and function, should be considered significant (EC, 2006)".

Other guidance documents also discuss significance criteria, some in more detail than others. The Dutch Guidance⁸ (translated, Neumann, 2004) discusses a number of criteria in relation to habitats and species population.

In general, significance indicators might include:

- impact on Annex I habitat (including loss or reduction in size - percentage relative to the overall area of the habitat in the Natura site; impairment of function);
- fragmentation of habitat or population (depending upon the duration or permanence);
- disturbance (noise, light etc. – distance from disturbance, duration of disturbance);
- effect on species populations (direct or indirect damage to size, breeding patterns etc), and;
- changes in water quality.

To summarise the significance issue, it is useful to quote from Morris (2008) who describes significance in the context of the Habitats Directive as follows:

“...Within the Habitats Regulations, significance is quite different. It is used as a coarse filter and the test is a question over the possibility that there will be a significant effect on a key receptor that determines the conservation status of a European site. Thus, determining whether there will be a ‘likely significant effect’ does not imply that there will be such an effect or even that such an effect is more likely than not; it simply flags the need to test the issues and then make a judgement of the pathways and mechanisms imposed by a project on the designated wildlife interest. This test best equates to the screening and scoping opinions sought for an EIA but is confined to the Natura 2000 and Ramsar interest rather than wider environmental or nature conservation issues”.

2.6 Consideration of integrity

In order to assess the likely impacts and ascertain whether an adverse effect on the integrity of the Natura site(s) is likely to occur as a result of the proposed development, should the appropriate assessment process be deemed to apply, it is necessary to consider what constitutes the integrity of a Site as referred to in Article 6(3). The document Managing Natura 2000 Sites, the provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC (2000) (Updated November 2018) gives clear guidance in this regard and states:

“The integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site’s conservation objectives”.

Integrity has been discussed and defined in various ways in guidance documentation and

⁸ Translated from Publication of Dutch State Printers in book: ‘Praktijkboek Habitattoets’, 2004 (F. Neumann en H. Woldendorp, SDU)

the literature. For example, Treweek (1999) discusses biological integrity and ecosystem health and refers to three generally accepted criteria: systematic indicators of ecosystem functional and structural integrity; ecological sustainability or resilience (relating to the ability of a system to withstand “natural” or anthropogenic stresses); and absence of detectable symptoms of ecosystem disease or stress. A similar, but less academic, approach is adopted by the various guidance documents with a number of definitions proposed.

3 PROPOSED ACTIVITIES

3.1 Background – an overview of the Corrib Gas Development

The Corrib natural gas field is located approximately 65 kilometres offshore from the closest coast of north west County Mayo. This gas field has been developed as a subsea 'tie-back' facility, connected by a pipeline to an onshore processing terminal located approximately 9 kilometres inland (See Figure 3-1).

All of the statutory permits and consents necessary to develop the Corrib Field and associated facilities and infrastructure were in place at the end of 2004 when construction commenced. By November 2009 the offshore production facilities had been installed and the 83 km offshore section of the Corrib pipeline between the field and the landfall had been laid. To allow the connection of the Corrib development with the national gas distribution network the 150 km Galway to Mayo pipeline was completed in 2006 and is now connected to the Terminal. Construction of the 8.3 km onshore section of the Corrib pipeline from the initial landfall at Glengad to the BBGT was completed in 2015.

Following the consent to operate at the end of 2015, the development was fully commissioned, and went into operation at the end of 2015 when first gas was achieved.

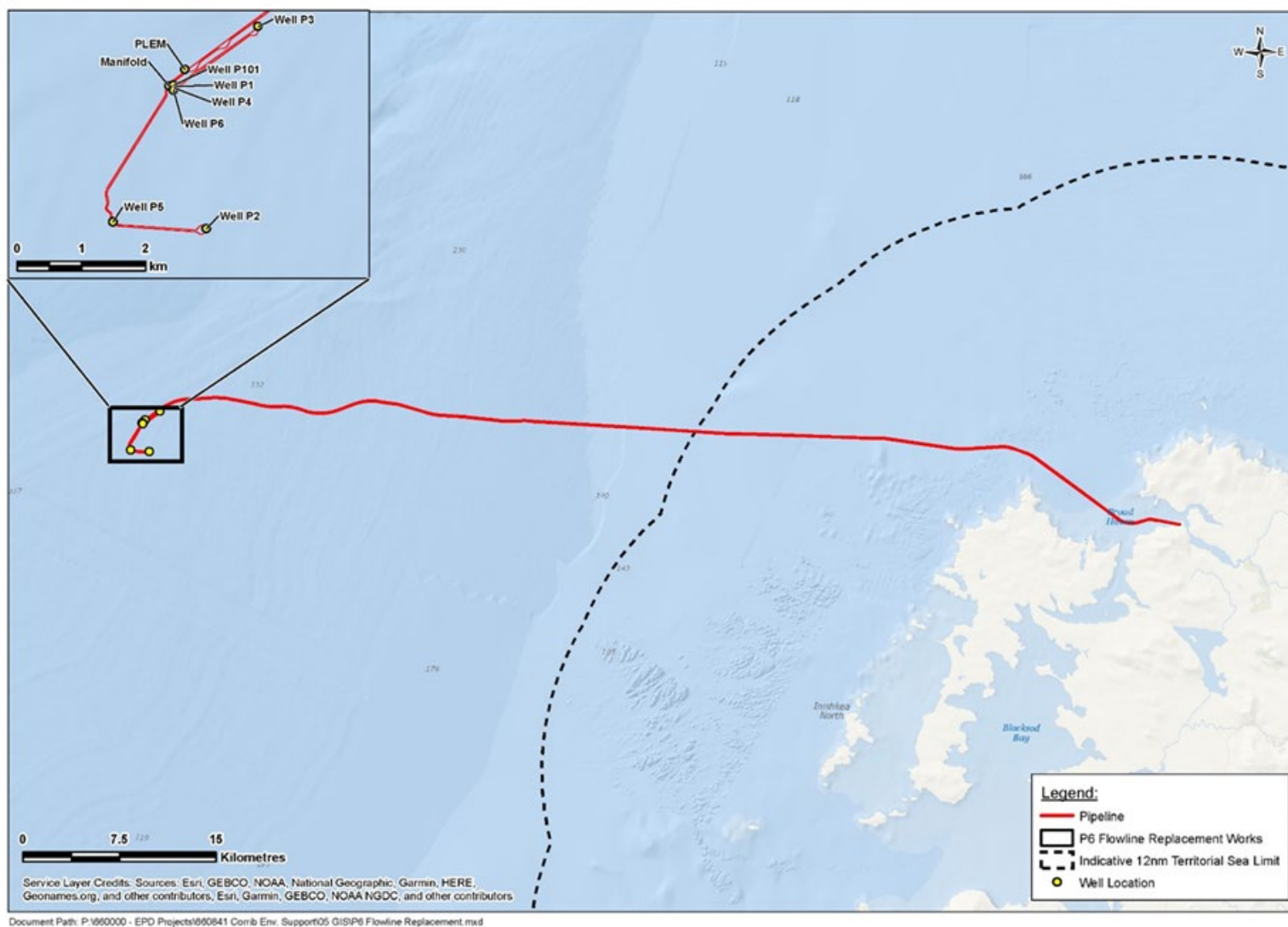


Figure 3-1: Location of Corrib Field and P6 wellhead

3.2 Work scope overview – Replacement of the flexible flowline at the P6 wellhead with the Corrib central manifold

The 2020 work scope's objective is to replace the existing flexible flowline connecting the P6 subsea wellhead with the Corrib central manifold (see Figure 3-2), leaving the decommissioned flowline in situ in a preserved state on the seabed. The new flowline will be shorter in length (158 m) than the existing flowline (1,560 m)⁹ and will significantly reduce unnecessary flowline restrictions between the wellhead and the manifold. The proposed work scope to do this is as follows:

- Mobilisation of the ROV support vessel (*Siem Spearfish*) and two ROVS from a UK port to the Corrib Field¹⁰;
- Trials and verification of dynamic positioning (DP) system and ultra-short baseline system (USBL) to be undertaken prior to arrival within the Corrib Field exclusion zone;
- Completion of an As-Found Survey at the P6 work site, including underwater video / stills, acoustic geophysical survey and any seabed preparation works required prior to commencement;
- Depressurisation and isolation of the existing flowline from the central manifold and P6 wellhead (gas displaced into subsea process system);
- Disconnection of existing flowline from central manifold and P6 wellhead (existing flowline will be left in situ on the seabed);
- Preparation of laydown area and lay route for new flexible flowline;
- Deployment of the new flexible flowline from the support vessel and connection to central manifold and P6 wellhead using ROVs and the remotely operated ICARUS tie-in tool;
- Pressure testing and pre-commissioning activities for new flowline;
- Installation of protective concrete mattresses along length of new flexible flowline and in places along disconnected flowline to provide stability;
- Reinstatement of the worksite and completion of an As-Left Survey including underwater video / stills and geophysical survey;
- Demobilisation of the support vessel and ROVs back to UK port.

The As-Found and As-Left surveys will be carried out using the ROVs using a combination of survey techniques, namely multibeam echo sounder (MBES) and underwater video / camera imagery. A range of other sensors may also be used as part of the survey and ROV operations including: Sound Velocity Probes (SVPs) (used to calibrate acoustic survey equipment); as well as navigation / positioning sensors including a subsea Ultra Short Baseline (USBL) beacon system, obstacle avoidance sonar, an altimeter, Motion Reference Unit (MRU), Inertial Navigation System (INS) and Doppler Velocity Log (DVL).

⁹ The existing flexible flowline was installed in 2014 and had an increased length to mitigate extreme low temperature gas from reaching the central manifold. As the reservoir pressure has dropped over time, the longer 'warm up' flowline is no longer required.

¹⁰ It should be noted that all vessel refuelling will take place in port.

The area of operations will be in the vicinity of the P6 wellhead and Corrib central manifold within the Corrib Field (Figure 3-2).

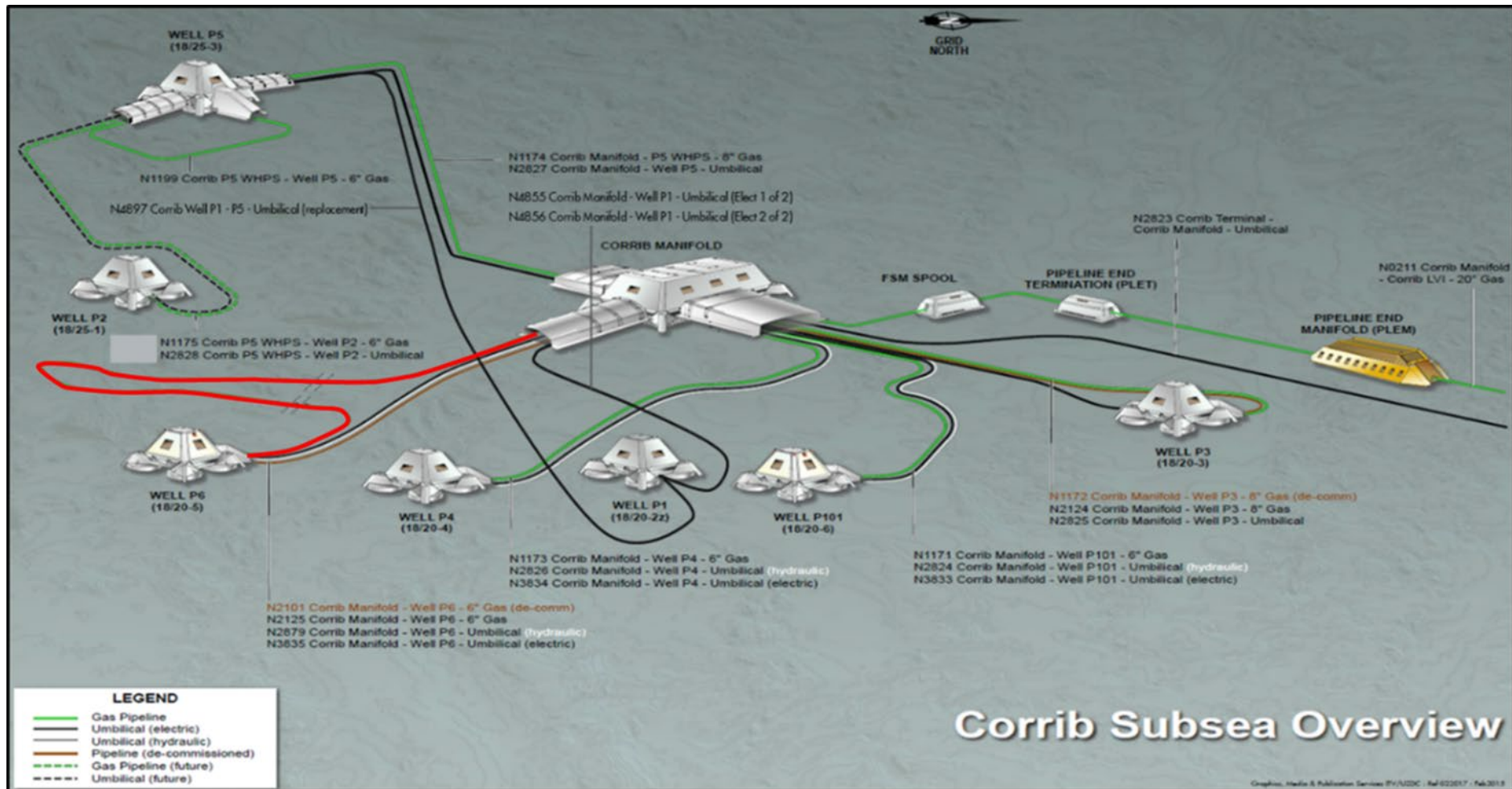


Figure 3-2: Corrib sub-sea overview and proposed P6 flowline replacement

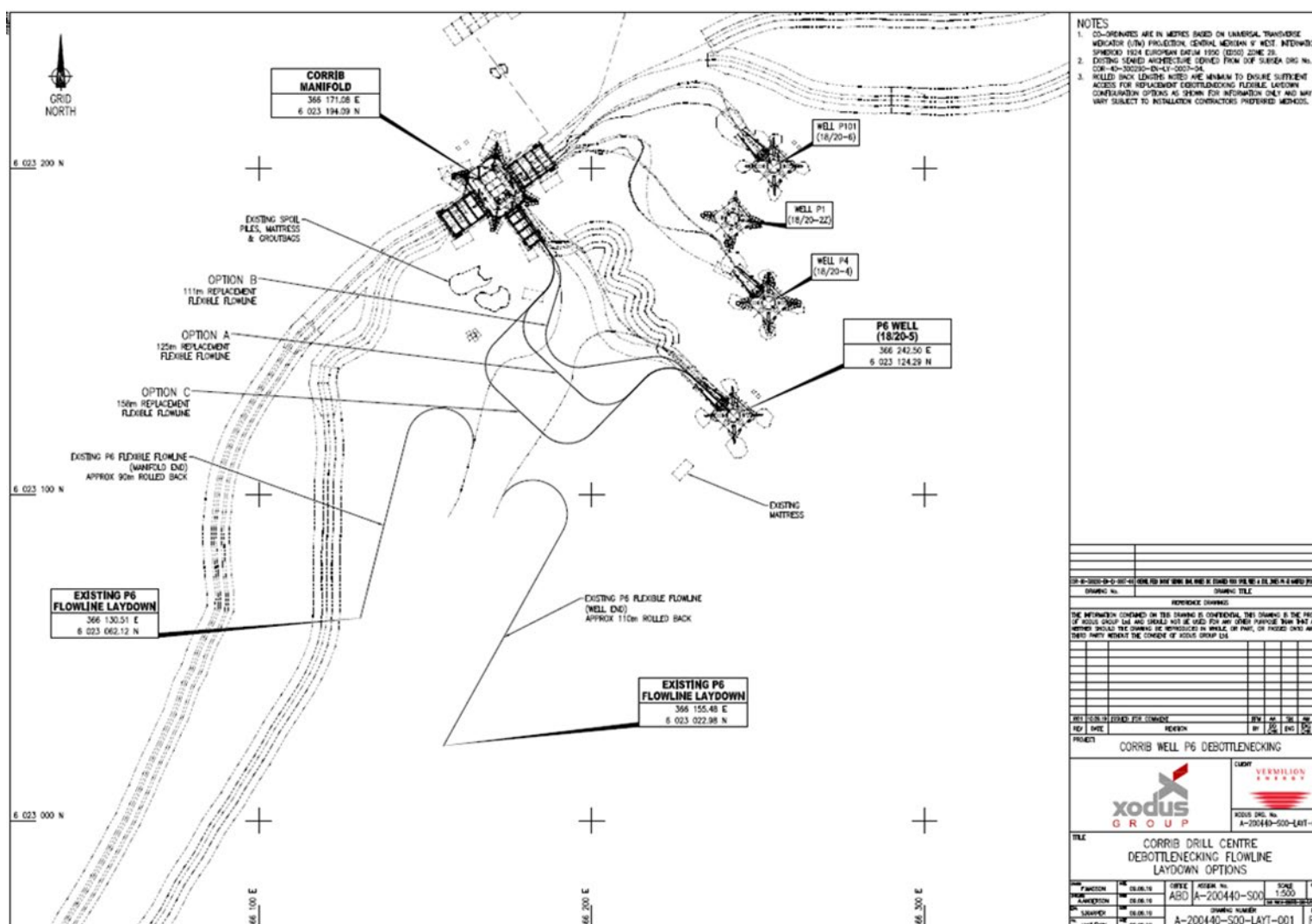


Figure 3-3: Detailed location of existing flowline to be decommissioned, and potential locations of new flexible flowline

3.3 Overview of equipment and materials

The equipment and materials required for the work scope includes, but is not limited to, the following:

- ROV construction support vessel (Figure 3-4 shows the proposed ROV support vessel (*Siem Spearfish*) and outline specifications are provided in Table 3-1).
- Two work class ROVs coupled with ROV tooling that will include: rock replacement system, mattress lifting beam, water jet cleaner, ICARUS remote intervention tooling (Integrated Connection tool And ROV operated Underwater System, see Figure 3-5) (used to decouple and connect the existing new flexible flowlines at the P6 wellhead and Corrib central manifold, and the new 158 m flexible flowline).
- Concrete protection mattresses including twenty for the installation of the new flowline and two for stabilising the decommissioned flowline (dimensions of 6 x 4 x 0.15 m).
- Sub-sea pre-commissioning spread (on ROV support vessel) and chemicals including Alcogel, methanol, corrosion inhibitor, biocide, oxygen scavenger and leak detection dye (see Table 3-2). It should be noted that the majority of these chemicals will not be released to sea during operations. A small quantity of treated inhibited potable water containing Alcogel and RX5225 is the exception. Further information is provided in Table 3-2 regarding the degree of toxicity, biodegradation, bioaccumulation in the aquatic environment for the chemicals that will be used as part of the work scope. Chemicals are assessed based on the OSPAR Harmonised Mandatory Control Scheme (HMCS). Chemicals are ranked according to their calculated Hazard Quotients (HQ) by the CHARM (Chemical Hazard Assessment and Risk Management) mathematical model, which uses toxicity, biodegradation and bioaccumulation data provided by the chemical suppliers. The Hazard Quotients are presented as a coloured banding from Gold to Purple (Least hazardous to most hazardous). In addition to the HMCS, chemicals can also be given a ranking under the Offshore Chemical Notifications Scheme (OCNS) based on toxicity in the water column and aquatic sediments. Chemicals are ranked A-E (greatest toxicity to least toxicity). As can be seen in Table 3-2 the chemicals proposed for use are either Gold Band or Group E.
- Sand bags or rock gabions temporarily installed as turning bollards on the seabed for the new flexible flowline that will be recovered to the ROV support vessel following operations.
- Survey equipment for the As-Found and As-Left surveys (detailed further in Table 3-3).

Table 3-1: Specifications of proposed ROV support vessel - *Siem Spearfish*

Parameter	Specification
Name	<i>Siem Spearfish</i> (IRM & Light Construction)
Owner	Siem Offshore
Type	ROV Survey / Construction Support Vessel
Length (overall)	120.9 m
Breadth	23 m
Deck cargo area	1,350 m ²
Tonnage (Gross)	5,000 t



Figure 3-4: Proposed ROV support vessel (*Siem Spearfish*)

Table 3-2: Composition and use of proposed chemicals

Chemical	Composition and function	Proposed use in project	Quantity (high level estimates)	Toxicity, biodegradation and bioaccumulation Information
Alcogel	Pipeline gel	Alcogel will be added to the inhibited seawater that the new flexible flowline will be prefilled with. A small volume of this inhibited potable water treated with this gel (and RX5225) will be released at the central manifold, the volume being that of the new flexible flowline (158 m in length).	1000 litres	OCNS Group E, PLONOR.
Methanol	To control hydrate formation. REACH ¹¹ Use Descriptor Product Category Code 20: processing aids such as pH-regulators, flocculants, precipitants, neutralization agents	Methanol will be used to flush the new flexible flowline prior to connection and will be retained within the subsea process system and processed at BBGT.	2000 litres	OCNS Group E, PLONOR.
RX5225	Corrosion inhibitor/ biocide/oxygen scavenger/leak detection dye	RX5225 will be used to treat the inhibited seawater that the new flexible flowline will be prefilled with. A small volume of the inhibited potable water treated with this chemical (and Alcogel) will be released at the central manifold, the volume being	25 litres	OSPAR HMCS HQ Band Gold.

Chemical	Composition and function	Proposed use in project	Quantity (high level estimates)	Toxicity, biodegradation and bioaccumulation Information
		that of the new flexible flowline (158 m in length).		
RX5208	Combined solid oxygen scavenger and biocide Globally Harmonised System (GHS) hazard statement H400: very toxic to aquatic life.	RX5208 oxygen scavenger/biocide sticks will be used to tie in the ends of the new flowline. The chemicals will be retained within the subsea process system and processed at BBGT.	1.5 kg	OSPAR HMCS HQ Band Gold.
RX9034A	Leak detection dye REACH Use Descriptor Product Category Code 20: see above	RX9034A dye sticks will be used during the leak test of the new flowline. The chemical will be retained within the subsea process system and processed at BBGT.	0.5 kg	OSPAR HMCS HQ Band Gold.

¹¹ Registration, Evaluation, Authorisation and Restriction of Chemicals (EC 1907/2006).

3.4 Location

The work will be carried out in the Corrib Field between the P6 wellhead and the Corrib central manifold.

The location of the Corrib Field offshore and due west of the coast of Ireland is presented in Figure 3-1, an overview of the Corrib subsea system and the location of the P6 wellhead and central manifold is provided in Figure 3-2. A more detailed figure showing the different options for the new flowline is provided in Figure 3-3.

3.5 Work scope programme

It is anticipated that the flowline replacement works will be approximately 6 days in duration and will take place in the summer months of 2020 (between July and October)¹².

¹² Timescale estimates dependent on regulatory approvals and weather/ sea state conditions.

