Vermilion Exploration & Production Ireland Limited

Corrib subsea infrastructure inspection, and maintenance surveys

EIA screening and environmental risk assessment for Annex IV species

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RSK

RSK GENERAL NOTES

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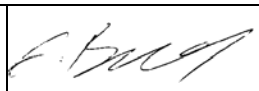
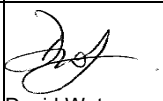
Authorised by:	 Andrew Bendell	**Project Manager**	**Date:**	**12-01-21**
Authorised by:	 David Watson	**Project QA Rep**	**Date:**	**12-01-21**

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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

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 Background

Vermilion Exploration & Production Ireland (Vermilion) plan to undertake a geophysical and visual survey programme of the Corrib offshore gas pipeline, sections of the umbilical, Bellanaboy Bridge Gas Terminal (BBGT) treated surface water outfall pipeline, and infield flowlines and umbilicals between the Corrib Field manifold and the landfall at Glengad, northwest Co. Mayo, between the months of May and September 2021. In addition to the survey works a limited programme of maintenance works will also be undertaken to ensure seabed stability and as a consequence ensuring integrity of the pipeline and other infrastructure. These works may involve localised areas of seabed sediment dredging and the placement of rock filter units in areas of pipeline free spanning. The surveys will inspect and assess the integrity of the subsea structures and are being undertaken to provide up-to-date seabed asset data, which will help determine the exact requirements of maintenance work scheduled for 2021 and beyond. The work will be carried out by two vessels (one for inshore and one for offshore) using a combination of acoustic survey techniques, namely multibeam echo sounder (MBES), side-scan sonar and sub- bottom profiler; furthermore, a visual survey using an underwater vessel deployed video / and stills camera (inshore) and ROV (offshore) will also be undertaken.

1.2 EIA screening for oil and gas exploration activities

Council Directive 85/337/EEC of 27th June 1985 on the assessment of the effects of certain public and private projects on the environment ('EIA Directive') put in place a system whereby certain projects by reason of their type, size, location, etc. must be assessed as to their likely effects on the environment through the process of Environmental Impact Assessment. Projects listed under Annex I must be subject to the EIA process in all cases (with the exception of national defence projects), while for those listed under Annex II EIA is at the discretion of the member states. Annex II projects will be subject to EIA based on predetermined thresholds or assessed on a case-by-case basis, as set out in national legislation. Where thresholds are set, some sub-threshold projects may be subject to EIA due to the likelihood of significant effects on the environment due to factors such as their nature, size, location, etc.

The EIA Directive has been amended three times. Directive 97/11/EC brought in the concept of transboundary effect; increased the number of projects covered by the Directive and also presented new screening criteria (Annex III) for assessing whether an Annex II project should be subject to EIA when considered on a case-by-case basis. Directive 2003/35/EC aimed to align public participation as set out in the Directive with the Aarhus Convention on public participation in decision-making and access to justice in environmental matters. Directive 2009/31/EC added projects to Annexes I and II that related to CO_2 transport, capture and storage.

The original 1985 Directive and its three amending directives were codified by Directive 2011/92/EU. In transposing the EIA Directive into Irish law (European Communities (Environmental Impact Assessment) Regulations 1989 – S.I. 349/1989 as amended), Ireland chose to set thresholds above which an EIA is required for projects listed under Annex II, while also allowing for sub-threshold projects to be subject to EIA where the Competent Authority considers the project is likely to have significant effects on the environment.

A further codification of the EIA Directive and its amendments by Directive 2014/52/EU has taken place and this amends Directive 2011/92/EU. This has now been transposed into Irish legislation (The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

It is understood that the proposed geophysical and visual surveys and limited maintenance programme would not fall under Annex I or II of the EIA Directive (or the First Schedule of the Irish 1989 regulations as amended, which transposes the Directive and its Annexes), and therefore does not require an EIA to be carried out on these grounds.

Other current relevant documentation in respect of EIA screening in Ireland include the following:

- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Government of Ireland, August 2018);*
- *Guidelines on the Information to be Contained in the Environmental Impact Assessment Reports, Draft August 2017 (EPA, 2017)*

1.2.1 Previous assessments

The proposed survey programme has also been considered under the European Union (Environmental Impact Assessment) (Petroleum Exploration) Regulations 2013 (S.I. 134 of 2013), which gives the Minister the discretion to require an Environmental Impact Statement (EIS) to be prepared where a significant effect on the environment is likely. As such a high-level impact screening exercise has been carried out (Section 4).

A full EIS was submitted and approved for the offshore phases of the project (RSK, 2001). The offshore EIS was updated in a Supplementary Update Report (RSK, 2010) to reflect changes to the project scope of works, as well as updates to the environmental baseline. The offshore EIS and update report included a project description, baseline for environmental and social receptors such as commercial fisheries, the physical environment, marine archaeology and seascape/landscape, and assessed all potential impacts from the project with regard to subsea infrastructure installation, as well as operational impacts as a result of vessel operations, and including subsea surveys.