While the overall duration of the works is expected to take 6 days, the As-Found and As-Left Surveys at the beginning and end of the programme would be expected to take less than 1 day each in duration.

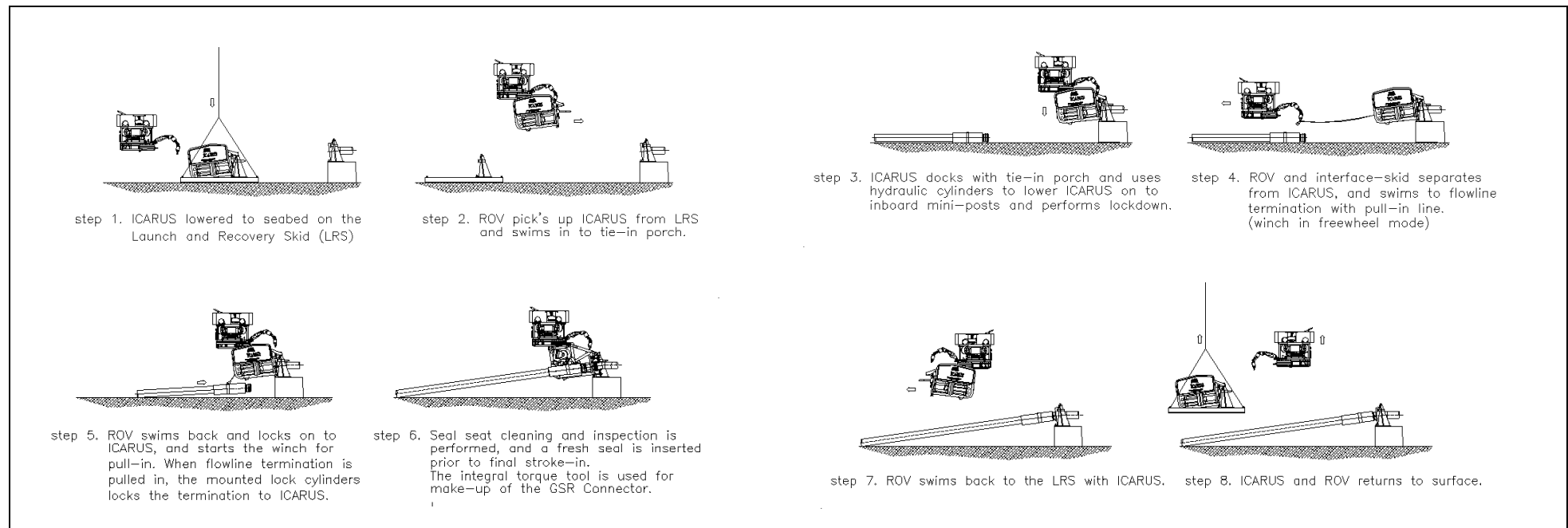


Figure 3-5: Step-by-step tie-in sequence illustration - Integrated Connection tool And ROV operated Underwater System (ICARUS)

3.6 Detailed information on flowline replacement

The following sequence of works will be conducted:

Firstly, the protection covers of the Corrib central manifold and P6 wellhead will be removed. Concrete mattresses (twenty for the new flowline and two for the existing flowline) will then be lowered to the seabed surface by a vessel crane and disconnected and laid down on the seabed by ROV. The mattresses will act as target boxes for the termination heads of the new flowline. A temporary weight and buoyancy module, and temporary turning bollards (gabion bags filled with gravel or grout) will also be laid on the seabed by ROV. The turning bollards will be used to aid the turning of the new flexible flowline. The weight and buoyancy module, and turning bollards, will be recovered to the ROV support vessel following the works as part of the reinstatement of the worksite.

The new 158 m flexible flowline (pre-filled with potable inhibited water containing Alcolgel and RX5225) will be laid by ROV along the concrete mattresses, between the P6 wellhead and the central manifold. The existing 1560 m flowline will then be depressurised and the gas (approx. 27 m³) displaced into the manifold and subsea process system, and isolations carried out at the P6 wellhead and Corrib central manifold. The ICARUS remote tie-in tool will be used to disconnect the existing flowline and connect the new flowline to the P6 wellhead and manifold (see Figure 3-5). Prior to connection, the inhibited potable water will be displaced from the new flowline to sea and the flowline flushed with methanol via a downline from the ROV support vessel connected to the P6 wellhead. The methanol will be retained within the subsea process system and sent to BBGT.

When connected, the new flowline will be pressure tested for leaks via a downline from the support vessel to the P6 wellhead. The RX9034a leak detection dye and RX5208 oxygen scavenger and biocide used during this phase will be retained within the subsea process system and sent to BBGT.

At the end of testing, the subsea equipment protection covers will be reinstalled. The concrete mattresses will be placed on top of the new flowline and the de-commissioned flowline to provide protection cover and stability. Corrosion inhibited water will then be used to fill the disconnected flowline and end caps installed for storage on the seabed for future use as needed.

3.7 Detailed information on navigation, positioning, communications and survey equipment

3.7.1 Navigation, positioning and communication equipment

A range of sensors will be used as part of the operations and As-Found and As-Left surveys for navigation, positioning and communication between the ROV support vessel and ROVs including a vessel DGNSS positioning system (differential global navigation satellite system), vessel high-accuracy GPS based heading reference and motion sensor, single-beam depth sounder, obstacle avoidance sonar, vessel 501 HiPAP (high precision acoustic positioning) USBL system, ROV USBL transponder/responder, and ROV survey class gyro compass and motion sensor (for accurate positioning and speed determination).

The vessel and ROVs will use an Ultra Short Baseline (USBL) beacon system for maintaining position and communications with any deployed equipment. USBL systems operate at a frequency of between 21 and 31 kHz at a very low intensity. The ROV will utilise a Doppler Velocity Log (DVL) for accurate positioning and speed determination. This operates at a relatively high frequency of 1200 kHz, also at negligible intensity, while a similar system will operate on the vessel itself operating at an extremely high frequency of 2 MHz, at negligible source levels of intensity. The ROV will also utilise a high accuracy bathymetric sensor which operates at a frequency of around 500 kHz and an obstacle avoidance sonar system, which operates at a frequency of around 675 kHz. All of these pieces of equipment operate at low source levels of intensity.

Prior to arrival at the Corrib Field, trials and verifications will be undertaken of the USBL systems. The testing of the USBL systems will have an acoustic signature although this operates at a very low intensity and the test will be conducted for a short duration.

Specifications for the acoustic survey and communication equipment are provided in Table 3-3.

3.7.2 As-Found and As-Left Surveys

An As-Found survey will be carried out at the start of the flowline replacement works in order to get an accurate record of current seabed conditions. The As-Left conditions will also be recorded by carrying out another survey on completion of the works following worksite reinstatement.

The primary sensor for the collection of geophysical data will be by a ROV forward looking multi-beam echosounder (MBES). The MBES system will operate at a frequency of 400 kHz. The equipment will operate at relatively low levels of source intensity compared to lower frequency geophysical exploration surveys, which use a percussive airgun as the sound source.

A MBES is a type of transducer-based sonar that is used to map the seabed. MBES systems transmit sound energy and analyse the return signal (echo) that reflects off the seafloor or other objects. The MBES system records the time for the acoustic signal to travel from the transmitter (transducer) to the seafloor (or object) and back to the receiver. Unlike other sonars, multibeam systems extract directional information from the returning

soundwaves, producing a swath of depth readings from a single ping. Specifications for this acoustic equipment are provided in Table 3-3.

Soft start

A soft start involves a gradual ramping up of sound intensity from underwater acoustic equipment to allow marine fauna to move away from the area before they are exposed to significant noise levels.

If the intensity cannot gradually be increased from a low level to operational levels, then the equipment can be switched on and off in a sequential manner for a few seconds at a time for a soft start / ramp up period of 20 minutes prior to the equipment being used for operations (NPWS, 2014).

According to NPWS guidance (2014), soft start for acoustic surveys is required for surveys within bays, inlets or estuaries and within 1,500 m of the entrance of enclosed bays / inlets / estuaries or as advised by the relevant regulatory authority. As such, soft start procedures would not be required for the As-Found and As-Left Surveys at the Corrib Field due to the open sea location of the proposed work activities. However, in line with environmental best practice, soft start procedures will be followed during the surveys when using the MBES survey equipment.

Table 3-3: Acoustic equipment specifications and operating frequency ranges

Equipment	Specification and operating frequency range
Vessel Doppler Velocity Log	2 MHz
Vessel Kongsberg 501 HiPAP USBL system	21-31 Hz
Vessel single beam echo sounder	38 kHz – 200 kHz (Typically operates at 50kHz)
Valeport MVS Sound Velocity Sensor	2.5 MHz
ROV USBL transponder/responder	21-31 Hz
ROV RDI Workhorse Doppler Velocity Log	1200 kHz
ROV high accuracy bathymetric sensor	Tritech SK704 altimeter - 500 kHz
ROV forward looking multibeam sensor (MBES)	Reson Seabat 7125 dual head Multibeam echosounder - 400 kHz
Kongsberg MS100 obstacle avoidance sonar	675 Hz

A Valeport Mini Sound Velocity probe will also be deployed occasionally throughout the As-Found and As-Left surveys to provide salinity, conductivity, temperature and sound velocity depth information. These probes operate at an extremely high frequency of around 2.5 MHz at a very low level of intensity. This allows periodic calibration of the primary acoustic survey (MBES) sensors.

4 EUROPEAN SITES

4.1 Introduction

European sites are a network (Natura 2000) of marine and terrestrial conservation areas established under the 1992 Habitats Directive, with the aim of providing protection to threatened species and habitats throughout Europe. These sites comprise Special Areas of Conservation (SACs), designed for the protection of certain habitats (Annex I) and species (Annex II), and Special Protection Areas (SPAs), for the protection of qualifying bird species. Specific conservation objectives have been developed for European sites in relation to their qualifying interests – habitats and/or species. These are published on the website of the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht (DCHG) (<https://www.npws.ie/protected-sites>) and are considered below.

Certain SACs are also designated under the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) as Marine Protected Areas (MPAs) for marine biodiversity¹³. The legislation in Ireland that confers legal protection to the OSPAR marine protected areas, to which Ireland is committed to establishing to protect biodiversity under the OSPAR Convention, is currently pending. By establishing SACs as OSPAR MPAs, these sites are then afforded the required legal protection. Therefore, OSPAR MPAs are considered as part of the consideration of SACs in this document.

4.2 European sites in the vicinity of the Corrib Development

Appropriate Assessment requires consideration of the European sites in the vicinity of the proposed activities on the Corrib development. The identification of sites to screen into the initial assessment requires consideration of the physical distance of the receptor site / qualifying features from the proposed operations and the likely connectivity (interaction or impact pathway) between the receptor site and qualifying features and the proposed operations). The consideration of connectivity of receptor sites and qualifying features to the proposed operations, as well as between each other and the potential likely significant effects of the proposed activities on these receptors considers species foraging distances and migration routes, and the proximity of the proposed activities to foraging and breeding areas. Also, of importance are the potential for indirect impacts, such as changes in species behaviour and the effects on prey species with the potential for an alteration in predator / prey relationships and associated impacts on foraging success. The closest sites with marine receptors as qualifying interests were considered. It is noted that the closest European sites are more than 50 km from the proposed operations at the Corrib Field, however those marine or terrestrial sites within Co. Donegal, Co. Leitrim, Co. Sligo, Co. Mayo, Co. Galway or Co. Clare were considered if marine mammals were qualifying interests for their designation due to the foraging distances these species can travel. These sites were included as their locations were all on the west coast of Ireland, within a reasonable study area that would be expected to encompass the typical foraging distances for resident and semi resident species of marine mammals. SAC sites with migratory fish as qualifying interest were primarily considered within Co. Mayo, as

¹³ <https://www.npws.ie/protected-sites/ospar-sites>

although these migratory fish species can migrate considerable distances, the sites within Co. Mayo are the most likely to be affected. A number of SACs with migratory fish as qualifying interest were also considered beyond Co. Mayo due to their coastal aspects, habitat connectivity and proximity to the proposed activities. As such a number of designated sites both inland and on the Galway coastline, as well as north and east of the proposed activities into Sligo and Donegal Bays are included. These European designated sites have been included within the study area due to the connectivity of rivers and lough systems with coastal waters, and their use as important spawning and nursery areas.

All European sites with diving seabirds, and hence those with the potential for direct impacts from the proposed survey activities, were qualifying interests. The sites were considered within an overall study area limited by the Republic of Ireland / Northern Ireland border at Lough Foyle to the north, and the borders between Co. Clare and Co. Kerry in the south at the Shannon Estuary. These boundaries represented a comprehensive study area based on the typical feeding ranges of diving species of seabird with the potential to be affected by the proposed work scope. This range included a number of designated sites that had significant breeding populations of these species, such as Tory Island in the north, and Loop Head at the southern extent of the study area.

The sites that have been initially screened into this assessment have been selected within ranges that consider the foraging and migratory ranges for the species being considered as having the potential to be affected by the proposed work scope, as well as considering the overall connectivity distances for the habitats and species, as well as any prey species, where direct and indirect effects could result and in combination with any other planned projects.

Such sites are listed below together with the qualifying features for which they are designated (Table 4-1). The location of these sites in relation to the Corrib Field are shown in Figure 4-1. Sites under consideration will be screened in the first stage of the Appropriate Assessment process (Section 5 of this report) based on the receptor species sensitivity and proximity to the proposed operations within the Corrib Field.

The characteristics of the European sites that have been initially screened in to this assessment for consideration are presented in Section 4.3, with summary information and distances to the proposed activities detailed in Table 4-1 below.

Table 4-1: European sites in the vicinity of the proposed area of works

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
Special Area of Conservation (SAC)			
West Connacht Coast	Common Bottlenose Dolphin <i>Tursiops truncatus</i>	002998	57 km
Inishkea Islands	Grey seal <i>Halichoerus grypus</i> , Petalwort <i>Petalophyllum ralfsii</i> , Machairs (habitat)	000507	59 km
Duvillaun Islands	Grey seal <i>Halichoerus grypus</i>	000495	64 km
Mullet/Blacksod Bay Complex	Tidal mudflats and sandflats (habitat) Large shallow inlets and bays (habitat) Reefs (habitat) <i>Salicornia</i> mud (habitat) Marram dunes (White dunes) (habitat) Fixed dunes (Grey dunes) (habitat) Decalcified dune heath (habitat) Machairs (habitat) Natural eutrophic lakes (habitat) Alkaline fens (habitat) Otter (<i>Lutra lutra</i>) Petalwort (<i>Petalophyllum ralfsii</i>)	000470	64 km
Broadhaven Bay	Tidal mudflats and sandflats (habitat) Large shallow inlets and bays (habitat) Reefs (habitat) Atlantic salt meadows (habitat) Sea caves (habitat)	000472	69 km
Glenamoy Bog Complex	Salmon <i>Salmo salar</i> Vegetated sea cliffs of the Atlantic and Baltic coasts (habitat) Slender green feather-moss <i>Drepanocladus vernicosus</i> Petalwort <i>Petalophyllum ralfsii</i> Marsh saxifrage <i>Saxifraga hirculus</i> Machairs (habitat)	000500	77 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<p>Natural dystrophic lakes and ponds (habitat)</p> <p>Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Blanket bog (*active only) (habitat)</p> <p>Transition mires and quaking bogs (habitat)</p> <p>Depressions on peat substrates of the <i>Rhynchosporion</i> (habitat)</p>		
Owenduff/Nephin Complex	<p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat)</p> <p>Natural dystrophic lakes and ponds (habitat)</p> <p>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation (habitat)</p> <p>Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat)</p> <p>Alpine and Boreal heaths (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Blanket bogs (* if active bog) (habitat)</p> <p>Transition mires and quaking bogs (habitat)</p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Slender Green Feather-moss <i>Drepanocladus vernicosus</i></p> <p>Marsh Saxifrage <i>Saxifraga hirculus</i></p>	000534	85 km
Inishbofin and Inishshark	<p>Coastal lagoons (habitat)</p> <p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat)</p> <p>Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat)</p> <p>European dry heaths (habitat)</p>	000278	94 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Grey Seal <i>Halichoerus grypus</i>		
Clew Bay Complex	<p>Mudflats and sandflats not covered by seawater at low tide (habitat)</p> <p>Coastal lagoons (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Annual vegetation of drift lines (habitat), Perennial vegetation of stony banks (habitat)</p> <p>Atlantic salt meadows <i>Glaucopuccinellietalia maritima</i> (habitat)</p> <p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p> <p>Machairs (habitat)</p> <p>Old sessile oak woods with Ilex and Blechnum in the British Isles (habitat)</p> <p>Geyer's Whorl Snail <i>Vertigo geyeri</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Harbour Seal <i>Phoca vitulina</i></p>	001482	96 km
River Moy	<p>Active raised bogs (habitat)</p> <p>Degraded raised bogs still capable of natural regeneration (habitat)</p> <p>Depressions on peat substrates of the <i>Rhynchosporion</i> (habitat)</p> <p>Alkaline fens (habitat)</p> <p>Old sessile oak woods with Ilex and Blechnum in the British Isles (habitat)</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) (habitat)</p> <p>White-clawed Crayfish <i>Austropotamobius pallipes</i></p> <p>Sea Lamprey <i>Petromyzon marinus</i></p> <p>Brook Lamprey <i>Lampetra planeri</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p>	002298	103 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
Mweelrea/Sheeffry/Erriff Complex	<p>Coastal lagoons (habitat)</p> <p>Annual vegetation of drift lines (habitat)</p> <p>Atlantic salt meadows <i>Glaucopuccinellietalia maritimae</i> (habitat)</p> <p>Mediterranean salt meadows <i>Juncetalia maritimi</i> (habitat)</p> <p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p> <p>Atlantic decalcified fixed dunes <i>Calluno-Ulicetea</i> (habitat)</p> <p>Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>) (habitat)</p> <p>Machairs (habitat)</p> <p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat)</p> <p>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> (habitat)</p> <p>Natural dystrophic lakes and ponds (habitat)</p> <p>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation (habitat)</p> <p>Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat)</p> <p>European dry heaths (habitat)</p> <p>Alpine and Boreal heaths (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (habitat)</p> <p>Blanket bogs (* if active bog) (habitat)</p>	001932	105 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<p>Transition mires and quaking bogs (habitat)</p> <p>Depressions on peat substrates of the Rhynchosporion (habitat)</p> <p>Petrifying springs with tufa formation (<i>Cratoneurion</i>) (habitat)</p> <p>Alkaline fens (habitat)</p> <p>Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>) (habitat)</p> <p>Calcareous rocky slopes with chasmophytic vegetation (habitat)</p> <p>Siliceous rocky slopes with chasmophytic vegetation (habitat)</p> <p>Geyer's Whorl Snail <i>Vertigo geyeri</i></p> <p>Narrow-mouthed Whorl Snail <i>Vertigo angustior</i></p> <p>Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Petalwort <i>Petalophyllum ralfsii</i></p> <p>Slender Naiad <i>Najas flexilis</i></p>		
The Twelve Bens/Garraun Complex	<p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat)</p> <p>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or Isoeto-Nanojuncetea (habitat)</p> <p>Alpine and Boreal heaths (habitat)</p> <p>Blanket bogs (* if active bog) (habitat)</p> <p>Depressions on peat substrates of the Rhynchosporion (habitat)</p> <p>Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>) (habitat)</p> <p>Calcareous rocky slopes with chasmophytic vegetation (habitat)</p> <p>Siliceous rocky slopes with</p>	002031	111 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	chasmophytic vegetation (habitat) Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (habitat) Freshwater Pearl Mussel <i>Margaritifera margaritifera</i> Salmon <i>Salmo salar</i> Otter <i>Lutra lutra</i> Slender Naiad <i>Najas flexilis</i>		
Newport River	Freshwater Pearl Mussel <i>Margaritifera margaritifera</i> Salmon <i>Salmo salar</i>	002144	111 km
Slyne Head Islands	Reefs (habitat) Grey Seal <i>Halichoerus grypus</i>	000328	113 km
Maumturk Mountains	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat) Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat) Alpine and Boreal heaths (habitat) Blanket bogs (* if active bog) (habitat) Depressions on peat substrates of the Rhynchosporion (habitat) Siliceous rocky slopes with chasmophytic vegetation (habitat) Salmon <i>Salmo salar</i> Slender Naiad <i>Najas flexilis</i>	002008	118 km
Connemara Bog Complex	Coastal lagoons (habitat) Reefs (habitat) Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat) Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or Isoeto-Nanojuncetea (habitat) Natural dystrophic lakes and ponds (habitat) Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i>	002034	118 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	vegetation (habitat) Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat) European dry heaths (habitat) Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinia caerulea</i>) (habitat) Blanket bogs (* if active bog) (habitat) Transition mires and quaking bogs (habitat) Depressions on peat substrates of the Rhynchosporion (habitat) Alkaline fens (habitat) Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (habitat) Marsh Fritillary <i>Euphydryas aurinia</i> Salmon <i>Salmo salar</i> Otter <i>Lutra lutra</i> Slender Naiad <i>Najas flexilis</i>		
Killala Bay/Moy Estuary	Estuaries (habitat) Mudflats and sandflats not covered by seawater at low tide (habitat) Annual vegetation of drift lines (habitat) Vegetated sea cliffs of the Atlantic and Baltic coasts (habitat) <i>Salicornia</i> and other annuals colonising mud and sand (habitat) Atlantic salt meadows <i>Glaucopuccinellietalia maritima</i> (habitat) Embryonic shifting dunes (habitat) Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat) Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat) Humid dune slacks (habitat) Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> Sea Lamprey <i>Petromyzon marinus</i>	000458	120 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Harbour Seal <i>Phoca vitulina</i>		
Kilkieran Bay and Islands	<p>Mudflats and sandflats not covered by seawater at low tide (habitat)</p> <p>Coastal lagoons (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Atlantic salt meadows <i>Glauco-Puccinellietalia maritima</i> (habitat)</p> <p>Mediterranean salt meadows <i>Juncetalia maritimi</i> (habitat)</p> <p>Machairs (habitat)</p> <p>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> (habitat)</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) (habitat)</p> <p>Otter <i>Lutra lutra</i></p> <p>Harbour Seal <i>Phoca vitulina</i></p> <p>Slender Naiad <i>Najas flexilis</i></p>	002111 (OSPAR site code: O-IE-0002979)	136 km
Lough Corrib	<p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletea uniflorae</i>) (habitat)</p> <p>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> (habitat)</p> <p>Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. (habitat)</p> <p>Water courses of plain to montane levels with the <i>Ranunculon fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation (habitat)</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) (habitat)</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (habitat)</p> <p>Active raised bogs (habitat)</p>	000297	147 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<p>Degraded raised bogs still capable of natural regeneration (habitat)</p> <p>Depressions on peat substrates of the Rhynchosporion (habitat)</p> <p>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> (habitat)</p> <p>Petrifying springs with tufa formation (<i>Cratoneurion</i>) (habitat)</p> <p>Alkaline fens (habitat)</p> <p>Limestone pavements (habitat)</p> <p>Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (habitat)</p> <p>Bog woodland (habitat)</p> <p>Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>White-clawed Crayfish <i>Austropotamobius pallipes</i></p> <p>Sea Lamprey <i>Petromyzon marinus</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Lesser Horseshoe Bat <i>Rhinolophus hipposideros</i></p> <p>Slender green feather-moss <i>Drepanocladus vernicosus</i></p> <p>Slender Naiad <i>Najas flexilis</i></p>		
Cummeen Strand/Drumcliff Bay (Sligo Bay)	<p>Estuaries (habitat)</p> <p>Mudflats and sandflats not covered by seawater at low tide (habitat)</p> <p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p> <p>Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous</p>	000627	154 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) (habitat) Petrifying springs with tufa formation (<i>Cratoneurion</i>) (habitat) Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> Sea Lamprey <i>Petromyzon marinus</i> River Lamprey <i>Lampetra fluviatilis</i> Harbour Seal <i>Phoca vitulina</i>		
Slieve Tooley/Tormore Islands/Loughros Beg Bay	Vegetated sea cliffs of the Atlantic and Baltic coasts (habitat) Embryonic shifting dunes (habitat) Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat) Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat) Decalcified fixed dunes with <i>Empetrum nigrum</i> (habitat) Atlantic decalcified fixed dunes (<i>Calluno-Ulicetia</i>) (habitat) Alpine and Boreal heaths (habitat) Blanket bogs (* if active bog) (habitat) Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> Otter <i>Lutra lutra</i> Grey Seal <i>Halichoerus grypus</i>	000190	154 km
Ballysadare Bay	Estuaries (habitat) Mudflats and sandflats not covered by seawater at low tide (habitat) Embryonic shifting dunes (habitat) Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat) Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat) Humid dune slacks (habitat) Narrow-mouthed Whorl Snail <i>Vertigo angustior</i>	000622	157 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Harbour Seal <i>Phoca vitulina</i>		
Lough Gill	<p>Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> - type vegetation (habitat)</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) (habitat)</p> <p>Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (habitat)</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) (habitat)</p> <p>White-clawed Crayfish <i>Austropotamobius pallipes</i></p> <p>Sea Lamprey <i>Petromyzon marinus</i></p> <p>Brook Lamprey <i>Lampetra planeri</i></p> <p>River Lamprey <i>Lampetra fluviatilis</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p>	001976	168 km
West of Ardara/Maas Road	<p>Estuaries (habitat)</p> <p>Mudflats and sandflats not covered by seawater at low tide (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Annual vegetation of drift lines (habitat)</p> <p>Atlantic salt meadows <i>Glaucopuccinellietalia maritimae</i> (habitat)</p> <p>Mediterranean salt meadows <i>Juncetalia maritimi</i> (habitat)</p> <p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p> <p>Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat)</p> <p>Decalcified fixed dunes with <i>Empetrum nigrum</i> (habitat)</p>	000197	170 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<p>Atlantic decalcified fixed dunes (<i>Calluno-Ulicetia</i>) (habitat)</p> <p>Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>) (habitat)</p> <p>Humid dune slacks (habitat)</p> <p>Machairs (habitat)</p> <p>Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat)</p> <p>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or Isoeto-<i>Nanojuncetia</i> (habitat)</p> <p>Northern Atlantic wet heaths with <i>Erica tetralix</i> (habitat)</p> <p>European dry heaths (habitat)</p> <p>Alpine and Boreal heaths (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) (habitat)</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (habitat)</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) (habitat)</p> <p>Blanket bogs (* if active bog) (habitat)</p> <p>Depressions on peat substrates of the Rhynchosporion (habitat)</p> <p>Alkaline fens (habitat)</p> <p>Geyer's Whorl Snail <i>Vertigo geyeri</i></p> <p>Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>Marsh Fritillary <i>Euphydryas aurinia</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Harbour Seal <i>Phoca vitulina</i></p>		

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Petalwort <i>Petalophyllum ralfsii</i> Slender Naiad <i>Najas flexilis</i>		
Galway Bay Complex	<p>Mudflats and sandflats not covered by seawater at low tide (habitat)</p> <p>Coastal lagoons (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Reefs (habitat)</p> <p>Perennial vegetation of stony banks (habitat)</p> <p>Vegetated sea cliffs of the Atlantic and Baltic coasts (habitat)</p> <p><i>Salicornia</i> and other annuals colonising mud and sand (habitat)</p> <p>Atlantic salt meadows <i>Glaucopuccinellietalia maritimae</i> (habitat)</p> <p>Mediterranean salt meadows <i>Juncetalia maritimi</i> (habitat)</p> <p>Turloughs (habitat)</p> <p><i>Juniperus communis</i> formations on heaths or calcareous grasslands (habitat)</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) (habitat)</p> <p>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> (habitat)</p> <p>Alkaline fens (habitat)</p> <p>Limestone pavements (habitat)</p> <p>Otter <i>Lutra lutra</i></p> <p>Harbour Seal <i>Phoca vitulina</i></p>	000268 (OSPAR site code: O-IE-0002969)	174 km
Rutland Island and Sound	<p>Coastal lagoons (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Reefs (habitats)</p> <p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p>	002283	178 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat) Humid dune slacks (habitat) Harbour Seal <i>Phoca vitulina</i>		
Lough Melvin	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> (habitat) <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (habitat) Salmon <i>Salmo salar</i> Otter <i>Lutra lutra</i>	000428	178 km
Donegal Bay (Murvagh)	Mudflats and sandflats not covered by seawater at low tide (habitat) Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat) Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>) (habitat) Humid dune slacks (habitat) Harbour Seal <i>Phoca vitulina</i>	000133	187 km
Lough Eske and Ardnamona Wood	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) (habitat) Petrifying springs with tufa formation (<i>Cratoneurion</i>) (habitat) Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (habitat) Freshwater Pearl Mussel <i>Margaritifera margaritifera</i> Salmon <i>Salmo salar</i> Killarney Fern <i>Trichomanes speciosum</i>	000163	194 km
Lower River Shannon	Sandbanks which are slightly covered by seawater all the time (habitat) Estuaries (habitat) Mudflats and sandflats not covered by seawater at low tide (habitat)	002165	209 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<p>Coastal lagoons (habitat)</p> <p>Large shallow inlets and bays (habitat)</p> <p>Reefs (habitats)</p> <p>Atlantic salt meadows <i>Glaucopuccinellietalia maritima</i> (habitat)</p> <p>Mediterranean salt meadows <i>Juncetalia maritimi</i> (habitat)</p> <p>Vegetated sea cliffs of the Atlantic and Baltic coasts (habitat)</p> <p>Perennial vegetation of stony banks (habitat)</p> <p><i>Salicornia</i> and other annuals colonising mud and sand (habitat)</p> <p>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation (habitat)</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (habitat)</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) (habitat)</p> <p>Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>Sea Lamprey <i>Petromyzon marinus</i></p> <p>Brook Lamprey <i>Lampetra planeri</i></p> <p>River Lamprey <i>Lampetra fluviatilis</i></p> <p>Salmon <i>Salmo salar</i></p> <p>Otter <i>Lutra lutra</i></p> <p>Bottlenose dolphin <i>Tursiops truncatus</i></p>		
Horn Head and Rinclevan	<p>Embryonic shifting dunes (habitat)</p> <p>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) (habitat)</p> <p>Fixed coastal dunes with herbaceous vegetation (grey dunes) (habitat)</p>	000147	214 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>) (habitat) Humid dune slacks (habitat) Machairs (habitat) Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> (habitat) Geyer's Whorl Snail <i>Vertigo geyeri</i> Grey Seal <i>Halichoerus grypus</i> Petalwort <i>Petalophyllum ralfsii</i> Slender Naiad <i>Najas flexilis</i>		
Special Protection Area (SPA)			
Inishkea Islands	Shag <i>Phalacrocorax aristotelis</i> Ringed Plover <i>Charadrius hiaticula</i> Sanderling <i>Calidris alba</i> Purple Sandpiper <i>Calidris maritima</i> Turnstone <i>Arenaria interpres</i> Common Gull <i>Larus canus</i> Herring Gull <i>Larus argentatus</i> Arctic Tern <i>Sterna paradisaea</i> Little Tern <i>Sterna albifrons</i> Barnacle Goose <i>Branta leucopsis</i> Dunlin <i>Calidris alpina schinzii</i>	004004	59 km
Inishglora and Inishkeeragh	Storm Petrel <i>Hydrobates pelagicus</i> Cormorant <i>Phalacrocorax carbo</i> Shag <i>Phalacrocorax aristotelis</i> Lesser Black-backed Gull <i>Larus fuscus</i> Herring Gull <i>Larus argentatus</i> Arctic Tern <i>Sterna paradisaea</i> Barnacle Goose <i>Branta leucopsis</i>	004084	61 km
Termoncarragh Lough and Annagh Machair	Corncrake <i>Crex crex</i> Greenland White-fronted Goose <i>Anser albifrons flavirostris</i>	004093	64 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Barnacle Goose <i>Branta leucopsis</i> Whooper Swan <i>Cygnus cygnus</i> Lapwing <i>Vanellus vanellus</i> Chough <i>Pyrhacorax pyrrhacorax</i> Dunlin <i>Calidris alpina schinzii</i> Wetland and Waterbirds		
Duvillaun Islands	Fulmar <i>Fulmarus glacialis</i> Storm Petrel <i>Hydrobates pelagicus</i> Barnacle Goose <i>Branta leucopsis</i>	004111	64 km
Blacksod Bay/Broadhaven	Great Northern Diver <i>Gavia immer</i> Light-bellied Brent Goose <i>Branta bernicla hrota</i> Common Scoter <i>Melanitta nigra</i> Red-breasted Merganser <i>Mergus serrator</i> Ringed Plover <i>Charadrius hiaticula</i> Sanderling <i>Calidris alba</i> Dunlin <i>Calidris alpina</i> Bar-tailed Godwit <i>Limosa lapponica</i> Curlew <i>Numenius arquata</i> Sandwich Tern <i>Sterna sandvicensis</i> Dunlin <i>Calidris alpina schinzii</i> Wetland and Wintering Waterbirds	004037	65 km
Bills Rocks	Storm Petrel <i>Hydrobates pelagicus</i> Puffin <i>Fratercula arctica</i>	004177	75 km
Stags of Broadhaven	Storm Petrel <i>Hydrobates pelagicus</i> Leach's Storm-petrel <i>Oceanodroma leucorhoa</i>	004072	82 km
Clare Island	Shag <i>Phalacrocorax aristotelis</i> Common Gull <i>Larus canus</i> Fulmar <i>Fulmarus glacialis</i> Kittiwake <i>Rissa triadactyla</i> Guillemot <i>Uria aalge</i> Razorbill <i>Alca torda</i> Chough <i>Pyrhacorax pyrrhacorax</i>	004136	89 km
Illanmaster	Storm Petrel <i>Hydrobates pelagicus</i>	004074	91 km
Cruagh Island	Manx Shearwater <i>Puffinus puffinus</i>	004170	105 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
Connemara Bog Complex	Cormorant <i>Phalacrocorax carbo</i> Merlin <i>Falco columbarius</i> Golden Plover <i>Pluvialis apricaria</i> Common Gull <i>Larus canus</i>	004181	119 km
West Donegal Coast	Fulmar <i>Fulmarus glacialis</i> Cormorant <i>Phalacrocorax carbo</i> Shag <i>Phalacrocorax aristotelis</i> Peregrine <i>Falco peregrinus</i> Herring Gull <i>Larus argentatus</i> Kittiwake <i>Rissa triadactyla</i> Razorbill <i>Alca torda</i> Chough <i>Pyrrhocorax pyrrhocorax</i>	004150	151 km
Ardboline Island and Horse Island	Cormorant <i>Phalacrocorax carbo</i> Barnacle Goose <i>Branta leucopsis</i>	004135	154 km
Inishmore	Kittiwake <i>Rissa triadactyla</i> Arctic Tern <i>Sterna paradisaea</i> Little Tern <i>Sterna albifrons</i> Guillemot <i>Uria aalge</i>	004152	154 km
Inishmurray	Shag <i>Phalacrocorax aristotelis</i> Barnacle Goose <i>Branta leucopsis</i> Herring Gull <i>Larus argentatus</i> Arctic Tern <i>Sterna paradisaea</i>	004068	155 km
Inishduff	Shag <i>Phalacrocorax aristotelis</i>	004115	165 km
Inner Galway Bay	Great Northern Diver <i>Gavia immer</i> Cormorant <i>Phalacrocorax carbo</i> Grey Heron <i>Ardea cinerea</i> Light-bellied Brent Goose <i>Branta bernicla hrota</i> Wigeon <i>Anas penelope</i> Teal <i>Anas crecca</i> Shoveler <i>Anas clypeata</i> Red-breasted Merganser <i>Mergus serrator</i>	004031	175 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Ringed Plover <i>Charadrius hiaticula</i> Golden Plover <i>Pluvialis apricaria</i> Lapwing <i>Vanellus vanellus</i> Dunlin <i>Calidris alpina</i> Bar-tailed Godwit <i>Limosa lapponica</i> Curlew <i>Numenius arquata</i> Redshank <i>Tringa totanus</i> Turnstone <i>Arenaria interpres</i> Black-headed Gull <i>Chroicocephalus ridibundus</i> Common Gull <i>Larus canus</i> Sandwich Tern <i>Sterna sandvicensis</i> Common Tern <i>Sterna hirundo</i> Wetland and Waterbirds		
Cliffs of Moher	Fulmar <i>Fulmarus glacialis</i> Kittiwake <i>Rissa triadactyla</i> Razorbill <i>Alca torda</i> Guillemot <i>Uria aalge</i> Puffin <i>Fratercula arctica</i> Chough <i>Pyrrhocorax pyrrhocorax</i>	004005	185 km
Mid-Clare Coast	Cormorant <i>Phalacrocorax carbo</i> Barnacle Goose <i>Branta leucopsis</i> Ringed Plover <i>Charadrius hiaticula</i> Purple Sandpiper <i>Calidris maritima</i> Sanderling <i>Calidris alba</i> Dunlin <i>Calidris alpina</i> Turnstone <i>Arenaria interpres</i> Wetland and Waterbirds	004182	197 km
Tory Island	Corncrake <i>Crex crex</i> Fulmar <i>Fulmarus glacialis</i> Razorbill <i>Alca torda</i> Puffin <i>Fratercula arctica</i>	004073	208 km
River Shannon and River Fergus Estuaries	Cormorant <i>Phalacrocorax carbo</i> Whooper Swan <i>Cygnus</i>	004077	210 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	<i>cygnus</i> Light-bellied Brent Goose <i>Branta bernicla hrota</i> Shelduck <i>Tadorna tadorna</i> Wigeon <i>Anas penelope</i> Teal <i>Anas crecca</i> Pintail <i>Anas acuta</i> Shoveler <i>Anas clypeata</i> Scaup <i>Aythya marila</i> Ringed Plover <i>Charadrius hiaticula</i> Golden Plover <i>Pluvialis apricaria</i> Grey Plover <i>Pluvialis squatarola</i> Lapwing <i>Vanellus vanellus</i> Knot <i>Calidris canutus</i> Dunlin <i>Calidris alpina</i> Black-tailed Godwit <i>Limosa limosa</i> Bar-tailed Godwit <i>Limosa lapponica</i> Curlew <i>Numenius arquata</i> Redshank <i>Tringa totanus</i> Greenshank <i>Tringa nebularia</i> Black-headed Gull <i>Chroicocephalus ridibundus</i> Wetland and Waterbirds		
Loop Head	Kittiwake <i>Rissa triadactyla</i> Guillemot <i>Uria aalge</i>	004119	210 km
Horn Head to Fanad Head	Fulmar <i>Fulmarus glacialis</i> Cormorant <i>Phalacrocorax carbo</i> Shag <i>Phalacrocorax aristotelis</i>	004194	215 km

Site name	Qualifying interests	Site code	Approximate distance from site to proposed area of works at closest point (km)
	Barnacle Goose <i>Branta leucopsis</i> Peregrine <i>Falco peregrinus</i> Kittiwake <i>Rissa triadactyla</i> Razorbill <i>Alca torda</i> Guillemot <i>Uria aalge</i> Chough <i>Pyrrhocorax pyrrhocorax</i> Greenland White-fronted Goose Anser <i>albifrons flavirostris</i>		
Inishtrahull	Shag <i>Phalacrocorax aristotelis</i> Barnacle Goose <i>Branta leucopsis</i> Common Gull <i>Larus canus</i>	004100	273 km

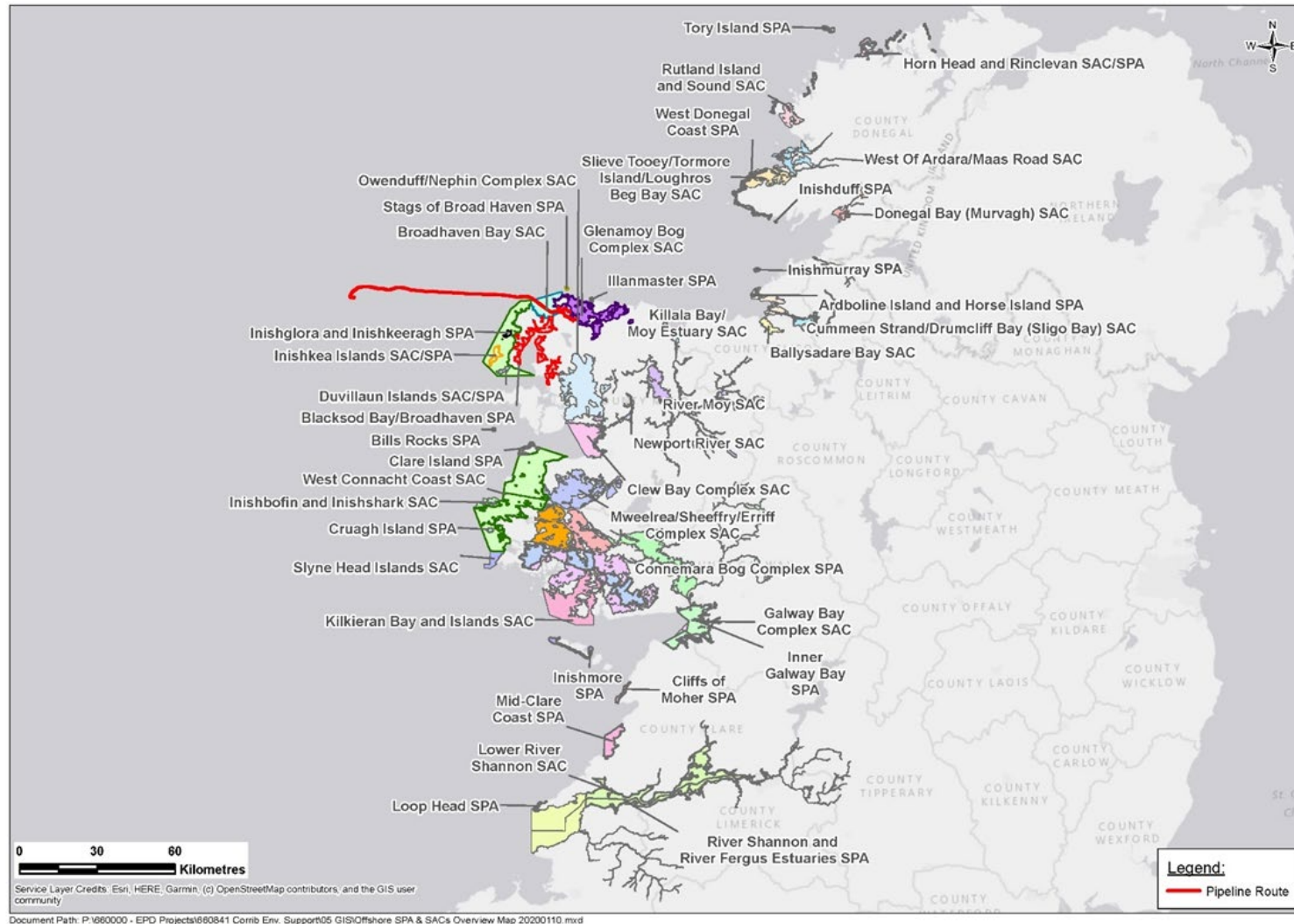


Figure 4-1: Pertinent European designated sites and their proximity to the proposed flexible flowline replacement works at the Corrib Field

4.3 Characteristics of European sites

The following sections describe the ecological features of the European sites in the vicinity of the Corrib Development. The following conservation objectives apply to all sites:

“The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when: its natural range, and area it covers within that range, are stable or increasing, and the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when: population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.”

Conservation objectives for the European sites in the Natura 2000 network are published on the website of the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht (DCHG) (<https://www.npws.ie/protected-sites>). A summary of each of the European sites is set out below along with the conservation objectives identified for each site.

4.3.1 Special Areas of Conservation (SAC)

4.3.1.1 West Connacht Coast SAC

The West Connacht Coast SAC is a large marine SAC (66,016 ha) adjacent to the Mullet peninsula and Mayo coastline. The SAC is situated approximately 57 km from the proposed operations area at its closest point and is designated on the basis of its importance for bottlenose dolphin (*Tursiops truncatus*).

Bottlenose dolphin occur within the site throughout the year and the area comprises a key habitat for the species both regionally and within Irish waters as a whole. The NPWS site synopsis notes that the SAC may contain a minimum of 123, and possibly up to 150-200, individuals. The SAC is known to be used for a variety of activities including foraging and

resting. Adults closely accompanying calves are commonly observed in summer and autumn months. The conservation objectives (NPWS, 2015 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

4.3.1.2 *Inishkea SAC*

The Inishkea islands are two large islands situated off the coast of the Mullet Peninsula, Co. Mayo. The islands are recognised for terrestrial habitats and ornithological interest. In addition, the grey seal (*Halichoerus grypus*) is a qualifying interest for the SAC owing to the importance of the islands as a breeding site. It has been estimated by O' Cadhla & Strong (2007) that the grey seal population using Inishkea North may be greater than 900 animals, which contributed to over 20% of all animals recorded during the nationwide survey.

The conservation objectives (NPWS, 2015 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.3 *Duvillaun Islands SAC*

The Duvillaun Islands SAC comprises a group of uninhabited marine islands, rocks and reefs, located approximately 3 km off the southern tip of the Mullet Peninsula in Co. Mayo. The islands are recognised for their ornithological interest. In addition, the grey seal is a qualifying interest for the SAC owing to the importance of the islands as a breeding site in combination with the Inishkea Islands.

The conservation objectives (NPWS, 2013 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.4 *Mullet / Blacksod Bay Complex SAC*

The Mullet / Blacksod Bay Complex SAC is a large coastal site that comprises much of the Mullet Peninsula, the sheltered waters of Blacksod Bay and the low-lying sandy coastline from Belmullet to Kinrovar. The site is also designated as an OSPAR MPA. The site character is strongly influenced by the Atlantic Ocean and the exposed location of much of the site results in a terrestrial landscape dominated by blown sand and largely devoid of trees. The underlying bedrock is principally metamorphic schist and gneiss. The site displays an excellent range of coastal and marine habitats.