The Consent to Operate the Corrib Gas Pipeline was issued pursuant to Section 40 of Gas Act, as amended. This consent was awarded in 2015 subject to a number of conditions, based on commitments made in the offshore EIS and its supplementary updates and the Consent to Operate application itself. Condition 20 of the Consent to Operate was as follows:

'Subsea facilities and flowlines will be subject to annual inspection to ensure that protection measures remain effective and any remedial measures necessary to provide additional protection will be undertaken as soon as practically possible. The first such

inspection will be undertaken within the first month from the start of commercial gas production, when the flowlines are at maximum operating pressure and temperature'.

In 2019, a necessary programme of subsea inspection, maintenance and infrastructure renewal surveys was proposed at the Corrib Field in accordance with Condition 20 of the Consent to Operate. RSK completed an EIA Screening and Environmental Risk Assessment for Annex IV species and a Natura Impact Statement for the proposed survey activities (RSK, 2019 a and b respectively). On the 26th November 2019, it was concluded through Appropriate Assessment by the Department of Communications, Climate Action and Environment (DCCAE)[1] (the competent authority) that the proposed surveys would not adversely impact the integrity of any relevant European sites, considering the sites' conservation objectives and the mitigation methods proposed. It was also concluded through the EIA Screening and Environmental Risk Assessment that the proposed surveys would not significantly impact any relevant Annex IV species. The survey programme has since taken place in the summer of 2020.

RSK has also completed an EIA Screening and Environmental Risk Assessment for Annex IV species and a Natura Impact Statement for proposed replacement of a flexible flowline at the P6 wellhead, including As-found and As-left geophysical and acoustic surveys (RSK, 2020 b). These reports have been submitted to the DCCAE for review.

This EIA screening and Risk Assessment document focuses on those impacts associated with underwater noise generated during the annual geophysical survey operation and the limited maintenance programme proposed for the pipeline for 2021 as required under Condition 20 of the Consent to Operate. All other operational impacts, including as a result of vessel operations, as well as those associated with subsea infrastructure installation were summarised and relevant sections referenced from the EIS and supplementary update in the Roadmap for EIS Documentation (RSK 2015), which was submitted as Appendix A to the Cover Letter in the Application for Consent to Operate the Corrib Pipeline under Section 40 of the Gas Act. This signposts to the relevant sections of the Offshore EIS and Supplementary Update where particular activities are assessed for environmental impacts. The Roadmap for EIS Documentation (RSK, 2015) is provided as Appendix 1 to this document for reference.

Section 3.2.1 of the Natura Impact Screening Statement (NISS) (EACS, 2015) of the Consent to Operate application details the previously assessed and approved operational activities associated with the offshore pipeline, while Section 5.2 discusses the various permits, consents and approvals under which the activities were included. Tables detailing the activities that have been previously assessed, and screened as part of the appropriate assessment process, are appended to this document as Appendix 2 for reference (EACS, 2015).

Impacts associated with underwater noise have been assessed in detail in this EIA screening and Risk Assessment document, and the high level EIA screening that has also been undertaken here for the annual inspection and maintenance survey operations has been carried out to ensure that any changes in the project scope, baseline receiving environment, designations or legislative regime are considered fully. No significant changes are noted. This has therefore concluded that an EIS / EIA would not be required

[1] Formally the Department of Communications, Energy and Natural Resources (DCENR) and as of September 2020 now known as the Department of the Environment, Climate and Communications.

in relation to the proposed survey programme in 2021. The results of this exercise have been provided for confirmation. The report continues by providing an additional risk assessment for species with the potential to be impacted the proposed survey operations, in particular those species that are listed under Annex IV of the EU Habitats Directive 92/43/EEC Article 12, which are considered to be the most sensitive receptors to the proposed activities.

A further codification of the EIA Directive and its amendments by Directive 2014/52/EU has taken place and this amends Directive 2011/92/EU. This has not yet been transposed into Irish legislation, although is considered in draft form. However, in accordance with the requirement that it should have been brought into force by Member States by 16 May 2017 (EC, 2017), in practice it is treated as though it has been fully enacted.

1.3 Appropriate Assessment

This report is submitted in support of an application to the Department of the Environment, Climate and Communications for permission to undertake the programme of survey work proposed. In addition to this report a Natura Impact Statement (NIS) for Appropriate Assessment (AA) report has also been submitted in support of the application. The NIS (RSK, 2020 a) has been prepared in order to assist the Competent Authority to undertake an Appropriate Assessment if it is deemed that there is the potential for likely significant effects on any Natura 2000 site. The inspection and maintenance geophysical survey scope of work is assessed annually in order to take into consideration any changes that may have occurred in the interim in respect of sites designated under the EU Habitats or Birds Directives.

It is also important to note that these survey activities were assessed during the appropriate assessment screening in 2015, as part of an overarching assessment for a number of ongoing scopes of work in relation to the operation of the Corrib pipeline (EACS, 2015), and were assessed by the Minister as part of the Section 40 Consent to Operate application, prior to consent being given.