The conservation objectives (NPWS, 2014 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

The site overlaps with the Blacksod Bay / Broadhaven SPA, Termoncarragh Lake and

Annagh Machair SPA and Mullet Peninsula SPA. It also adjoins West Connacht Coast SAC. The conservation objectives for these sites ought also to be taken into consideration when considering this site as required.

4.3.1.5 Broadhaven Bay SAC

In addition to the qualifying interests listed in Table 4-1, the site synopsis for Broadhaven Bay SAC notes the presence of a number of breeding and wintering bird populations, including golden plover (*Pluvialis apricaria*), bar-tailed godwit (*Limosa lapponica*), sandwich tern (*Thalasseus sandvicensis*), common tern (*Sterna hirundo*) and Arctic tern (*Sterna paradisaea*). Nine cetacean species have been recorded in the SAC during dedicated monitoring studies undertaken since 2001 (Anderwald et al., 2012; Culloch et al., 2014). The conservation objectives for this site NPWS (2014 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species (as detailed in Table 4-1 for which the SAC has been selected. The main conservation objectives for the pertinent qualifying habitat *Large shallow inlets and bays* [1160] are to ensure the stability or growth of the permanent habitat as well as to maintain the favourable conservation condition of a number of community complexes in a natural condition, as described below:

Coarse sediment to sandy mud with *Pygospio elegans*

Sand with *Angulus tenuis*

Sand to coarse sediment with crustaceans and *Polyophthalmus pictus*

Subtidal sand with polychaetes

Fucoid dominated reefs

Subtidal reef

In addition to maintaining the above community complexes in their natural condition, there is the potential for *Zostera* dominated seabed communities within Broadhaven Bay, and potentially within the qualifying feature Large shallow inlets and bays, the *Zostera* communities within Broadhaven Bay have the following conservation objectives:

Maintain the extent of the *Zostera* dominated community, subject to natural processes

Conserve the high quality of the *Zostera* dominated community, subject to natural processes

4.3.1.6 Glenamoy Bog Complex SAC

The Glenamoy Bog Complex is an extensive, mainly terrestrial, site dominated by low-level undulating blanket bog and a fringe of high sea-cliffs. The SAC includes Sruwaddacon Bay and Rosspport Bay to the north, which are also within the Blacksod Bay / Broadhaven SPA. Sruwaddacon Bay is a shallow tidal inlet which forms an integral part of the Glenamoy River salmonid fishery.

As well as being designated for a number of terrestrial features (Table 4-1), the SAC is designated for salmon (*Salmo salar*), which migrates annually through Sruwaddacon Bay to and from the Glenamoy River catchment. Downstream migration of salmon smolts occurs between mid-April and early May, while the upstream migration of adult salmon

occurs after late July.

The conservation objectives (NPWS, 2017 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

4.3.1.7 Owenduff / Nephin SAC

The Owenduff / Nephin Complex SAC is a mainly terrestrial site situated in Co. Mayo, with a large area of relatively intact blanket bog and mountains incorporating the catchment of the Owenduff River and much of the Nephin Beg Mountain range. There is an important population of salmon, a qualifying species, that spawns in the Owenduff River system.

The conservation objectives (NPWS, 2017 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting sites within the SAC in a natural condition.

4.3.1.8 Inishbofin and Inishshark SAC

The Inishbofin and Inishshark SAC comprises the two named islands and several islets and stacks, with part of the surrounding marine waters including in the site. It is located about 5.5 km off the Co. Galway coast. The site is important for terrestrial habitats (Table 4-1) and is also an important ornithological site. The SAC also supports a breeding colony of grey seals, with the site synopsis reporting an estimated population of 749-963 individuals in 2005.

The conservation objectives (NPWS, 2015 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1). This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.9 Clew Bay Complex SAC

The Clew Bay Complex SAC comprises of Clew Bay, a wide, west-facing bay on the west coast of Co. Mayo and Clare Island. The geomorphology of the bay results in a series of interlocking bays giving rise to a variety of marine and terrestrial habitats. The SAC supports an important population of harbour seals (*Phoca vitulina*), a qualifying interest. The site synopsis notes that land-based monitoring in August 2010 recorded 118 seals ashore.

The conservation objectives (NPWS, 2011) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.10 River Moy SAC

The River Moy SAC is the terrestrial SAC adjacent to the Killala Bay / Moy Estuary SAC. It comprises almost the entire freshwater element of the River Moy and its tributaries and contains examples of important terrestrial habitats (Table 4-1). The Moy system is one of Ireland's premier salmon waters and is a highly productive salmonid nursery. Salmon is a qualifying interest of the SAC and runs the river every month of the year. Sea lamprey (*Petromyzon marinus*), another qualifying interest, is regularly encountered in the lower stretches of the river around Ballina. The conservation objectives (NPWS, 2016) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

4.3.1.11 Mweelrea / Sheeffry / Erriff Complex SAC

The Mweelrea / Sheeffry / Erriff Complex SAC is an extremely large site and covers a large area of the hill of south Co. Mayo, encompassing several river catchments. The SAC contains a wide range of habitats, including five with priority status on Annex I of the EU Habitats Directive. An important population of salmon, a qualifying species, spawns in the Erriff River system.

The conservation objectives (NPWS, 2017 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting sites within the SAC in a natural condition.

4.3.1.12 The Twelve Bens / Garraun Complex SAC

The Twelve Bens / Garraun Complex SAC is an extensive site dominated by mountainous terrain. It is bounded by the Connemara Bog Complex in the south, the Maumturk Mountains in the east and Killary Harbour in the north. The site includes a wide variety of habitat types, with nine listed on Annex I of the EU Habitats Directive and is one of the largest and most varied protected sites in Ireland. The Owenglin River, which is included with the site, supports an important population of salmon, a qualifying species.

The conservation objectives (NPWS, 2017 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve important sites within the SAC in a natural condition.

4.3.1.13 Newport River SAC

The Newport River SAC comprises the River itself, Lough Beltra and the tributaries the Skerdagh, Glenisland Crumpaun / Boghadoon and Bracklagh / Cloondaff. It is mainly a terrestrial site. The Newport River is a renowned salmonid river and supports salmon, a qualifying interest.

The conservation objectives (NPWS, 2018 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the

SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) sites within the SAC in a natural condition.

4.3.1.14 *Slyne Head Islands SAC*

The Slyne Head Islands SAC comprises a long archipelago of islands, islets, rocks and reefs located off the western shores and south-western tip of the Slyne Head Peninsula in Co. Galway. The islands are low-lying and covered in grassy maritime turf. The SAC contains excellent examples of reefs and supports an important breeding colony of grey seals. The site synopsis estimates the 2005 breeding population as 238-306 seals.

The conservation objectives (NPWS, 2012 a) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.15 *Maumturk Mountains SAC*

The Maumturk Mountains SAC comprises the area between Killary Harbour to the north and the Galway / Clifden road in the south. The site is a good example of an extensive mountain landscape, containing blanket bog, large areas of heath, siliceous rocky vegetation, oligotrophic lakes and upland grassland. It is an important site for salmon with the rivers and lakes, particularly the Bealnabrack system, providing high quality spawning and nursery rivers.

The conservation objectives (NPWS, 2017 e) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve spawning and nursery sites within the SAC in a natural condition.

4.3.1.16 *Connemara Bog Complex SAC*

The Connemara Bog Complex SAC is a large site encompassing much of the south Connemara lowlands of Co. Galway. It encompasses a large area of relatively undamaged lowland Atlantic blanket bog of high conservation significance and is of ornithological interest, illustrated by the corresponding SPA. Many of the rivers within the site support salmon, with good spawning and nursery grounds occurring within the Cashla and Ballynahinch systems.

The conservation objectives (NPWS, 2015 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and

resting sites within the SAC in a natural condition.

4.3.1.17 Killala Bay / Moy Estuary SAC

The Killala Bay / Moy Estuary SAC comprises the long narrow estuarine channel and a north-facing triangular bay on the border between Co. Mayo and Co. Sligo. A long sandy island (Bartragh Island) separates the south-western side of the bay from the open water and much of the inner part of the bay is intertidal. The site supports a population of harbour seals, a qualifying interest, with the site synopsis reporting 108 individuals in 2003. Sea lamprey is also supported within the site.

The conservation objectives (NPWS, 2012 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.18 Kilkieran Bay and Islands SAC

The Kilkieran Bay and Islands SAC is an extensive coastal complex. It contains a large area of open marine water; many islands and rocky islets and a coastline indented with a series of bays and is situated just north of Galway Bay. The site is also designated as an OSPAR MPA. The site is of ornithological interest and supports a population of harbour seal, a qualifying interest, with 112 individuals counted in 2003. The grey seal is also a qualifying interest and is a regular visitor to the SAC and may breed.

The conservation objectives (NPWS, 2014 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.19 Lough Corrib SAC

The Lough Corrib SAC encompasses the Lough Corrib basin, the rivers Clare, Grange, Abbert, Sinking, Dalgan and Black to the east and the Cong, Bealanabrack, Failmore, Cornamona, Drimneen and Owenriff to the west, as well as adjoining areas of conservation interest, including raised bog, woodland, grassland and limestone pavement. Lough Corrib is the second largest lake in Ireland and as well as supporting the qualifying species listed in Table 4-1, is of ornithological interest. Salmon spawn in the lake and rivers, while the site also supports a population of sea lamprey.

The conservation objectives (NPWS, 2017 f) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting sites within the SAC in a natural condition.

4.3.1.20 Cummeen Strand / Drumcliff Bay (Sligo Bay) SAC

The Cummeen Strand / Drumcliff Bay SAC is a large coastal site comprising two large, shallow bays, Drumcliff Bay and Sligo Harbour, and two islands, Ardboline and Horse Island. The site is also designated as an OSPAR MPA. The dominant habitats of the SAC are estuaries and intertidal sand and mudflats. In addition to the qualifying interests in Table 4-1, the site synopsis notes the site is of conservation interest due to the presence of wintering waterfowl and breeding seabirds. Drumcliff Bay supports a breeding population of harbour seals, while the Ardboline and Horse Island are important haul out sites for the species, with a minimum population of 12-15 individuals estimated from 2007 and 2008 counts. Sea and river lamprey (*Lampetra fluviatilis*) have been recorded in the Garavogue River, which is included within the site.

The conservation objectives (NPWS, 2013 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.21 Slieve Tooley / Tormore Islands / Loughros Beg Bay SAC

The Slieve Tooley / Tormore Island / Loughros Beg Bay SAC is a large site stretching from Ardara in the east to Glencolumbkille and Glen Bay in the west. The northern coast of the site is fringed with coastal habitats, while inland it is mainly mountainous, with a variety of terrestrial habitats (Table 4-1). The cliffs and rocky islets of the SAC, particularly Tormore Island, are of ornithological interest as breeding habitat for seabirds. In addition, the grey seal breeds in sea caves in this SAC, the breeding population estimated at 868-1116 individuals in 2005, according to the site synopsis.

The conservation objectives (NPWS, 2015 e) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.22 Ballysadare Bay SAC

The Ballysadare Bay SAC is the most southerly of three inlets of the larger Sligo Bay, extending 10 km westwards of the town of Ballysadare, Co. Sligo. The SAC contains extensive intertidal sand and mudflats and supports a colony of harbour seals. The site synopsis reports a maximum of 257 seals in 2003.

The conservation objectives (NPWS, 2013 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within

the SAC in a natural condition.

4.3.1.23 *Lough Gill SAC*

The Lough Gill SAC includes Lough Gill, Doon Lough, the Bonet River and a stretch of Owenmore River. The SAC contains four Annex I habitats, including two with priority status, and supports a high number of rare or scarce animal and plant species. The Lough Gill system connects with Cummeen Strand / Drumcliff Bay SAC, and the site is of considerable importance for brook, sea and river lamprey and salmon.

The conservation objectives (NPWS, 2018 b) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting sites within the SAC in a natural condition.

4.3.1.24 *West of Ardara / Maas Road SAC*

The West of Ardara / Maas Road SAC is an extensive coastal site situated in south-west Co. Donegal. The SAC has a diverse range of coastal and terrestrial habitats, with qualifying interests (Table 4-1) of great ecological interest. The estuaries of the Gweebarra, Owentocker and Owena Rivers are the most extensive habitats of the site. The SAC is also of ornithological interest. In addition, the harbour seal is a qualifying interest, with the site synopsis reporting the site supporting a maximum of 59 in 2003. The site also supports populations of salmon, which is included as a qualifying species.

The conservation objectives (NPWS, 2015 f) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.25 *Galway Bay Complex SAC*

The Galway Bay Complex SAC comprises the inner shallow part of the large Galway Bay on the west coast. The site is also designated as an OSPAR MPA. The SAC contains a diverse range of marine, coastal and terrestrial habitats, including numerous small islands composed of glacial deposits, and the rarer soft type of sea cliffs. For one of the qualifying interests, the harbour seal, the site provides extensive good quality habitat, with the seals using a variety of haul out sites throughout the bay. According to the site synopsis a maximum of 317 individuals were counted in 2003. The site is also of ornithological interest.

The conservation objectives (NPWS, 2013 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within

the SAC in a natural condition.

4.3.1.26 Rutland Island and Sound SAC

The Rutland Island and Sound SAC lies between Aran Island and Burtonport in north-west Donegal. It contains important examples of the qualifying interest habitats listed in Table 4-1. The SAC also supports a population of harbour seal, the species included as a qualifying interest, with the site synopsis noting a count of 202 in 2003.

The conservation objectives (NPWS, 2013 e) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.27 Lough Melvin SAC

The Lough Melvin SAC is located in the north-west of Co. Leitrim. The lake is oligo-mesotrophic, and the site includes a number of river and streams, including the Drowes River, which links Lough Melvin to Donegal Bay. The unique fish community of the lake is the main feature of interest, as Lough Melvin is an excellent example of a natural, post-glacial salmonid lake. Salmon is a qualifying interest of the site.

The conservation objectives (NPWS, 2018 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting sites within the SAC in a natural condition.

4.3.1.28 Donegal Bay (Murvagh) SAC

The Donegal Bay (Murvagh) SAC occupies the inner part of Donegal Bay, south-west of Donegal Town. The site contains the estuary of the River Eske and a number of other rivers and consists mainly of intertidal habitats. It is recognised for its ornithological interest, particularly as a wintering ground for common scoter (*Melanitta nigra*). In addition, the harbour seal is a qualifying interest for the SAC, supporting a population of approximately 150 seals in 2003 according to the site synopsis.

The conservation objectives (NPWS, 2012 c) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.29 Lough Eske and Ardnamona Wood SAC

The Lough Eske and Ardnamona Wood SAC encompasses the Lough Eske (a large lowland oligotrophic lake), the Eske Rover, short stretches of the Loreymore, Clogher and

Drummeny Rivers and other smaller tributaries. Ardnamona Wood, situated on the west side of the lake, is an old oak woodland of great scientific interest due to its size, naturalness and flora. The Eske system supports an important multi-sea-winter (spring) stock of salmon, and is one of the few rivers nationally to hold 2 sea winter fish over 20 lbs. The conservation objectives (NPWS, 2018 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1). This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) sites within the SAC in a natural condition.

4.3.1.30 Lower River Shannon SAC

The Lower River Shannon SAC is an extremely large site, with a high number of qualifying interest habitats and species (Table 4-1). It stretches along the Shannon valley and encompasses the Shannon, Feale, Mulkear and Fergus estuaries, and parts of their catchments. The site is of ornithological importance for wintering waterfowl. There is a resident population of bottlenose dolphins, a qualifying interest of the SAC, in the Shannon Estuary, with site synopsis noting an estimated population of 140 individuals in 2006. Sea lamprey, River lamprey, and salmon are qualifying interests and all three have been observed spawning in the lower Shannon or its tributaries.

The conservation objectives (NPWS, 2012 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1).

This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding (spawning in the case of fish species) and resting and moulting haul out sites within the SAC in a natural condition.

4.3.1.31 Horn Head and Rinclevan SAC

The Horn Head and Rinclevan SAC is a diverse coastal site, containing a wide range of habitats and ranging northwards from Dunfanaghy in Co. Donegal and westwards reaching just beyond Dooros Point. The grey seal is also a qualifying interest for the SAC, with a small breeding population estimated at four or five individuals in 2005. In addition to the other qualifying interests in Table 4-1, the site synopsis notes the site is of conservation interest due to the presence of several Annex I EU Birds Directive species and breeding seabirds on the cliffs of Horn Head.

The conservation objectives (NPWS, 2014 d) are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been designated (as described in Table 4-1). This will be achieved by ensuring that there are no restrictions to the animals' range within the SAC, and also to conserve their breeding and resting and moulting haul out sites within the SAC in a natural condition.

4.3.2 Special Protection Areas (SPA)

A number of coastal SPAs, designated for a range of qualifying bird species, are located within in proximity to the area of works at the Corrib Field. Given the ability to fly, and the large foraging distances of some species (e.g. gannet), it is possible that birds contributing

to SPAs beyond the immediate survey area have the potential to be impacted. Designated European sites for diving seabirds (SPAs) in a wider area of search are also presented in Figure 4-1. The rationale for the definition of the area of search for SPAs is detailed in Section 4.2. Further consideration of birds and SPAs is made in Sections 5 and 6.

All coastal SPA's share the same primary conservation objective, which is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the respective SPA sites.

4.3.2.1 *Inishkea Islands SPA*

The Inishkea Islands also has great ornithological importance, as it serves as a main breeding ground for seabirds, some of which are listed on Annex I of the EU Birds Directive. The conservation objectives (NPWS, 2018 e) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- shag (*Phalacrocorax aristotelis*)
- ringed plover (*Charadrius hiaticula*)
- sanderling (*Calidris alba*)
- purple sandpiper (*Calidris maritima*)
- turnstone (*Arenaria interpres*)
- common gull (*Larus canus*)
- herring gull (*Larus argentatus*)
- Arctic tern
- little tern (*Sterna albifrons*)
- barnacle goose (*Branta leucopsis*)
- dunlin (*Calidris alpina schinzii*).

Other, non-listed bird species include great black-backed gull (*Larus marinus*), black-headed gull (*Chroicocephalus ridibundus*) and black guillemot (*Cepphus grylle*). The Islands also support important concentrations of breeding oystercatcher (*Haematopus ostralegus*), and lapwing (*Vanellus vanellus*). Furthermore, the Islands act as a main wintering site for barnacle goose and hold internationally important numbers. Nationally important concentrations of golden plover have also been recorded.

4.3.2.2 *Inishglora and Inishkeeragh SPA*

Inishglora and Inishkeeragh are two islands approximately 1.5-3 km west of the Mullet Peninsula and are part of a larger group of islands that consist of the Inishkeas and the Duvillauns. Both islands are low-lying and support maritime grassland vegetation and serve as a wintering site for barnacle geese.

The site is a SPA under Annex I of the EU Birds Directive for the following species:

- storm petrel (*Hydrobates pelagicus*)
- barnacle goose

- Arctic tern
- cormorant (*Phalacrocorax carbo*)
- shag
- lesser black-backed gull (*Larus fuscus*)
- herring gull.

Storm petrel uses the islands as an established breeding site, and the islands are of national importance with regards to Arctic tern. Other bird species (not listed) include greater black-backed gull, common gull and black guillemot. Barnacle geese are also present, as they use the islands as a good feeding habitat as well as for protection. Aside from the ornithological interest, the islands are also an important breeding site for grey seals (which are listed under Annex II of the EU Habitat Directive).

The objectives (NPWS, 2018 f) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- storm petrel (*Hydrobates pelagicus*) - breeding
- cormorant – breeding
- shag – breeding
- lesser black-backed gull – breeding
- herring gull – breeding
- Arctic tern – breeding
- barnacle goose – wintering.

4.3.1.1 Termoncarragh Lough and Annagh Machair SPA

Termoncarragh Lough is a shallow, coastal lake on the north-west side of Mullet Peninsula that is fringed with swamp vegetation and sporadically edged with marsh and fen. The site is particularly important with regards to wetlands and wetland bird species, and the area is a SPA under Annex I of the EU Birds Directive for the following species:

- barnacle goose
- whooper swan (*Cygnus cygnus*)
- Greenland white-fronted goose (*Anser albifrons flavirostris*)
- corncrake (*Crex crex*)
- chough (*Pyrrhocorax pyrrhocorax*)
- lapwing
- dunlin.

The lake and surrounding area are particularly important as a wintering ground, supporting the largest barnacle goose population in the country. Whooper swan visit the site during autumn and spring, with approximately 300 individuals overall. Other wintering species in the area include Greenland white-fronted goose, golden plover, teal (*Anas crecca*), mallard (*Anas platyrhynchos*) and ringed plover, as well as the mute swan (*Cygnus olor*).

The conservation objectives (NPWS, 2018 g) are to maintain or restore the favourable

conservation condition of the bird species listed as Special Conservation Interests for this SPA (eight species listed above) and to maintain or restore the favourable conservation condition of the wetland habitat at Termoncarragh Lake and Annagh Machair SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

4.3.1.2 Duvillaun Islands SPA

The Duvillaun Islands SPA comprises a group of uninhabited marine islands, rocks and reefs, located approximately 3 km off the southern tip of the Mullet Peninsula in Co. Mayo. The surrounding seas, where seabirds forage, bathe and socialise are included within the designated site boundaries.

The Duvillaun Islands are of importance for both breeding and wintering birds, some of which are listed on Annex I of the EU Birds Directive. The conservation objectives (NPWS, 2018 h) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- storm petrel – breeding
- fulmar (*Fulmaris glacialis*) – breeding
- barnacle goose – wintering.

Other bird species that are supported within the Duvillaun Islands include peregrine falcon (*Falco peregrinus*), ringed plover, oystercatcher, rock pipit (*Anthus petrosus*), skylark (*Alauda arvensis*), wheatear (*Oenanthe oenanthe*), raven (*Corvus corax*), shag, herring gull, great black-backed gull and common gull.

4.3.1.3 Blacksod Bay / Broadhaven SPA

This SPA comprises all the inner parts of Broadhaven Bay and includes various sheltered bays of Blacksod Bay. Both these regions are situated in the extreme north-west of Co. Mayo. Interstitial sand and mudflats are exposed during low tide, supporting a well-developed ecosystem that includes polychaetes, bivalves and crustaceans. Open sand flats are present at the low-lying margin of the salt-marshes, supporting flora such as Glasswort and Seablite. Sandy and shingle beaches are also present. The site contains salt marshes that are situated on a peat substrate, providing roosts for a high diversity of wintering waterfowl and has been described as one of the most important wetland complexes in the west. The environment supports five nationally important waterfowl populations, including:

- great northern diver (*Gavia immer*)
- red-breasted merganser (*Mergus serrator*)
- bar-tailed godwit
- ringed plover – 3% of the national population
- dunlin.

On Inishderry Island, there is a nationally important colony of sandwich tern located on the site, as well as common tern, Arctic tern. Localised populations of little tern have been documented in the past. A colony of black-headed gulls (*Chroicocephalus ridibundus*) also lives in this area.

Seven of the regular species that occur at the site are listed on Annex I of the EU Birds Directive. These are:

- great northern diver
- red-throated diver (*Gavia stellata*)
- golden plover
- bar-tailed godwit
- sandwich tern
- common tern
- Arctic tern.

The conservation objective (NPWS, 2014 e) is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

- wintering populations of great northern diver, light-bellied brent goose (*Branta bernicla hrota*), common scoter, red-breasted merganser, ringed plover, sanderling, dunlin, bar-tailed godwit, curlew (*Numenius arquata*)
- breeding populations of sandwich tern
- wetlands.

4.3.1.4 Bills Rocks SPA

The Bills Rocks SPA comprises the cliffs around Clare Island and the adjacent marine waters. Clare Island lies at the entrance to Clew Bay, Co. Mayo, approximately 5 km from the mainland. It is one of the top seabird sites in Ireland, hosting nationally important populations of seven species, particularly fulmar.

The site is a SPA under Annex I of the EU Birds Directive. The conservation objectives (NPWS, 2018 i) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- storm petrel
- puffin (*Fratercula arctica*).

Other seabird species breed regularly on the island including black guillemot, gannet (*Morus bassanus*), puffin, cormorant, great black-backed gull, lesser black-backed gull and herring gull. The site also is a traditional nesting site for peregrine.

4.3.1.5 Stags of Broadhaven SPA

The Stags of Broad Haven are a group of four precipitous rocky islets, rising to almost 100 m, located about 2 km north of Benwee Head, Co. Mayo. The surrounding seas to a distance of 500 m are included in the site.

The site is a SPA under the EU Birds Directive for the following species:

- storm petrel
- Leach's storm-petrel (*Oceanodroma leucorhoa*).

The Stags are of particular importance owing to the presence of the only known colony of Leach's petrel in Ireland, as well as a nationally important population of storm petrel. Both Leach's petrel and storm petrel are listed on Annex I of the E.U. Birds Directive. Other species that breed at the site include fulmar, kittiwake (*Rissa triadactyla*), puffin, herring gull and great black-backed gull.

The objectives (NPWS, 2018 j) are to maintain or restore the favourable conservation conditions of the bird species listed as Special Conservation Interests for this SPA:

- storm petrel
- Leach's storm-petrel.

4.3.1.6 Clare Island SPA

The Clare Island SPA comprises the cliffs around Clare Island and the adjacent marine waters. Clare Island lies at the entrance to Clew Bay, Co. Mayo, approximately 5 km from the mainland. It is one of the top seabird sites in Ireland, hosting nationally important populations of seven species, particularly fulmar.

The site is a SPA under Annex I of the EU Birds Directive. The conservation objectives (NPWS, 2018 k) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- chough
- fulmar
- shag
- kittiwake
- common gull
- guillemot (*Uria aalge*)
- razorbill (*Alca torda*).

Other seabird species breed regularly on the island including black guillemot, gannet, puffin, cormorant, great black-backed gull, lesser black-backed gull and herring gull. The site also is a traditional nesting site for peregrine.

4.3.1.7 Illanmaster SPA

Illanmaster is a steep, rocky island, rising to 107 m and topped with a maritime grassy sward, situated just off the north Co. Mayo coast. The SPA site comprises the island and the surrounding seas to a distance of 500 m, with the southern boundary of the site adjoining the mainland shoreline.

The site is a SPA under the EU Birds Directive due to the presence of an internationally important population of storm petrel, which is one of the largest populations in the region. Other species that have been recorded breeding at the site are fulmar, puffin, great black-backed gull and black guillemot. The site is also visited by a small flock of wintering barnacle geese (*Branta leucopsis*), which, along with the storm petrel, is listed on Annex I of the EU Birds Directive.

The objectives (NPWS, 2018 l) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- storm petrel.

4.3.1.8 Cruagh Island SPA

The Cruagh Island SPA comprises a small to medium sized, low-lying island and the sea surrounding it to a distance of 500 m to accommodate 'rafting' shearwaters. The site is of ornithological importance on account of its internationally important population of nesting Manx shearwater (*Puffinus puffinus*) and nationally important population of wintering barnacle goose. There is also a nationally important colony of resident great black-backed gulls, and a small number of fulmars on the island.

The site is a SPA under the EU Birds Directive and the conservation objectives (NPWS, 2018 m) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- Manx shearwater– breeding
- barnacle goose – wintering.

4.3.1.9 Connemara Bog Complex SPA

The Connemara Bog Complex SPA is a large site encompassing much of the south Connemara lowlands of Co. Galway. There are three separate areas and the site is characterised by areas of deep peat surrounded by heath-covered rocky outcrops.

The site is a SPA under the EU Birds Directive, supporting nationally important breeding populations of the bird species listed as Special Conservation Interests. The conservation objectives (NPWS, 2018 n) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- cormorant
- merlin (*Falco columbarius*)
- golden plover
- common gull (*Larus canus*).

Wintering Greenland white-fronted goose also utilise the site.

4.3.1.10 West Donegal Coast SPA

The West Donegal Coast SPA comprises separate sections of the Co. Donegal coastline, including Aran Island. The most important seabird breeding colony is at Tormore Island, a small sea stack on the north of the Glencolumbkille Peninsula, while chough breeding pairs concentrate on the Glencolumbkille Peninsula, from Kilybegs in the south to Loughros Beg Bay in the North and on Aran Island.

The site is a SPA under the EU Birds Directive and the conservation objectives (NPWS, 2018 o) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- fulmar

- cormorant
- shag
- peregrine
- herring gull
- kittiwake
- razorbill
- chough.

Other breeding seabird species include black guillemot, guillemot (*Uria aalge*), great black-backed gull and lesser black-backed gull. The barnacle goose is known to occasionally graze in small groups on the top of Tormore Island, while twite (*Linaria flavirostris*) and ring ouzel (*Turdus torquatus*) are also known to occur.

4.3.1.11 Ardboline Island and Horse Island SPA

The Ardboline Island and Horse Island SPA comprises of the named two small marine islands and the surround marine waters where seabirds forage, bathe and socialise. The site is located approximately 500 m from the mainland as Dooneragh Point, Co. Sligo. The islands are an important breeding site for seabirds, with a population of cormorant of national importance, and breeding herring gulls and great black-backed gulls. Breeding eider (*Somateria mollissima*) and shelducks (*Tadorna tadorna*) have also been recorded. An internationally important flock of barnacle goose also winter on the site.

In addition to the ornithological interest, the islands are also an important haul out site for grey seals, which are listed under Annex II of the EU Habitat Directive, and also breed at the site.

The site is a SPA under the EU Birds Directive and the conservation objectives (NPWS, 2018 p) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- cormorant – breeding
- barnacle goose – wintering.

4.3.1.12 Inishmore SPA

The Inishmore SPA comprises all the cliffs and rocky shore of along the southern side of the Inishmore Island, the largest of the three Aran Islands, part of the low cliffs/rocky shore at the west end, the low cliffs / rocky shore at the east end, the two islands west of Inishmore (Brannock Island and Rock Island), Straw Island at the east end of Inishmore, the dune system at Barr na Coise, and the adjacent seas out to 500 m.

The SPA is an important site for breeding seabirds, especially cliff-nesting species, and the site is designated under the EU Birds Directive for four migratory species with populations of national importance. Other breeding seabird species include fulmar, razorbill, shag, black guillemot, great black-backed gull and herring gull. The black guillemot colony is one of the largest in Ireland.

Inishmore is also important for peregrine, and chough breed on the cliffs. Some of the

species listed on Annex I of the EU Birds Directive.

The conservation objectives (NPWS, 2018 q) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- kittiwake
- Arctic tern
- little tern
- guillemot.

4.3.1.13 *Inishmurray SPA*

The Inishmurray SPA is a low flat, exposed island located in Donegal Bay, approximately 6 km north-west of Steerdagh Point, Co. Mayo. The site includes the surrounding seas to a distance of 200 m from the shoreline. The island is important for breeding seabirds, including three Annex I Species of the EU Birds Directive, the common tern, Arctic tern and storm petrel. Other breeding species include shag, herring gull, common gull, great black-backed gull, lesser black-backed gull, fulmar, black guillemot, and eider duck. The site is also a regular roost site for a wintering population of barnacle goose, another Annex I species.

The site is a SPA under the EU Birds Directive and the conservation objectives (NPWS, 2018 r) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- shag – breeding
- herring gull – breeding
- Arctic tern – breeding
- barnacle goose (*Branta leucopsis*) – wintering

4.3.1.14 *Inishduff SPA*

The Inishduff SPA comprises a small rocky island and the sea surrounding it to a distance of 200 m, approximately 2 km off the south Co. Donegal coast. The site is a designated a SPA under the EU Birds Directive due to the nationally important breeding population of shag. The island is an important breeding site for a number of other seabirds, including the storm petrel, which is listed on Annex I of the EU Birds Directive, great black-backed gull, herring gull and eider duck. Another Annex I species, the barnacle goose, also uses the site as a wintering ground.

The conservation objectives (NPWS, 2018 s) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- shag.

4.3.1.15 *Inner Galway Bay SPA*

The Inner Galway Bay SPA is a very large, marine-dominated site that overlaps with Galway Bay Complex SAC. The inner bay is protected from Atlantic swells by the Aran Islands and Black Head. The SPA is of high ornithological importance with two wintering

species having populations of international importance (great northern diver and light-bellied brent goose) and a further sixteen of national importance. There is a high diversity of waterbirds. Three of the breeding seabird colonies (common tern, sandwich tern and cormorant) are also of national importance.

Part of the site is formed of wetlands and the SPA is partially designated under the EU Birds Directive for its wetlands and associated waterbirds. The conservation objectives (NPWS, 2013 f) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- wintering populations of great northern diver, light-bellied brent goose, cormorant, grey heron (*Ardea cinerea*), wigeon (*Anas penelope*), teal, shoveler (*Anas clypeata*), red-breasted merganser, ringed plover, golden plover, lapwing, dunlin, bar-tailed godwit, curlew, redshank (*Tringa totanus*), turnstone, black-headed gull, and common gull
- breeding populations of sandwich tern and cormorant.

The Inner Galway Bay is also a Ramsar Convention site and part of the Inner Galway Bay SPA is a Wildfowl Sanctuary.

4.3.1.16 Cliffs of Moher SPA

The Cliffs of Moher SPA comprises the cliffs, the land adjacent to the cliffs and the adjacent sea up to 500 m from the cliff base, along the north Clare coast from Faunmore to just south of Cancreggia Point. The SPA is one of the most important seabird colonies in Ireland and is of special conservation interest as the breeding assemblage is over 20,000 seabirds.

The conservation objectives (NPWS, 2018 t) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- fulmar
- kittiwake (*Rissa tridactyla*)
- guillemot
- razorbill
- puffin
- chough.

The site holds the largest kittiwake and razorbill colonies in Ireland, and the second largest fulmar colony. The breeding colony of chough is also nationally important, while breeding peregrine also nest on the cliffs, both listed on Annex I of the EU Birds Directive.

4.3.1.17 Mid-Clare Coast SPA

The Mid-Clare Coast SPA comprises the mainland shoreline, Mutton Island, Mattle Island, as series of rocky reefs, and the open marine water of Mal Bay between the islands and the mainland along the Co. Clare coast. As part of the site is wetlands, the SPA is partially designated under the EU Birds Directive for these and the associated waterbirds, some of which are listed on Annex I.

The conservation objectives (NPWS, 2014 f) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- cormorant
- barnacle goose
- ringed plover
- sanderling
- purple sandpiper
- dunlin
- turnstone.

A range of breeding seabirds use the site during summer, but the population of cormorant is nationally important. The wintering population of purple sandpiper is internationally important, while the other four wintering waders and the barnacle goose are nationally important.

4.3.1.18 Tory Island SPA

The Tory Island SPA comprises the remote rocky island of Tory and a marine area extending 500 m from the base of the cliffs that form the eastern and north-east side of the island. The site is partially designated a SPA because of the population of breeding corncrake. Furthermore, it is one of the few sites along the coast that is regularly utilised by nationally important numbers of the species. Corncrake is listed on the 2010 International Union for Conservation of Nature (IUCN) Red List of Threatened Species, as well as listed under Annex I of the EU Birds Directive.

The conservation objectives (NPWS, 2018 u) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- fulmar
- corncrake
- razorbill
- puffin.

Nationally important breeding populations of the three seabirds the SPA is designated for also occur on the site. Other species include kittiwake, guillemot, black guillemot, shag, herring gull, great black-backed gull, black-headed gull and common gull.

4.3.1.19 River Shannon and River Fergus Estuaries SPA

The River Shannon and River Fergus Estuaries SPA overlaps with the Lower River Shannon SAC. The estuarine complex of the River Shannon and River Fergus is the largest in Ireland and the site comprises the entire estuarine habitat, including vast intertidal flats. The SPA is the most important coastal wetland site in the country and is partially designated under the EU Birds Directive due to this and the associated waterbirds, some of which are listed on Annex I of the EU Birds Directive. The site is of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds, and regularly supports in excess of 50,000 wintering waterfowl.

The conservation objectives (NPWS, 2012 e) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- wintering populations of whooper swan, light-bellied brent goose (*Branta bernicla hrota*), shelduck (*Tadorna tadorna*), wigeon, teal, pintail (*Anas acuta*), shoveler (*Anas clypeata*), scaup (*Aythya marila*), ringed plover, golden plover, grey plover (*Pluvialis squatarola*), lapwing, knot (*Calidris canutus*), dunlin, black-tailed godwit (*Limosa limosa*), bar-tailed godwit, curlew, redshank, greenshank (*Tringa nebularia*) and black-headed gull
- wintering and breeding populations of cormorant.

The SPA is one of the most important sites for dunlin, lapwing and redshank, and the wintering populations of light-bellied brent goose, dunlin, black-tailed godwit and redshank are internationally important. other regularly occurring species include mute swan, mallard, red-breasted merganser, great crested grebe (*Podiceps cristatus*), grey heron, oystercatcher, turnstone and common gull.

4.3.1.20 Loop Head SPA

The Loop Head SPA is the most westerly point of Co. Clare and the site comprises the cliffs, shoreline and adjacent marine water out to 500 m. The cliffs support large numbers of breeding seabirds, as well as small numbers of chough and peregrine, both of which are listed on the Annex I of EU Birds Directive.

The conservation objectives (NPWS, 2018 v) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- kittiwake
- guillemot.

The kittiwake and guillemot populations are of national importance. other breeding seabird species include fulmar and razorbill.

4.3.1.21 Horn Head to Fanad Head SPA

The Horn Head to Fanad Head SPA comprises a number of separate sections of the north Co. Donegal coastline. The site includes high coast areas and sea cliffs, land adjacent to the cliff edge and the sand dunes and lake at Dunfanaghy / Rinclevan. At Horn Head the adjacent sea area out to 500 m is also included. The site hosts an internationally important population of breeding chough and a large peregrine population. It also supports nationally important Greenland white-fronted goose and barnacle goose populations.

The SPA is used by a wide variety of nesting seabirds. Along with the seabird species the SPA is designated for, which are nationally important population, the site is also of special conservation interest for holding an assemblage of over 20,000 breeding seabirds.

The conservation objectives (NPWS, 2018 w) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- fulmar
- cormorant

- shag
- barnacle goose
- peregrine
- kittiwake
- guillemot
- razorbill
- chough
- Greenland white-fronted goose.

4.3.1.22 Inishtrahull SPA

The Inishtrahull SPA comprises the whole island of Inishtrahull and the Tor Rock island group approximately 2 km north-north-west of Inishtahull, as well as the intervening sea. The site is approximately 12.5 km north-east of Malin Head, Co. Donegal. It is the most northerly seabird colony in Ireland and supports a good diversity of seabird species. It also supports other breeding birds including eider, chough, raven, lapwing, oystercatcher, turnstone and ringed plover. A wintering population of barnacle goose feed and roost on Inishtrahull, and peregrine and kestrel (*Falco tinnunculus*) regularly hunt on the island.

In addition to the ornithological importance, grey seal, an Annex II species of the EU Habitats Directive, also hauls out on Inishtrahull, with up to 600 individuals reported in the area in the summer.

The conservation objectives (NPWS, 2018 x) are to maintain or restore the favourable conditions of the bird species listed as Special Conservation Interests for this SPA:

- shag
- barnacle goose
- common gull.

The shag and common gull populations are on national importance. Other breeding seabird species include fulmar, lesser black-backed gull, herring gull, kittiwake, black guillemot and storm petrel. The great black-backed gull is a resident species and the population is also of national importance.

5 APPROPRIATE ASSESSMENT SCREENING

5.1 Introduction

This section provides the information necessary for the Competent Authority to screen for AA and determine whether the proposed flexible flowline replacement works and related As-Found and As-Left surveys, in view of best scientific knowledge, are likely to have a significant effect on nearby or relevant European (Natura 2000) sites. Specifically, it aims to:

- Provide information on, and assess the potential for the proposed operations to significantly impact European sites;
- Determine whether the proposed operations, alone or in combination with other projects, are likely to have significant effects on European sites in view of their qualifying features (conservation objectives).

5.2 Potential Impacts on European sites

The 31 coastal SACs and 24 coastal SPAs described in the previous section may have qualifying features that are screened into, or out of, the AA. The following sections discuss the aspects of the project that may impact the qualifying features of the European sites:

- Physical presence of the ROV support vessels, ROVs and equipment;
- As-Found and As-Left acoustic geophysical surveys and associated general vessel activity;
- Routine emissions and discharges during vessel operations;
- Direct and indirect impacts resulting from the P6 flowline replacement works activities themselves;
- Accidental events.

A statement about which qualifying features of the relevant European sites with the potential for environmental impacts are screened into the assessment below (Section 6).

5.2.1 Physical presence of ROV support vessel, ROVs and equipment

The physical presence of the ROV support vessel, ROVs, and installation equipment (including rock mattresses, gabions and the new flexible flowline) results in the potential for interaction with marine mammals (disturbance / risk of collision) and seabirds (disturbance resulting in displacement from foraging areas).

In regard to the interaction with marine mammals in coastal SACs, activities will be temporary, with the duration at sea for the installation vessel and associated equipment minimised and confined to as small an area as possible at the Corrib Field. For any

reduction in Annex IV species abundance from the area in the vicinity of the operations, rapid repopulation is likely, as responses by marine mammals is likely to be behavioural and temporary in nature. No changes in overall species abundances are anticipated. It is recognised that the marine mammals that are potentially in the vicinity of the proposed activities can have extensive foraging ranges. As such the potential zones of influence for these Annex IV species from direct and indirect impacts could potentially be extensive as animals may contribute to the designation of SACs / MPAs which are either close to the proposed survey area or considerably further away. Due to the foraging distances of these species, and the suitability of the waters off the western coasts of Ireland, there is likely extensive connectivity of habitat. The west coast of Ireland supports both resident and semi-resident populations of both grey and harbour seals and a number of species of small cetacean. As such European sites that are within these extensive foraging ranges have been screened in to the initial Appropriate Assessment screening.

The likelihood of collision with animals is considered to be extremely low, as the vessel will operate in accordance with the principles of the relevant codes of conducts at all times; and at low speeds. Also, despite the potential for animals from a wide area to be present in the vicinity at the time of the operations, the potential actual area where impacts have the potential to occur is extremely localised to the immediate vicinity of the area of works at the Corrib Field where the ROV support vessels and near seabed installation and survey operations are likely to be relatively static for the duration of the c. 6 day work scope. The likelihood of interaction (such as entanglement) is low as acoustic survey equipment will be mounted directly to the ROVs and any lowered equipment such as the replacement flexible flowline, installation equipment and other material such as rock gabions and concrete mattresses will be lowered to the seabed by means of a taut and directly vertical cable from the ROV support vessel. In addition, the marine mammal species are all highly mobile species, that are free to move in any direction within an open marine environment in which the static nature of the proposed operations will not be acting to drive or confine animals in any particular direction. Therefore, it is unlikely that the physical presence of vessel or equipment will traumatise or interact with marine mammals.

Seabirds will occur in the vicinity of the Corrib Field. Depending on the foraging range of the species involved, these birds could contribute to the designation of SPAs which are either relatively close to the proposed area of works (the closest site with relevant receptors is the Inishkea Islands SPA approximately 59 km distance from the Corrib Field) or much further away. Due to the foraging distances of certain seabird species, and the suitability of the coastal waters on the western coasts of Ireland to support large seabird populations, there is likely extensive connectivity of habitat. Broadhaven Bay SPA has an important breeding colony of sandwich terns and Inishkea Islands SPA also supports Arctic and little terns and Shag, while other SPAs in the vicinity also support large breeding populations of auks, gannets and gulls. European sites within the typical foraging ranges for these species have been screened into the initial Appropriate Assessment.

These birds could potentially be present in the area of the proposed works at a similar time to when works are taking place. In a worst case scenario, the presence of the ROV support vessel, ROVs and equipment could prevent or reduce access to foraging seabirds. However, activities will be temporary, with the duration of the survey minimised, and confined to as small an area as possible, making it unlikely that the entire survey area

would be unavailable for the scheduled duration. Seabird counts from the ObSERVE aerial surveys (Rogan et al., 2018) suggest that there is sufficient alternative foraging habitat in the wider area to accommodate any temporarily displaced seabirds. This would be further aided by the habitats' connectivity together with the fact that seabird species are highly mobile, and free to move in any direction in an open marine environment. Therefore, it is unlikely that the physical presence of vessel or equipment will displace seabirds permanently.

5.2.1.1 *Screening Outcome*

In view of the best scientific knowledge and in view of the conservation objectives of the sites, the physical presence of the ROV support vessel, ROVs and equipment during the installation works and associated surveys, when taken either individually or in combination with other plans or projects will not have a likely significant effect on any European site. There are no European sites in close proximity to the proposed area of works and it is considered unlikely that the qualifying species of those sites in closest proximity would be affected by the physical presence of the proposed operations.

5.2.2 **As-Found and As-Left acoustic surveys and associated general vessel activity**

The potential effects of underwater sound on different marine biota is a key environmental concern. The noise and disturbance resulting from the general vessel activity (e.g. navigation, bathymetric systems and general engine and plant noise) and the As-Found and As-Left acoustic surveys are considered the primary potential impacts as a result of the proposed activities.

In order to assess the potential impacts of acoustic surveys on receptor species associated with European designated sites, the characteristics of the sound source, sound propagation and the auditory sensitivity of the biota all need to be considered.

An animal's ability to detect sounds produced by anthropogenic activities depends on their auditory hearing range and on levels of natural ambient or background sound. Wind, precipitation, vessel traffic, and biological sources all contribute to ambient sound. Table 5-1 shows various anthropogenic sources and received levels of sound in the marine environment.

Table 5-1: Typical anthropogenic sound sources and received levels of sound in the marine environment (adapted from: Evans & Nice, 1996; Richardson et al., 1995, in IOSEA2 (ERT/Aqua-Fact International Services, 2007))

Activity	Frequency range (kHz)	Average source level (dB re 1µPa-m)	Estimated received level at different ranges (km) by spherical spreading ^a			
			0.1 km	1 km	10 km	100 km
High resolution geophysical survey; pingers, side-scan, echo sounder	10 to 200	<230	190	169	144	69
Low resolution geophysical seismic survey; seismic air gun	0.008 to 0.2 ^b	248	210 ^c	144 ^c	118 ^c	102 ^d
			208	187	162	87
Production drilling	0.25	163	123	102	77	2
Jack-up drilling rig	0.005 to 1.2	85 to 127	45 to 87	24 to 66	<41	0
Semi-submersible rig	0.016 to 0.2	167 to 171	127 to 131	106 to 110	81 to 85	6 to 10
Drill ship	0.01 to 10	179 to 191	139 to 151	118 to 130	93 to 105	18 to 30
Large merchant vessel	0.005 to 0.9	160 to 190	120 to 150	99 to 129	74 to 104	<29
Military vessel	-	190 to 203	150 to 163	129 to 142	104 to 117	29 to 42
Super tanker	0.02 to 0.1	187 to 232	147 to 192	126 to 171	101 to 146	26 to 71

a Spherical spreading is calculated here using the formula presented in IOSEA2(ERT/Aqua-Fact International Services, 2007).

b Seismic surveys produce occasional sounds with frequencies of 1 to 22 kHz (Evans, 1998) c Actual measurements in St George's Channel, Irish Sea.

d Extrapolated figure as presented by Evans & Nice, 1996.

5.2.2.1 Sound propagation

In general, sound sources that have high sound pressure levels and low frequency (i.e. large air gun array seismic sources) will travel the greatest distances underwater. The spread of low frequency sound in the sea is efficient, with little loss due to attenuation (i.e. due to absorption and scattering). Conversely, high frequency sources (such as those emitted from geophysical survey equipment, such as MBES) tend to have greater attenuation over distance. The process is non-linear with the rate of absorption varying roughly as the square of the frequency. The overall degree of attenuation is also

dependent on the pressure, temperature and salinity.

Additional to the transmission loss through attenuation, spherical spreading loss (the reduction in intensity caused by the spreading of waves into an ever increasing space) results in signal intensity dropping quickly. Overall the intensity of sound waves decay exponentially and although low-level signals travel for long distances, higher amplitude waves lose much of their energy very close to the sound source (Gisiner, 1998).

5.2.2.2 *Characteristics of proposed sound sources*

The proposed programme of works will result in a degree of acoustic disturbance to marine life from general ROV construction support vessel noise and ROV operations, as well as the As-Found and As-Left geophysical (acoustic) and visual surveys.

During the deployment of the principal survey transducer (MBES) there exists the potential for marine life to be disturbed or displaced. In order to assess the potential impacts of the operation of this survey equipment on key receptor species, the characteristics of the sound source are considered.

The MBES system will be mounted on an ROV, allowing for the use of the equipment at a higher frequency (400 kHz) than could be otherwise used from a vessel mounted device in deeper waters areas, such as those present in the vicinity of the Corrib Field.

Based on the proposed models of MBES (see Table 3-3), the peak source level expected, or maximum amplitude, will be in the range of 225 dB re: 1µPa @1 m. The acoustic intensity will attenuate as it propagates throughout the water column rapidly through spreading loss alone. In addition to this, the high frequency acoustic energies typified by this equipment are more quickly absorbed through the water column than sounds with lower frequencies.

Other acoustic survey equipment

The obstacle avoidance and altimeter systems proposed for use on the ROV operate at relatively high frequencies (500 - 675 kHz), compared to that of the primary MBES survey equipment. These high frequencies are outside of the peak hearing thresholds of most cetaceans and pinnipeds, with ~500 kHz being beyond the upper limit of harbour porpoises peak hearing frequency threshold (Richardson *et al.*, 1995; Southall *et al.*, 2007). The migratory fish that are likely to be in the vicinity of the proposed survey activities do not have particularly sensitive hearing and are considered low frequency hearing generalists (Nedwell *et al.*, 2003, 2006; Popper, 2005), so these higher frequencies would also be beyond their typical auditory threshold. In addition, this equipment will operate at a relatively low sound pressure intensity compared with the primary MBES survey equipment.

The Sound Velocity probes proposed for use operate at a very high frequency and at an extremely low sound pressure intensity level that would not be detectable to any receptor animals, while the USBL beacons proposed operate at a much lower frequency (in the range 21-31 kHz) are within the range of hearing for small cetaceans and pinnipeds. However, these are also operating at a very low sound pressure intensity level compared with equipment that operates in a similar range (the USBL transponders are for

communicating a position relative to the survey vessel); therefore, the acoustic pulses from these are not considered likely to cause undue disturbance to those animals.

In addition to spreading loss for acoustic propagation in the water column, high frequency acoustic energies are more quickly absorbed through the water column than sounds with lower frequencies. Again, most of the sound energy generated is likely to be orientated downwards towards the seabed, over a relatively short distance. Due to these factors the use of ROV mounted acoustic equipment is considered to result in a negligible risk of an injury or disturbance to receptor species.

5.2.2.3 *Screening outcome*

In view of the best scientific knowledge and in view of the conservation objectives of the European sites, there is the potential for underwater acoustic disturbance, to mobile marine species, from general ROV support vessel and ROV activity and the use of MBES during acoustic surveys, when taken either individually or in combination with other plans or projects. Owing to the foraging ranges and behaviour of certain seabirds, it is not possible to say with certainty whether or not such species would be present at the time of the operations. Sites within the typical foraging ranges of receptor species of seabirds that spend time underwater, have been considered. The potential for impacts on these species cannot be ruled out. It is known from the ObSERVE aerial surveys from 2015-2016 that certain species of seabirds are present throughout the year, however the areas of proposed operations at the Corrib Field, are regarded to have lower densities of seabirds than areas to the north and south (Rogan et al. 2018). Therefore, it is considered unlikely that such activities would result in any significant effect on these species.

A number of the SACs that have been considered are unlikely to be affected by acoustic disturbance owing to the nature of their qualifying features. Marine mammals, however, are considered to be key receptors that have the potential to be affected by underwater noise, for example, grey seals (Inishkea Islands, Duvillaun Islands SACs), harbour seals (Killala Bay and Moy Estuary, Clew Bay Complex SACs) and bottlenose dolphins (West Connacht Coast and Lower River Shannon SACs) (Table 4-1). The foraging ranges for these species can be significant, and as such sites within these typical foraging ranges that have these species as qualifying features have been considered. Although Annex IV species of marine mammals such as harbour porpoise and bottlenose dolphins are not qualifying species of the Broadhaven Bay SAC (69 km from the Corrib Field), the potential impacts of underwater noise also require further consideration due to the known presence of these species in the vicinity. Both species of seal are also known to occur in Broadhaven Bay SAC. Monitoring results during similar surveys over previous years, when bottlenose dolphins, harbour seals, grey seals and harbour porpoise were present in the immediate area during the surveys (RSK, 2016; 2018; 2019), have shown little or no discernible effects on the animals present, and as such it is considered unlikely that the proposed activities, which are much reduced in the scope in terms of the use of acoustic survey equipment and confined to a single areas considerably further offshore to previous survey operations which come within the boundary of the SAC, would result in any significant effect on them.

Further discussion of the likelihood and magnitude of impacts to marine mammals is provided in Section 6, which also discusses the rates at which the intensity of the acoustic sources rapidly propagate and attenuate throughout the water column. While it is

recognised that there exists the potential for animals from a wide area to have the potential to occur in the vicinity of the operations, the likelihood of these occurrences is relatively low (based on previous monitoring results), with the potential for animals being exposed to source intensities from the acoustic survey equipment that would cause injury or distress of negligible likelihood. Due to the rapid attenuation of the high frequency sound underwater through natural spherical spreading and absorption during propagation, the impact ranges for marine mammals are localised in extent.

For similar reasons (short duration of the surveys and rapid attenuation of high frequency sound under water) the impact range of underwater noise on migratory fish will be localised in extent and therefore many of the SACs with migratory fish as qualifying features are unlikely to be affected by acoustic disturbance. Salmon in Glenamoy Bog Complex, Mweelrea / Sheeffry / Erriff Complex, Owenduff / Nephin Complex and Newport River SACs, salmon and sea lamprey in the River Moy SAC and sea lamprey in the Killala Bay / Moy Estuary SAC are considered as these sites represent the closest receptor sites to the proposed operations at the Corrib Field (the closest European site with migratory fish as a qualifying interest is the Glenamoy Bog Complex at c. 77 km distance). However, salmonids (e.g. salmon and trout, including sea trout) and lamprey (both river and sea) are thought to be relatively insensitive to sound due to a lack of hearing specialist structures (Nedwell et al., 2003, 2006; Popper, 2005). Based on auditory evoked potential experiments, salmon detect sounds between 100 and 800 Hz, while sea lamprey detect sounds between 50 and 300 Hz (Simpson and Brintjes, 2016; Mickle et al., 2018). Salmon are also highly mobile and a relatively large fish and are easily able to undertake avoidance behaviour and return following cessation of the survey activities. Lamprey are less mobile but as sea lamprey have shown behavioural changes only to sound in the range of 50-200 Hz (Mickle et al., 2018), it is unlikely the noise from the proposed As-Found and As-Left survey activities would result in any significant effect on this species. As all lamprey species are thought to lack hearing specialist structures, the hearing sensitivity of river lamprey is considered similar to sea lamprey and so it is also unlikely this species would be significantly affected by underwater noise from the proposed As-Found and As-Left survey activities.

5.2.3 Routine emissions and discharges during vessel operations

Atmospheric emissions (primarily exhaust gases) and routine marine discharges (macerated food, grey water, bilge water and ballast water) will be released by the ROV support vessel during the normal operations while conducting the P6 flexible flowline replacement and associated surveys. The atmospheric emissions may result in locally elevated concentrations of gases in the immediate vicinity of the vessel, but they will be temporary given the rapid dispersion of emissions in the exposed location at the Corrib Field.

The routine marine discharges could reduce water quality and result in toxicity effects on marine fauna. However, relatively small quantities will be generated, and these will disperse rapidly given the open exposed location and deep water at the Corrib Field, and considering the short duration of works on site, resulting in localised and temporary impacts to the marine environment.

Furthermore, levels of carbon dioxide emitted by the marine vessel during the proposed

works will be negligible and will have minimal effects on climate change.

5.2.3.1 Screening Outcome

In view of the best scientific knowledge and in view of the conservation objectives of the sites, routine emissions and discharges during vessel operation, when taken either individually or in combination with other plans or projects will not have a likely significant effect on any European site. None of the qualifying features of the SACs and SPAs are likely to be impacted by routine emissions and discharges.

5.2.4 P6 flowline replacement works

During the removal and installation works for the flexible flowline between the P6 wellhead and the Corrib Central Manifold, ROV operations will entail some limited physical intervention including laying down of the new flowline, movement of the existing flowline on the seabed, installation of concrete mattresses and turning bollards (gabions). This will result in localised suspension of sediments in the immediate vicinity. There will be a degree of disturbance to the surrounding physical seabed environment and associated benthic habitats and communities from resuspended sediments during the installation works. This disturbance will be minimal and restricted to the vicinity of the works with minimal and rapid dispersion. Currents close to the seabed at the Corrib Field are relatively weak.

There will be direct disturbance to the seabed in the movement of the existing flexible flowline terminations away from the P6 wellhead and the Corrib manifold, this will result in a degree of direct disturbance to the seabed, that will be temporary as well as a degree of permanent disturbance and alteration of habitat in the area where the existing flowline terminations are permanently positioned. It is understood that this will be limited in spatial extent. Temporary disturbance to the seabed will also result for the duration of the works from the placement of temporary concrete mattresses and gabions. These are to be removed when the worksite is reinstated at the completion of the works. Approximately 158 m (worst case) length of seabed habitat will be permanently altered by the installation of the new flexible flowline. The flowline will be approximately 20 cm in width. The area of seabed altered will be increased by any permanently placed concrete mattresses used to protect the new and existing flowlines once in position. The total area of permanent alteration of the seabed will be approximately 32 m² for the new flowline and an additional 528 m² for the 22 concrete mattresses. The overall significance of these physical impacts is determined as negligible.

The flowline replacement activities will involve displacement of a small volume of inhibited potable water and Alcolgel gel pill (the volume within the new flexible flowline approximately 16 m³ total discharge) to the surrounding seawater at the Corrib Central Manifold. Due to the small volume to be released and rapid dilution and dispersion due to the buoyant nature of this release, the impact of this is considered to be negligible. The Alcolgel gel pill within the inhibited potable water released is a PLONOR listed chemical and also registered on the Offshore Chemical Notification Scheme under Group E. It is therefore considered to be of lowest toxicity on the OCNS list. Inhibited seawater will be used as part of the new flexible flowline pre-commissioning activities, and a quantity of methanol may then be used to help displace this. The methanol will not be released

but will be retained within the subsea process system and sent back to the BBGT.

5.2.1.1 Screening Outcome

In view of the best scientific knowledge of the conservation objectives of the sites, the removal and installation works to be undertaken for replacement of the P6 flowline, when taken either individually or in combination with other plans or projects will not have a likely significant effect on any European site. None of the qualifying features of the SACs and SPAs are likely to be impacted by the specific flowline replacement works.

5.2.5 Accidental events

As with any marine-based operation, accidental events may occur. An accidental fuel oil spillage along the vessel transit route and at the proposed area of works, could potentially result in a spill that could impact the coastline. Such a spill could result in a reduction of water quality and degradation of habitats, resulting in impacts on qualifying habitats and species. Owing to the location of the works (exposed nature of the location and distance from the nearest coastline) it is considered likely that any spill would be rapidly dispersed. Additionally, such spillages occur rarely, and the likelihood of impact is commensurately very low.

There are also several chemicals that will be used during the flexible flowline replacement works but retained within the subsea system and transported back to the BBGT via the process system. These are described above. While there are known planned releases of certain chemicals during the P6 flexible flowline replacement works, there does also exist the potential for an unplanned release of chemicals. Chemicals that are not planned for release but would be retained within the subsea process system include methanol (approx. 2000 litres) to be used to flush the new flexible flowline prior to connection, RX5208 oxy scav/biocide sticks (approx. 1.5 kg) will be used to tie in the ends of the new flowline and RX9034A dye sticks (approx. 0.5 kg) will be used during the leak test of the new flowline. These amounts are high-level precautionary estimates and actual amounts used would likely be far lower. There is potential for accidental release of these chemicals into the surrounding environment, which could cause a reduction in water quality and/or a toxic effect on marine fauna. However, the likelihood of chemical leaks is extremely unlikely. In addition, the amounts of chemicals to be used are low and would be rapidly dispersed in the unlikely event of a leak. Chemicals also, where appropriate have been selected based on their performance in the aquatic environment in terms of benign toxicity, rapid biodegradation and reduced potential for bioaccumulation.

5.2.1.2 Screening Outcome

In view of the best scientific knowledge and in view of the conservation objectives of the sites, as accidental fuel oil spillages and accidental chemical leaks are risk-based events, when taken either individually or in combination with other plans or projects, it could have a likely significant effect on any European site. All marine operations carry the risk of an accidental fuel oil spill. However, in the context that the likelihood of such a spillage or a chemical leak occurring is considered to be very low it is therefore considered unlikely in terms of the potential for impact on European sites and their qualifying interests.

5.2.6 AA Screening Conclusions

No habitats are likely to be significantly affected by the potential impacts assessed here and so in view of the best scientific knowledge and in view of the conservation objectives of the sites, the proposed activities when taken either individually or in combination with other plans or projects are unlikely to have a significant effect on any European site, where habitats are the main qualifying features.

Based on the duration and nature of proposed scope of works and related As-Found and As-Left surveys, and the zone of potential impact, the main potential impact on any European site is the effects of underwater noise generated from the As-Found and As-Left acoustic surveys on key receptor species (qualifying features). It has been concluded, on the basis of objective information (survey activities carried out since 2010, with monitoring showing no impacts), that significant effects on the conservation objectives of the SACs and or OSPAR MPAs, as well as the coastal SPAs in the vicinity of the proposed activities listed in Table 4-1, are highly unlikely.

In respect to a fuel oil spillage or chemical leak, these would be accidental and therefore unpredictable events, the likelihood of such events occurring is therefore considered to be very low and hence considered unlikely in terms of the potential for impact on European sites and their qualifying interests. All chemicals that have been selected for use for the proposed work scope will require only the use of small volumes and have been selected based on their environmental performance in the aquatic environment with regards toxicity, biodegradation and bioaccumulation.

As a result of the above assessment, which takes account of the best scientific knowledge – including in the light of monitoring these activities over a period of years - and the conservation objectives of each European site, it is considered that the proposed activities taken either individually or when in combination with other plans or projects, are not likely to have a significant effect on any European site.

6 IMPACT ASSESSMENT IN SUPPORT OF STAGE 2: APPROPRIATE ASSESSMENT

6.1 Introduction

This section of the NIS has been prepared to inform and assist the competent authority, should it decide to proceed to an appropriate assessment to determine whether or not the proposed activities will adversely affect the integrity of European sites.

This section presents, in light of best scientific knowledge, the assessment of underwater noise impacts, generated by the undertaking of the As-Found and As-Left acoustic surveys, on European sites' qualifying interest species, and whether these impacts affect the conservation objectives of any European sites and thus adversely affect the integrity of these sites.

Consideration is also given to routine emissions and discharges during vessel operations and accidental fuel oil spillages, as although significant impacts on the conservation objectives of European sites are unlikely, best practice includes protocols and procedures that are required for statutory compliance. In the context of the judgment in CJEU Case C-323/17 (People over Wind) it is not clear whether such statutory requirements are considered as to be mitigation or standard best marine practice.

6.2 Potential impacts on European sites

This section considers the potential impacts arising from certain aspects of the proposed work scope, as discussed above, and further considers whether any such impact has the capacity to adversely affect the integrity of any European site.

6.2.1 Impacts of noise on key receptor species

As discussed above in Section 5, there are various potential effects of exposure to sound from anthropogenic activities that can be characterised as pathological, physiological or behavioural. Criteria can be established for zones of influence based on ambient sound levels, absolute hearing thresholds of the species of interest, slight changes in behaviour of the species of interest (including habituation), stronger disturbance effects (e.g. avoidance), temporary hearing impairment (TTS) and permanent hearing impairment (PTS), or other physical damage.

Southall et al. (2007) carried out an extensive review of the available literature and formulated scientific recommendations for marine mammal exposure criteria, based on the peak pressure known or assumed to elicit the onset of TTS.

For mid frequency hearing cetaceans, which includes bottlenose dolphins (auditory sensitivity range estimated at 150 Hz to 160 kHz), the sound pressure level (SPL) for injury was set at 230 dB re 1 μ Pa (peak). The sound exposure level (SEL) for injury is given as 198 dB re 1 μ P²-s. For pinnipeds in water Southall et al. (2007) gives the SPL threshold for injury at 218 dB re: 1 μ Pa (peak), and the SEL for injury is given as 186 dB

re 1 $\mu\text{P}^2\text{-s}$.

The fundamental difference between these two parameters is that SPL can be an instantaneous value and SEL is the total noise energy to which the mammal is exposed during a given duration: 1 second in this case. It should be stressed that no marine mammal mortality or damage to tissue has been documented for exposure to geophysical acoustic surveys, and that the exposure level for injury is a theoretical value extrapolated from experimental data. Also, it is recognised that many variables affect the nature and extent of responses to a particular stimulus. Such variables may include the recent experience of marine mammals with the sound stimulus, and their current activity (e.g. feeding vs. migrating).

6.2.1.1 Bottlenose dolphins in West Connacht SAC

One way of estimating the level of effect on marine mammals is to consider species specific hearing audiograms, and to identify areas where the anthropogenic sound source level frequencies overlap with them. A calculated audiogram for the bottlenose dolphin and harbour porpoise is presented in Figure 6-1.

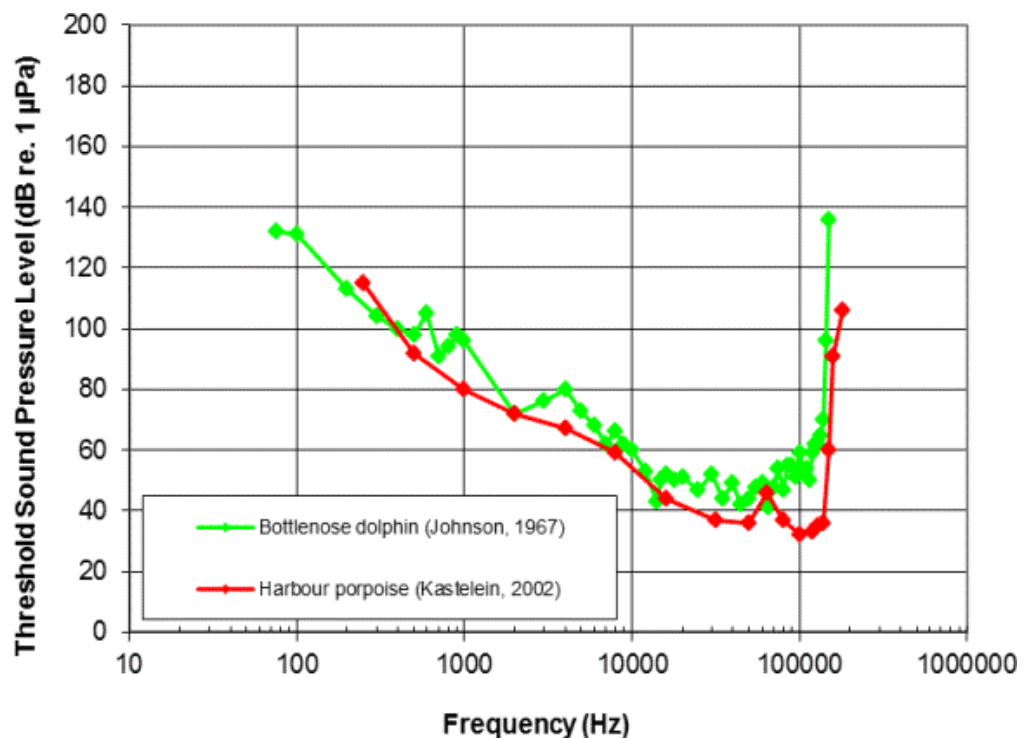


Figure 6-1: Bottlenose dolphin and harbour porpoise hearing threshold audiogram

The acoustic energy proposed for the ROV deployed MBES system operates at a frequency of around 400 kHz and ROV positioning equipment is 500 to 675 kHz, which are frequencies largely outside the range of hearing for bottlenose dolphins and are therefore unlikely to have a significant effect on the species. The audiogram in Figure 6-1 shows that the sound pressure level (SPL) required to be perceived to the dolphin at 100 kHz is around 50 dB re1Pa. The maximum SPL at 1m distance for the MBES proposed for the survey is estimated to be approximately 225 dB re 1 μPa .

At ~ 225 dB re: 1 μPa @1 m the maximum amplitude would be expected to drop exponentially due to spherical spreading and attenuation (as shown in Figure 6-1). A

further extrapolation of the values from Table 5-1 for the maximum source levels for the MBES would result in dB levels of around 184 dB at 0.1 km, 164 dB at 1 km, 139 dB at 10 km, and 64 dB at 100 km. The closest boundary of the West Connacht Coast SAC is approximately 59 km. These reductions in amplitude would be the result of spherical spreading alone.

These losses would likely be increased due to the fact that the maximum amplitude of 225 dB re: 1µPa @1 m is expected at frequencies at the higher operational ranges of the equipment typically used for the purposes of the survey (around 400 kHz, but up to 900 kHz). At these frequencies the losses through absorption and attenuation are anticipated to be greater.

The sound energy generated by the use of the MBES will be directed downwards to the seabed from the transducers mounted on the ROV.

In the event that the survey equipment is operated at lower frequencies, the proposed As-Found and As-Left survey activities may be audible to bottlenose dolphins in the West Connacht Coast SAC, and therefore may cause localised short-term impacts on behaviour, however due to the remoteness of the proposed activities from the closest boundaries of this site, it is not considered this would result in likely significant impacts. Nonetheless the employment of industry standard best environmental practice protocols at all times, including soft starts, the use of Marine Mammal Observers (MMO's), and the following of the guidance in the Vessel Operators Code-of-Conduct (Document No. COR-14-SH-0227, 2018) - as required by the statutory agencies will further reduce the likelihood of potential impacts.

Exposure to any such impacts will be of short duration, with the proposed duration of activities expected to be 6 days in total, with the As-Found and As-Left surveys only taking part of the programme at the beginning and end of the installation works.

Noise from vessels is also likely to be of low amplitude and frequency (Table 5-1) and unlikely to reach the SEL for Bottlenose dolphins even at very close proximity.

It is recognised that this part of the assessment focusses on the West Connacht Coast SAC due to its qualifying sensitive receptor species as well as its proximity to the proposed activities. West Connacht Coast SAC is the closest European protected site to the Corrib Field, but is in excess of 50 km. A number of other sites at greater distances from proposed operations have been considered during the screening phase (Stage 1 of the Appropriate Assessment process (as described in the AA process in Section 2.2) due to the foraging ranges of the species that are their qualifying species. Extrapolating the source level values by range, as has been carried out in this section serves to highlight the way in which the source level rapidly attenuates with increased distance. As such the West Connacht Coast SAC and its relevant qualifying feature (bottlenose dolphin) is considered as a worst case scenario in terms of the direct impacts as a result of its proximity.

As concluded in Section 5 above, the potential impacts described above are not considered to have any likely significant effect on the conservation objectives for this species for the European site in question (West Connacht Coast SAC) when the described statutory-required protocols for the protection of these species are applied. It is considered therefore, that the potential impacts of underwater noise on bottlenose dolphins will not

adversely affect the integrity of the West Connacht Coast SAC.

6.2.1.2 *Annex IV species in Broadhaven Bay SAC*

Higher frequency cetaceans such as harbour porpoise may be sensitive to some of the lower frequencies of the survey equipment (MBES). Estimates provided by Nedwell et al., (2008) using comparable MBES specifications (maximum source level of 220 dB re: 1µPa @1 m and an operating frequency of 200kHz) and using harbour porpoise as being the worst case scenario and a 90 dBht (dB values above hearing threshold) strong avoidance impact criterion (Nedwell et al., 2008), it was estimated a strong avoidance reaction might occur at around 30 m from the sound source. Again, considering the natural avoidance behaviour, the peak source level of the sound source and the SPL and SEL for injury it is unlikely that injury would occur. It should be noted that the proposed peak source level of 225 dB re: 1µPa @1 m is a maximum and will also drop exponentially due to spherical spreading and greater attenuation of high frequencies.

Exposure to any impacts will be of short duration, as the As-Found and As-Left surveys will take place during two very short windows.

These sound source levels may result in sound levels that would potentially be perceived by any Annex IV species of cetacean that happened to be within Broadhaven Bay SAC but would be unlikely to result in any behavioural responses by animals due to the loss of amplitude of the source levels due to the distances. In addition to this the equipment is proposed to be operated at higher frequencies and would be less likely to overlap with the typical peak range of these species. Impacts are considered to constitute a negligible impact. All vessels operating on the project will follow the principles of the Vessel Operators Code of Conduct (Document No. COR-14-SH-0227, 2018) for vessels as a matter of good practice (although this is not a requirement) in order to minimise interactions with marine mammals.

It is recognised that this part of the assessment focusses on the presence of receptor species within the Broadhaven Bay SAC. Sites at greater distances from the proposed operations have been considered during the screening phase (Stage 1 of the Appropriate Assessment process (as described in the AA process in Section 2.2) due to the foraging ranges of the species that are their qualifying species and the overall connectivity of the habitat. Extrapolating the source level values by range due to attenuation and loss through spherical spreading, as has been carried out in this section serves to highlight the way in which the source level rapidly attenuates with increased distance. As such Broadhaven Bay SAC and its relevant qualifying features (it is appreciated that harbour porpoise and other Annex IV species of marine mammals are not qualifying species of interest for Broadhaven Bay SAC, but their presence here has been recorded and as such this site has been considered as a worst case scenario in terms of these direct impacts, and as such has been included here as the example due to its proximity.

When the required protocols described here are applied, the potential impacts of underwater noise are not considered to have any likely significant effect on the conservation objectives of the European site in question (Broadhaven Bay SAC) and will therefore not adversely affect the integrity of Broadhaven Bay SAC.

6.2.1.3 *Grey seals in Inishkea Islands and Duvillaun Islands SACs*

Figure 6-2 presents an audiogram for grey seals.

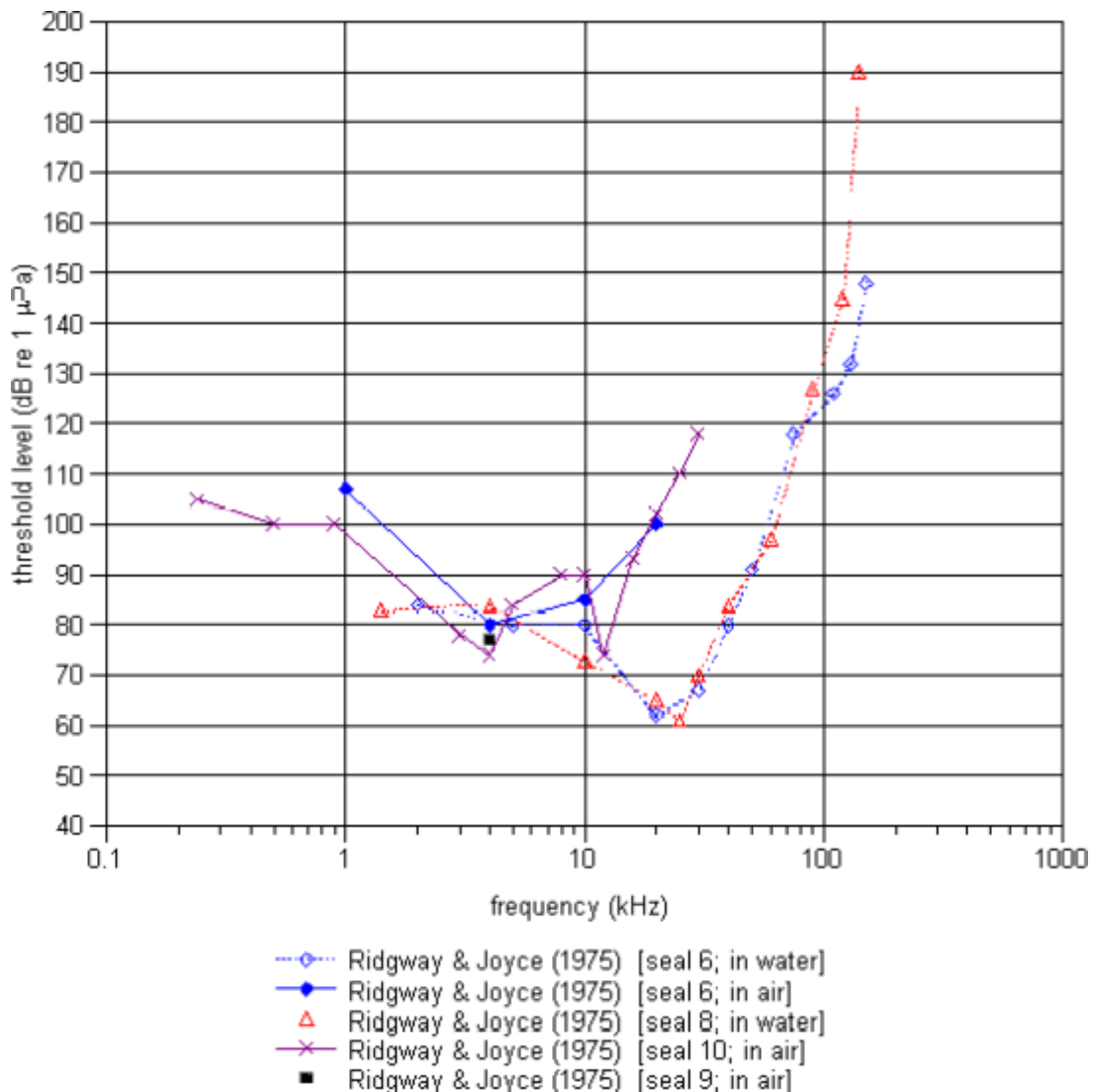


Figure 6-2: Audiogram for grey seal (Nedwell et al., 2004)

Pinnipeds have a hearing range typically between 75 Hz and 75 kHz, with peak sensitivity within that range between 20-30 kHz above a threshold level of approximately 60 dB re 1 μ Pa. The audiogram shows that the upper limits of frequency that could be detected by grey seals is close to 100 kHz. This would therefore mean that the acoustic energy for the MBES and much of the ROV navigational and communication equipment (Table 3-1) is outside the upper frequency range of grey seal hearing.

The USBL transponders may be audible to seals, however due to the very low intensity at which this equipment operates, impacts are considered negligible.

Studies dedicated to the effect of noise from acoustic survey on seals are limited, despite seals being recognised as having good underwater hearing. Of the few dedicated studies undertaken, Thompson (1998) provides an assessment of the physiological responses of grey and harbour seals to airguns. The study showed that harbour seals exhibited fright responses when a sound source (source levels of 215 to 224 dB) was switched on, followed by strong avoidance behaviour. The seals also stopped feeding during this time.

The behaviour of the harbour seals soon returned to normal after the sound source was switched off. Similar avoidance responses were recorded in grey seals at similar exposure levels, with seals changing from foraging behaviour to transiting away from the sound source. The grey seals were recorded as returning to normal behaviour within two hours of the sound source ceasing.

The maximum amplitude of the proposed MBES equipment is 225 dB re: 1µPa @1 m (when operating at around 400 kHz). These typical operating frequencies are well outside the audible range for grey seals. Using the extrapolated values in Table 5-1, the source levels would be expected to drop to below 100 dB at the closest boundaries to the Inishkea Islands SAC (59 km) through spherical spreading alone. This value is well below both the SPL and SEL for injury provided by Southall et al. (2007). As the Duvillaun Islands SAC boundary is even further away from the Corrib Field (64 km at its closest point) source levels would be expected to drop even further. These values are likely to be further reduced through increased absorption and attenuation associated with source levels at higher frequencies, and therefore the potential for injury to seals from the acoustic sound sources proposed for this survey is considered to be extremely low as are any behavioural impacts also.

Exposure to any impacts will be of short duration. The flexible flowline replacement operations and As-Found and As-Left surveys are expected to take only around 6 days in duration, with the time period and area of works minimised as far as possible. The ROV support vessel will follow the principles of the Vessel Operators Code of Conduct (Document No. COR-14-SH-0227, 2018) as a matter of good practice where appropriate to minimise interactions with marine mammals.

The As-Found and As-Left surveys will be carried out at considerable distances offshore and will only be using high frequency MBES equipment and other very high frequency low-intensity sensors. As a result, the likelihood for injury or disturbance to seals is reduced, as the frequency of occurrence of seals decreases with increasing distances from areas of known coastal sensitivity.

It is recognised that this part of the assessment focusses on the receptor species of seals within the Inishkea Islands or Duvillaun Islands SACs due to these sites being in closest proximity to the proposed operations at the Corrib Field (c. 60 km). Sites at greater distances, with both grey and harbour seals as qualifying features, from proposed operations have been considered during the screening phase (Stage 1 of the Appropriate Assessment process) due to the foraging ranges of these species. Extrapolating the source level values by range, as has been carried out in this section serves to highlight the way in which the source level rapidly attenuates with increased distance. As such the Inishkea Islands and Duvillaun Islands SACs are considered as a worst case scenario in terms of the direct impacts and as such have been included here as examples due to their proximity.

As stated above in Section 5, in view of the conservation objectives for this species, the predicted impacts described above are not likely to have a significant effect on the qualifying interests of the European sites in question (Inishkea Islands and Duvillaun Islands SACs). It is considered therefore that the potential impacts of underwater noise on grey seals would not adversely affect the integrity of these or any other European site.

6.2.1.4 *Indirect impacts on prey species for cetaceans and pinnipeds*

Indirect impacts on the prey species of fish behaviour and availability for all species of Annex II marine mammal under consideration is also considered. Impacts on fish species are discussed in more detail in Section 6.2.1.6 below. This assessment focusses on the impacts on migratory species of fish listed under Annex II of the Habitats Directive, however does also consider other species of fish that will include likely prey species for cetaceans and seals in the vicinity of the proposed activities for which European sites have been designated. A number of species of fish have known sensitivity to underwater noise, in particular those whose auditory apparatus are closely linked with a swimbladder, such as herring are considered to be of higher sensitivity compared with others (Nedwell et al., 2004). Studies on smaller species of fish that would be expected to make up the prey species for marine mammals are more limited but would tend to suggest that impacts are extremely localised to the immediate vicinity of the underwater noise source at the Corrib Field and that furthermore impacts are of very short duration, and fish quickly resume normal behaviour once the sound source has passed by / ceased. Impacts on larger species such as salmonids, which would also be important prey would suggest that they are less sensitive to underwater noise (Nedwell et al., 2003, 2006; Popper, 2005). Salmonids are also highly mobile and relatively large, and therefore easily able to undertake avoidance behaviour and return following cessation of the As-Found and As-Left survey operations.

Due to the localised extent of the impact, the overall proportion of the prey species population that is affected is likely to be minimal. Designated species of marine mammals in the vicinity of the proposed activities have access to a large area for foraging and are highly mobile (as are their prey species), and consequently they have wide potential prey availability. Therefore, the localised and short duration impacts on prey species will not have a significant indirect impact on the marine mammal populations in the vicinity. The use of Soft-Start procedures will mitigate the impacts on prey species of fish by gradually increasing the intensity of the equipment over time allowing time for these species to take avoiding action.

6.2.1.5 *Seabirds in the coastal SPAs*

Although impacts to birds (and the SPAs to which they may contribute) from the proposed works are considered highly unlikely, they are briefly considered here.

Seabirds will occur at the Corrib Field, and it is probable that some of these individual birds are those that collectively contribute to the designation of an SPA. Depending on the foraging range of the species involved, these birds could contribute to the designation of SPAs which are either close to the proposed survey area (and shown in Figure 4-1, e.g. Inishglora and Inishkeeragh) or much further away. For example, gannets are reported as having a maximum foraging range of 640 km, which could therefore encompass individuals from SPAs in Scotland. Broadhaven Bay (in excess of 65 km from the Corrib Field) has an important breeding colony of Sandwich terns (*Sterna sandvicensis*) and these birds could be present in the area of the proposed works at a similar time to when works are taking place. Terns are surface feeding and very shallow diving and the impacts of acoustic surveys would not be expected to cause injury, however the disturbance either directly or indirectly to prey species of fish could potentially result in minor, non-significant impacts as described in the following section.

However, the potential exposure of birds to underwater noise varies greatly with their

feeding ecology. Some species may be at higher risk to noise sources either because a) they enter the water by plunge diving directly from the air (e.g. gannets) and therefore may not be able to detect noise prior to exposure; and b) they spend a relatively long time underwater and/or dive to a deep depth (e.g. auks, scoter). Other species of seabird (such as terns, gulls and shearwaters) only have very shallow diving depths and/or spend a short time underwater, thereby inherently minimising any exposure. Many species of wader and wildfowl that contribute to SPAs are unlikely to be affected, as they do not fully immerse their bodies in water when they are feeding (e.g. by wading or dabbling; examples contributing to the Inishkea Islands SPA (59 km from the Corrib Field) designation include ringed plover, sanderling, purple sandpiper, turnstone, barnacle goose and dunlin). A number of European sites have been considered for birds where there exists the potential for direct or indirect impacts as a result of the proposed operations.

Even for those species that are potentially at higher risk to noise exposure (e.g. auks), such exposure will be inherently minimised by the nature of the operations and related surveys and the location in which these take place. Factors inherently reducing risk (several of which are also applicable to marine mammals and fish) are summarised below:

- Natural flight response: most surface-diving birds (such as auks and scoter) will, in response to moving vessels, fly out of the way, due to natural evasion behaviour. This will therefore increase the distance between them and the highest sound levels;
- Exposure to sound: as noted, the sound pressure levels from the As-Found and As-Left acoustic sources are expected to attenuate rapidly in water. Furthermore, transducer-based acoustic sources will target sound directly downwards to the seabed from a close distance (the ROV will be operating close to the seabed), and in a narrow band or cone. To be subjected to maximum noise levels, birds would therefore have to be very close to the sound source. In practice this would require them to be very near the ROV (close to the seabed and therefore highly unlikely or not possible; see below). This scenario is considered unlikely. The soft start procedure will allow animals to move away from the area, or curtail a deep dive, in response to gradually increasing sound levels.
- Water depths: the peak source noise levels from the ROV will be largely restricted to near the seabed in deep water (c. 350 m). This depth is far beyond the maximum diving depths of the majority of the seabirds that might occur in the region (e.g. gannets and eider duck 40 m; black guillemots 50 m; puffins 70 m; BirdLife International, 2014). Two species (the guillemot and the razorbill have greater maximum diving depths (of 180 m and 140 m respectively, with maximum recorded dive times of over 3.5 minutes for guillemot), although the mean depths for these species are significantly shallower (90 m and 40 m respectively) (BirdLife International, 2014). It would therefore be highly improbable that any bird would be in close proximity to the noise source in deeper water (especially given soft-start procedure noted above); even if this was to occur, no injury would be expected to occur given that no fatalities of diving seabirds were recorded as a result of seismic surveys using much greater sound levels from equipment (see below).

In addition to the above factors, it is considered highly improbable that seabirds will be

impacted by the proposed work programme (using standard and widely-used equipment) given that there is some evidence that diving seabirds are not especially vulnerable to the much greater sound levels experienced as a result of airguns firing during seismic surveys. In a risk assessment for seismic surveys offshore from Ireland, Turnpenny and Nedwell (1994) cited research (Stemp, 1985) that considered the effects of seismic surveys on three seabird species; this concluded that no fatalities resulted, and any variations in abundance were within natural variation. A further study found no effect of seismic activity on movements and diving of long-tailed ducks in the North Pacific (*Clangula hyemalis*) (Lacroix et al. 2003).

Indirect impacts on the prey species behaviour and availability for seabirds is also considered. Impacts on fish species are discussed in Section 6.2.1.6 below. This assessment focusses on the impacts on migratory species of fish listed under Annex II of the Habitats Directive, however does also consider other species of fish that will include likely prey species for Annex II designated seabirds. A number of species of fish have known sensitivity to underwater noise, in particular those whose auditory apparatus are closely linked with a swimbladder, such as herring are considered to be of higher sensitivity compared with others (Nedwell et al., 2004). Studies on smaller species of fish that would be expected to make up the prey species of seabirds are more limited but would tend to suggest that impacts are extremely localised to the immediate vicinity of the underwater noise source and that furthermore impacts are of very short duration, and fish quickly resume normal behaviour once the sound source has passed by / ceased. In addition, due to the localised extent of the impact the overall proportion of the prey species population that is affected is likely to be minimal. Given that Annex II designated species of seabirds in the vicinity of the proposed activities have access to a large area for foraging and are highly mobile (as are their prey species), and consequently they have wide potential prey availability. Therefore, the localised and short duration impacts on prey species will not have a significant indirect impact on the seabird populations in the vicinity. The use of Soft-Start procedures will mitigate the impacts on prey species of fish by gradually increasing the intensity of the equipment over time.

The predicted impacts described above are considered unlikely to have a significant effect on the conservation objectives for diving seabird species for the European sites in question. Therefore, the potential impacts associated with underwater noise on seabirds are not considered to adversely affect the integrity of any of the coastal / offshore SPAs in proximity to the proposed activities at the Corrib Field.

6.2.1.6 *Fish species in Glenamoy Bog Complex, Mweelrea / Sheeffry / Erriff Complex, Owenduff / Nephin Complex, Newport River, River Moy and Killala Bay / Moy Estuary SACs*

As for seabirds described in the previous section above, although significant impacts to certain fish species (and consequently the integrity of the SACs for which they may contribute) from the proposed As-Found and As-Left surveys are considered highly unlikely, they are briefly considered here.

Of the Annex II fish species that occur in Ireland and have marine life history stages (i.e. river lamprey, sea lamprey, twaite shad, allis shad, salmon), the migratory salmon, river and sea lamprey contribute to the designation of SACs within Co. Mayo (i.e. the Glenamoy Bog Complex, Mweelrea / Sheeffry / Erriff Complex, Owenduff / Nephin Complex, Newport

River, River Moy and Killala Bay / Moy Estuary), and as are migratory could be impacted by the proposed activities. It is possible that these migratory species of fish may occur in coastal areas during the time of the proposed survey, although would not be expected to be in relatively close proximity to the acoustic survey sound sources being operated at the Corrib Field.

Significant impacts to migratory fish such as salmon and lamprey are considered highly unlikely, given knowledge on the known sensitivity of various fish species to underwater noise. Although some fish species (whose auditory apparatus are closely linked with the swimbladder, such as herring) are considered to be of high sensitivity (Nedwell et al., 2004), salmonids (e.g. salmon and trout, including sea trout) and lamprey are thought to be relatively insensitive to sound (Nedwell et al., 2003, 2006; Popper, 2005). Salmon are also highly mobile and relatively large, and therefore easily able to undertake avoidance behaviour and return following cessation of the underwater noise generating activities.

Lamprey are less mobile, but are less sensitive to higher frequency sounds, with sea lamprey showing behavioural changes, such as increased activity in response to low frequency sounds in the range of 50-200 Hz (Mickle et al., 2018). The use of Soft-Start procedures will provide ample time for migratory fish to avoid the sound source prior to the equipment reaching full intensity.

The potential impacts described above are considered unlikely to have any significant effect on the conservation objectives for these species for the European sites in question (Glenamoy Bog Complex, Mweelrea / Sheeffry / Erriff Complex, Owenduff / Nephin Complex, Newport River, River Moy and Killala Bay / Moy Estuary SACs) particularly given the frequency levels and intensity of the equipment to be used, the remoteness of the proposed operations from known European sites, and that Soft-Start procedures will be applied. Therefore, the potential impacts of underwater noise on migratory fish are not considered to have the potential to adversely affect the integrity of Glenamoy Bog Complex, Mweelrea / Sheeffry / Erriff Complex, Owenduff / Nephin Complex, Newport River, River Moy or Killala Bay / Moy Estuary SACs.

6.2.1.7 *Conclusion*

In view of the best scientific knowledge and in view of the conservation objectives of the designated sites, these proposed activities when taken either individually or in combination with other plans or projects, will not have a likely significant effect on any European site as a consequence of underwater noise or disturbance resulting from the works.

Impacts to the European sites in closest proximity to the proposed activities that have the potential to be impacted have been predicted as not significant. Given the nature of the impact sources, it is not expected that any residual impacts would result in significant impacts to designated features of other European sites in the wider locality or on their conservation objectives.

Therefore, as there are no residual impacts of underwater noise on the conservation objectives of any of the European sites in the vicinity of the Corrib development, the integrity of these sites is not expected to be adversely affected.

6.2.2 Other potential impacts

Impacts from the ROV support vessel and the flowline replacement activities in terms of standard emissions and discharges during operation will be minimised where possible. Emissions will be minimised through regular maintenance of all engines onboard, in line with Maritime Registry of Shipping (MRS), MARPOL 73/78 Annex VI (as appropriate) and other similar requirements. Vessel discharges will also be managed in accordance with the requirements of MARPOL 73/78 as appropriate.

As previously discussed, there will be a small volume of inhibited potable water and Alcolgel gel pill released at the manifold (the volume of the new 158 m flexible flowline), during the replacement works at the P6 wellhead. The chemicals released will include RX5225 and Alcolgel. The release of these chemicals is not considered to result in reduced water quality in the surrounding area and/or toxic effects on marine fauna, or European sites in the vicinity, as only a small volume will be released and rapid dispersion will occur. Chemicals have been selected for use for the P6 flexible flowline replacement work scope based on their performance in the aquatic environment.

As previously mentioned, fuel oil spillage along the vessel transit route to/from and within the proposed area of works at the Corrib Field from the ROV support vessel, could potentially result in a residual spill or slick. The likelihood of such an event occurring is considered to be very low. The ROV support vessel will only be refuelled at a designated port, will have strict safety, navigation, operations and communications plans in place to minimise collision risk and will have maintenance, audit and inspection plans in place to identify fuel spillage risks as soon as possible. Furthermore, during works the fuel valves will be kept closed and only marine grade oil will be used (less of an environmental hazard than heavy fuel oil).

All deck machinery will only be refuelled within a bunded area.

While it is accepted that a deposit of fuel oil within the European sites, or in areas where qualifying features could be impacted, could have a significant effect on the designated sites, including their qualifying interests for which the sites were selected, the protocols and procedures in place to prevent this occurrence and the low probability of such a deposit occurring mean that the overall significance of this impact is determined as very unlikely (negligible). The considerable distance between the work site at the Corrib Field and the closest European site (approximately 60 km) further reduces the significance of this impact.

There is also the potential for chemical leaks of the chemicals to be used during the flexible flowline replacement works. However, considering that the chemicals will be retained within the subsea process system and transported back to the BBGT via the main gas pipeline, the likelihood of a leak is extremely low. Furthermore, given the small volumes of chemicals to be used, the fact that they have been selected based on their performance in the aquatic environment, and the rapid dispersion in the marine environment, the impact on European sites or qualifying features in the event of a leak is low. Thus, considering the unlikelihood and the low potential impact, the overall significance of a chemical leak is determined as negligible.

During the installation works at the P6 wellhead and Corrib Central Manifold, construction and repair works using the ROV will entail some limited physical intervention using the ROV manipulators as well as localised disturbance and alteration to the seabed and

localised suspension of sediments in the immediate vicinity. Disturbance to the surrounding seabed habitat will be minimised and will be limited to the immediate location of the central Corrib Field. No seabed habitat within the boundary of any European site will be affected. The overall significance of this impacts is determined as negligible.

6.2.2.1 Conclusion

In view of the best scientific knowledge and in view of the conservation objectives of the sites, these activities when taken either individually or in combination with other plans or projects will not have a likely significant effect on any European site.

Impacts from other impact sources to the European sites in closest proximity to the proposed activities have been predicted as not significant. Given the nature of the impact sources, it is not expected that any residual impacts would result in significant effects on designated features of other European sites in the wider locality or on their conservation objectives.

Therefore, as there are no residual impacts of the proposed activities on the conservation objectives of any of the European sites in the vicinity of the Corrib development, the integrity of these sites will not be adversely affected.

6.3 Cumulative impacts

Given that the proposed activities will involve acoustic survey techniques and the presence of a vessel and ROVs, there is potential for cumulative impacts with other projects or plans in the area. For instance, cumulative impacts may occur from increased acoustic impacts or increased disturbance from vessels.

At the Corrib Field specifically, there is an additional work programme scheduled for summer 2020, as discussed in Section 2.3. This work is to undertake geophysical and visual surveys for inspection, maintenance and renewal of infrastructure. These surveys will cover the length of the Corrib offshore pipeline route, sections of the umbilical, the BBGT treated surface water outfall and the infield flowlines and umbilicals at the Corrib Field and between the manifold and landfall at Glengad. The programme will also involve the repair of the P6 wellhead and rectification/integrity testing at the Corrib field. The competent authority (DCCAE) concluded on the 26/11/2019 that there would be no significant impacts to European sites as a result of these proposed works. However, as the activities are proposed for a similar timeframe as the flexible flowline replacement works, cumulative impacts must be considered.

A review of projects planned by other contractors in the area over a similar timeframe has been undertaken, with the study area for this review covered a large enough area to include foraging and migratory ranges of sensitive species. The information is publicly available from the DCCAE and the Department of Housing, Planning and Local Government. One project was identified; Seismic, geophysical and environmental site surveys proposed at Licensing Option LO 16/23, by CNOOC Petroleum Ltd. An Appropriate Assessment has been undertaken so far for this project, with public consultation recently closing on 22nd November 2019.

As there is potential for two additional projects to take place within the study area within a similar timeframe to the flexible flowline replacement works, the potential impacts of all

projects need to be considered in combination. All projects will have an underwater noise impact through the use of equipment for geophysical and visual surveys and positioning, in addition to that from vessels. In addition, there will be a disturbance impact from the physical presence of vessels and associated equipment being present in the study area.

Due to the location of these projects, marine mammals as qualifying features, particularly the bottlenose dolphins designated in the West Connacht SAC and the harbour seals in the Clew Bay Complex SAC are likely to represent the worst case in terms of receptors to the potential cumulative impacts. The potential cumulative impacts from underwater noise on marine mammals, including bottlenose dolphins and harbour seals, would be as described in Section 5.2.2. However, these species are mobile, with the ability to move in any direction and over long distances in an open marine environment, while the frequencies of the survey equipment are outside their peak hearing thresholds. Therefore, it is unlikely there will be an impact on the qualifying species of the West Connacht and Clew Bay Complex SACs.

Communication between the operators will also ensure that operations are coordinated to limit noise exposure, and the stringent application of the described statutory-required marine mammal mitigation protocols by operators for the protection of these species will result in no significant cumulative impacts. Furthermore, regarding the Corrib works, efforts will be made to schedule the works over different weeks. For instance, the repair of the P6 wellhead cannot take place at the same time as the connection of the new flexible flowline to it.

The impact of disturbance from additional vessels and equipment in the area will be minimised by the short-duration of the project activities and the limited area of each project.

As all activities will take place in the open marine environment underwater noise will be rapidly attenuated. The mitigation procedures in place will also allow designated marine mammals and other species adequate time and ability to temporarily leave the affected area and avoid entanglement/disturbance.

Overall, it can be determined that the additional proposed projects in or close to the Corrib Field will not result in any significant effects on any European protected sites or key designated species in the vicinity of the Corrib Field, nor will they adversely affect the integrity of any such site.

7 CONCLUSION

As a result of the assessment undertaken in support of the AA process, which takes account of the best scientific knowledge and the conservation objectives of each European site, it can be determined that the proposed flexible flowline replacement works and related surveys taken individually or in combination with other plans or projects, are not likely to have a significant effect on a European site.

If it is decided that it is necessary to carry out an appropriate assessment under Article 6.3 of the EU Habitats Directive, it is the view of the authors of this NIS that based on the scientific evidence presented (including the monitoring undertaken since annual geophysical inspection and maintenance surveys of the Corrib development subsea infrastructure began following installation in 2009), that the proposed operations will not adversely affect the integrity of the European sites in the vicinity and in the wider location or on any other designated site, when taken individually or when taken in combination with the other plans or projects and there is no reasonable scientific doubt in this regard.

The conservation objectives for the Special Areas of Conservation (i.e. the habitats and species for which they have been selected) will not be compromised by the proposed operations, and there will be no likely significant effect on the European sites in the Natura 2000 network either when taken individually or when taken in combination with the other plans or projects.

However, if it is decided that, it is necessary to carry out an appropriate assessment under Article 6(3) of the EU Habitats Directive, this NIS provides the requisite information to ground such an assessment. In the context of such an assessment it is the considered view of the authors of this NIS that the proposed survey operations will not adversely affect the integrity of any European sites or on any other designated site and there is no reasonable scientific doubt in this regard.

The conservation objectives for the Special Protection Areas (i.e. the species for which they have been selected) will not be compromised by the proposed operations, and there will be no likely significant effect on the European sites in the Natura 2000 network either when taken individually or when taken in combination with the other plans or projects.

However, if it is decided that, it is necessary to carry out an appropriate assessment, this NIS provides the requisite information to ground such an assessment. In the context of such an assessment it is the considered view of the authors of this NIS that the proposed operations will not adversely affect the integrity of any European sites or on any other designated site and there is no reasonable scientific doubt in this regard.

8 REFERENCES

- Anderwald, P., Coleman, M., O'Donovan, M., Pinfield, M., Walshe, L., Haberlin, D., Jessopp, M., and Cronin, M. (2011). *Marine mammal monitoring in Broadhaven Bay 2010*. Progress Report to RSK Environment Limited Group. Coastal and Marine Research Centre, University College Cork, Ireland.
- Anderwald, P., Brandecker, A., Haberlin, D., Coleman, M., Collins, C., O'Donovan, M., Pinfield, R. and Cronin, M. (2012). *Marine mammal monitoring in Broadhaven Bay 2011*. Progress Report to RSK Environment Limited Group. Coastal and Marine Research Centre, University College Cork, Ireland.
- Birdlife International (2014). BirdLife Seabird wikispace. <http://seabird.wikispaces.com/home> [accessed 10th June 2014]
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: *Terrestrial, Freshwater, Coastal and Marine* version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.
- Culloch, R., Brandecker, A., Collins, C., Haberlin, D., Kruegel, K., McGovern, B. Jessopp, M. and Cronin, M. (2014). *Marine mammal monitoring in Broadhaven Bay 2013*. Progress Report to RSK Environment Limited Group. Coastal and Marine Research Centre, University College Cork, Ireland.
- Culloch, R., Brandecker, A., Kruegel, K., McGovern, B., Pinfield, R., Robbins, J., Jessopp, M. and Cronin, M. (2014). *Marine mammal monitoring in Broadhaven Bay 2014*. Progress Report to RSK Environment Limited Group. Beaufort/Coastal and Marine Research Centre, University College Cork, Ireland.
- Ecological Advisory and Consultancy Services (EACS) (2015). Corrib Gas Pipeline: Operation under Section 40 of the Gas Act 1976 (as amended) - Natura Impact Screening Statement - Screening for Appropriate Assessment. Report prepared for Shell E&P Ireland – 18 August 2015.
- EPA (2015). Advice Notes for Preparing Environmental Impact Statements (draft) Environmental Protection Agency, Wexford September 2015
- EPA (2017). *Guidelines on the information to be contained in environmental impact assessment reports* (draft) Environmental Protection Agency, Wexford August 2017
- ERT/Aqua-Fact International Services (2007). Second Strategic Environmental Assessment for Oil and Gas Activity in Ireland's Offshore Atlantic Waters: IOSEA2 Porcupine Basin, Environmental Report. Department of Communications, Energy and Natural Resources.
- European Communities (*Birds and Natural Habitats*) Regulations 2011 (S.I. No. 477 of 2011).
- European Commission (2018). Final *Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.*, (21-11-18) C (2018) 7261 Final. Commission Notice Brussels.
- Evans, P.G.H. and Nice H. (1996). Review of the effects of underwater sound generated

by seismic surveys on cetaceans. Sea Watch Foundation, Oxford.

Gisiner, R.C., 1998. Proceedings on workshop on the effects of anthropogenic noise in the marine environment. 10-12 February 1998. Marine Mammal Science Program, Office of Naval Research, VA, USA.

Haberlin, D., Anderwald, P., Brandecker, A., Collins, C., Kruegel, K. and Cronin, M. (2013). *Marine mammal monitoring in Broadhaven Bay 2012*. Progress Report to RSK Environment Limited Group. Coastal and Marine Research Centre, University College Cork, Ireland

Johnson, C. S. (1967). "Sound detection thresholds in marine mammals," in Marine Bioacoustics, edited by W. Tavalga (Pergamon, New York), pp.247–260

Kastelein, R., Bunschoek, P., Hagedoorn, M., Whitlow A & de Haan, D. (2002). Audiogram of a harbor porpoise (*Phocoena phocoena*) measured with narrow-band frequency-modulated sounds. *The Journal of the Acoustical Society of America*. 112. 334-44. 10.1121/1.1480835.

Lacroix, D.L., R.B. Lanctot, J.A. Reed, and T.L. McDonald. (2003). Effect of underwater seismic surveys on molting male Long-tailed Ducks in the Beaufort Sea, Alaska. *Canadian Journal of Zoology* 81(11):1862-1875.

Mickle, M.F, Miehl, S.M., Johnson, N.S., and Higgs, D.M. (2018). Hearing capabilities and behavioural responses of sea lamprey (*Petromyzon marinus*) to low-frequency sounds. *Canadian Journal of Fisheries and Aquatic Science*.

Nedwell J.R., Langworthy, J., and Howell, D. (2003). *Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise*. Subacoustech Report Reference: 544R0424 submitted to COWRIE.

Nedwell J.R., Edwards, B., Turnpenny, A.W.H. and Gordon, J. (2004). *Fish and marine mammal audiograms: a summary of available information*. Subacoustech Report Reference: 534R0214.

Nedwell, J.R, Turnpenny, A.W.H, Lovell, J.M., Edwards, B. (2006). An investigation into the effects of underwater piling noise on salmonids. *Journal of the Acoustic Society of America* 120, 5, 2550-2554.

NPWS, (2009, revised February 2010). Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities. Department of Environment, Heritage and Local Government (DoEHLG)
<http://www.npws.ie/media/npws/publications/codesofpractice/AA%20Guidance%2010-12-09.pdf>

NPWS (2011). Conservation Objectives: Clew Bay Complex SAC 001482. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012 a). Conservation Objectives: Slyne Head Islands SAC 000328. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012 b). Conservation Objectives: Killala Bay/Moy Estuary SAC 000458. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012 c). Conservation Objectives: Donegal Bay (Murvagh) SAC 000133. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012 d). Conservation Objectives: Lower River Shannon SAC 002165. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012 e). Conservation Objectives: River Shannon and River Fergus Estuaries SPA [004077]. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 a). Conservation Objectives: Duvillaun Islands SAC 000495. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 b). Conservation Objectives: Cummeen Strand/Drumcliff Bay (Sligo Bay) SAC 000627. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 c). Conservation Objectives: Ballysadare Bay SAC 000622. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 d). Conservation Objectives: Galway Bay Complex SAC 000268. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 e). Conservation Objectives: Rutland Island and Sound SAC 002283. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013 f). Conservation Objectives: Inner Galway Bay SPA [004031]. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014 a). Conservation Objectives: Mullet/Blacksod Bay Complex SAC 000470. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014 b). Conservation Objectives: Broadhaven Bay SAC 000472. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
http://www.npws.ie/sites/default/files/protectedsites/conservation_objectives/CO000472.pdf

NPWS (2014 c). Conservation Objectives: Kilkieran Bay and Islands SAC 002111. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014 d). Conservation Objectives: Horn Head and Rinclevan SAC 000147. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014 e). Conservation Objectives: Blacksod Bay/Broad Haven SPA 004037. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014 f). Conservation Objectives: Mid-Clare Coast SPA [004182]. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015 a). Conservation Objectives: West Connacht Coast SAC 002998. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht

NPWS (2015 b). Conservation Objectives: Inishkea Islands SAC 000507. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015 c). Conservation Objectives: Inishbofin and Inishshark SAC 000278. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015 d). Conservation Objectives: Connemara Bog Complex SAC 002034. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015 e). Conservation Objectives: Slieve Tooey/Tormore Island/Loughros Beg Bay SAC 000190. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015 f). Conservation Objectives: West of Ardara/Maas Road SAC 000197. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2016). Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017 a). Conservation objectives: Glenamoy Bog Complex SAC 000500. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017 b). Conservation Objectives: Owenduff/Nephin Complex SAC 000534. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017 c). Conservation Objectives: Mweelrea/Sheeffry/Erriff Complex SAC 001932. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

NPWS (2017 d). Conservation Objectives: The Twelve Bens/Garraun Complex SAC 002031. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017 e). Conservation Objectives: Maumturk Mountains SAC 002008. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017 f). Conservation Objectives: Lough Corrib SAC 000297. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2018 a). Conservation objectives for Newport River SAC 002144. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 b). Conservation objectives for Lough Gill SAC 001976. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 c). Conservation objectives for Lough Melvin SAC 000428. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 d). Conservation objectives for Lough Eske and Ardnamona Wood SAC

000163. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 e). Conservation objectives for Inishkea Islands SPA [004004]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 f). Conservation objectives for Inishglora and Inishkeeragh SPA [004084]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 g). Conservation objectives for Termoncarragh Lake and Annagh Machair SPA [004093]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 h). Conservation objectives for Duvillaun Islands SPA [004111]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 i). Conservation objectives for Bills Rocks SPA [004177]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 j). Conservation objectives for Stags of Broad Haven SPA [004072]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 k). Conservation objectives for Clare Island SPA [004136]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 l). Conservation objectives for Illanmaster SPA [004074]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 m). Conservation objectives for Cruagh Island SPA [004170]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 n). Conservation objectives for Connemara Bog Complex SPA [004181]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 o). Conservation objectives for West Donegal Coast SPA [004150]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 p). Conservation objectives for Ardboline Island and Horse Island SPA [004135]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 q). Conservation objectives for Inishmore SPA [004152]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 r). Conservation objectives for Inishmurray SPA [004068]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 s). Conservation objectives for Inishduff SPA [004115]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 t). Conservation objectives for Cliffs of Moher SPA [004005]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 u). Conservation objectives for Tory Island SPA [004073]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 v). Conservation objectives for Loop Head SPA [004119]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 w). Conservation objectives for Horn Head to Fanad Head SPA [004194]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

NPWS (2018 x). Conservation objectives for Inishtrahull SPA [004100]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

Ó Cadhla, O., and Strong, D (2007). *Grey seal moult population survey in the Republic of Ireland, 2007*. Unpublished report to the National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland. Coastal & Marine Resources Centre, University College Cork. 22pp.

Popper, A.N. (2005). *A Review of Hearing by Sturgeon and Lamprey*. U.S. Army Corps of Engineers, Portland District.

Richardson, W.J., Greene, C.R., Malme, C.I. and Thomson, D.H. (1995). *Marine Mammals and Noise*. Academic Press Ltd, London.

Ridgway, S & Joyce, P.L. (1975). *Studies on seal brain by radiotelemetry*. Rapp. P.-V. Reun. Cons. Int. Explor. Mer. 169. 81-91.

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. & Jessopp, M. (2018). *Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017*. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp.

RSK (2001). *Corrib Field Development Offshore (Field to Terminal) Environmental Impact Statement*, Report prepared for Enterprise Energy Ireland Ltd. 2001

RSK (2010). *Corrib Offshore EIS – Supplementary Update Report*. Report prepared for Shell E&P Ireland Ltd – May 2010.

RSK (2016). *Corrib Marine Mammal Observations*. Annual Report 2016 prepared for Shell E&P Ireland Ltd – December 2016.

RSK (2018). *Corrib Marine Mammal Observations*. Annual Report 2017 prepared for Shell E&P Ireland Ltd – May 2018.

RSK (2019). *Corrib Marine Mammal Observations*. Annual Report 2018 prepared for Shell E&P Ireland Ltd – February 2019.

RSK, 2019. EIA screening and environmental risk assessment – Corrib Subsea Inspection, Maintenance and Infrastructure Renew Surveys 2019. Prepared on behalf of Vermilion E&P Ireland Ltd. June 2019.

RSK, 2019. Natura Impact Statement – Corrib Subsea Inspection, Maintenance and Infrastructure Renew Surveys 2019. Prepared on behalf of Vermilion E&P Ireland Ltd. June 2019.

Simpson, S.D. and Bruintjes, R. (2016). Audiometry, using Auditory Evoked Potentials (AEP) to Determine Hearing Thresholds of a Number of Cohorts of Salmon. In Harding, H., Bruintjes, R., Radford, A.N. and Simpson, S.D.: Measurement of Hearing in the Atlantic salmon (*Salmo salar*) using Auditory Evoked Potentials, and effects of Pile Driving Playback on salmon Behaviour and Physiology. *Scottish Marine and Freshwater Science* Vol 7 No 11.

Southall, B.L., Bowles, A.E. Ellison, W.T., Finneran, J.J. Gentry, R.L. Greene, C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and

P.L. Tyack. (2007) Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*, 33 (4) 411-521

Shell E&P Ireland Ltd. (2018). Corrib Vessel Code of Conduct for Vessels and Personnel Undertaking Survey, Operations or Maintenance Activities on the Corrib Offshore Pipeline- Document No: COR-14-SH-0227

Thompson, D. (1998). Biology of seals of the north-east Atlantic in relation to seismic surveys. Paper presented at the seismic and marine mammals workshop, 23-25 June 1998, London.

Turnpenny, A.W.H. and Nedwell, J.R. (1994). *The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sound Generated by Seismic Surveys*. Report from Fawley Aquatic Research Laboratories Ltd, FCR 089/94.