The accompanying NIS report for 2021 surveys describes the Natura 2000 sites in the vicinity of the proposed survey works and assesses the potential impacts on the integrity of these sites and their receptor habitats and species, including bottlenose dolphins (*Tursiops truncatus*), grey seals (*Halichoerus grypus*), and seabirds, as well as potential accidental impacts such as a fuel spill.

It is recommended that the NIS report be read in conjunction with this report when considering the application.

1.4 Environmental risk assessment

Under the EU Habitats Directive 92/43/EEC Article 12, member states are required to establish a system of strict protection for the animal species listed on Annex IV, which in Irish waters includes all cetaceans, some turtle species, and otter. This environmental risk assessment for the proposed activities has been prepared as required under the

2011 Department of Communications, Energy and Natural Resources (DCENR[2]) "Rules and Procedures Manual for Offshore Petroleum Exploration and Appraisal Operations", (DCENR, 2011) and relates specifically to the potential impact of the proposed activities on Annex IV species. As a result, Vermilion are required to ensure that current best industry practice is applied with regard to impact mitigation and monitoring measures during operations such as site surveys, which utilise underwater acoustic sources.

Accordingly, surveys will be carried out in accordance with the National Parks and Wildlife Service (NPWS) 2014 "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters", which recently replaced the 2007 "Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish waters' or the Code of Conduct (CoC)". Joint Nature Conservation Committee (JNCC) qualified Marine Mammal Observers (MMOs) will be present on geophysical survey vessels in an advisory capacity, although they will have the power to delay the commencement of any operations that have been assessed as potentially posing a risk to Annex IV species. All masters and duty watchkeepers of vessels are required to familiarise themselves with this risk assessment (particularly sections discussing mitigation).

The waters in the vicinity of the Corrib Field have the potential to support an ecologically diverse range of resident and/or migratory Annex IV designated, as well as other sensitive species. Annex IV species considered to have the potential to occur in the vicinity of the proposed survey area includes five species of marine turtle: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*); and approximately 18 species of cetaceans: harbour porpoise (*Phocoena phocoena*); bottlenose (*Tursiops truncatus*), common (*Delphinus delphis*), Risso's (*Grampus griseus*), white-sided (*Lagenorhynchus acutus*), white-beaked (*Lagenorhynchus albirostris*) and striped (*Stenella coeruleoalba*) dolphins; long-finned pilot (*Globicephala melas*), false killer (*Pseudorca crassidens*), killer (*Orcinus orca*), northern bottlenose whale (*Hyperoodon ampullatus*), Cuvier's beaked (*Ziphius cavirostris*), sperm (*Physeter macrocephalus*), minke (*Balaenoptera acutorostrata*), blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), sei (*Balaenoptera borealis*) and humpback (*Megaptera novaeangliae*) whales. European otter (*Lutra lutra*) are also listed under Annex IV of the Directive and have the potential to be present in environs of Broadhaven Bay. In addition, grey (*Halichoerus grypus*) and harbour (common) (*Phoca vitulina*) seals are also present in Irish waters, and are listed as Annex V species, a status that affords similar levels of protection, and thus are included as part of the assessment.

This report includes an assessment; the primary focus of which is the potential impacts from noise and disturbance to marine species listed under Annex IV of the EU Habitats Directive 92/43/EEC Article 12. In addition, other key receptor species that are not designated under Annex IV, and that have the potential to be impacted from underwater noise and disturbance from the proposed survey activities are considered. These include species of fish and seabirds that have the potential to be present in the vicinity of the proposed survey activities. Summary risk assessment tables are however provided, that

[2] Between 2016 and September 2020 the DCENR (Department of Communications, Energy and Natural Resources) was known as the Department of Communications, Climate Action and Environment (DCCAE). This is now referred to as the Department of the Environment, Climate and Communications

identify and assess the full range of potential impacts from the proposed survey activities, including collision risk, shipboard pollution etc, while Section 4 provides an EIA screening assessment.

1.5 Document structure

The contents of this report are structured as follows:

Section 1 – Introduction to this EIA screening assessment and environmental risk assessment for Annex IV and other sensitive species;

Section 2 – Brief description of the baseline conditions;

Section 3 – Outline of the project description;

Section 4 – EIA screening assessment tables;

Section 5 – Discussion of the potential impacts to Annex IV and other sensitive species from the proposed survey programme;

Section 6 – Outline of mitigation measures;

Section 7 – Risk assessment matrix;

Section 8 – Conclusions.

2 ENVIRONMENTAL BASELINE

2.1 Geographical setting and principal project seabed assets

The Corrib natural gas field (Corrib Field) is located in the northeast Atlantic, within frontier acreage blocks 18/20 and 18/25, approximately 65 km off the closest point on the coast of northwest County Mayo. The Corrib Field extends over an area of 15 km^2, over which the seabed varies in depth from approximately 335 m to 425 m. An export pipeline runs from the subsea facility to the landfall location at Glengad, Broadhaven Bay, in an approximate east/west orientation (Figure 3-1).

2.1.1 Pipeline and umbilical

The Corrib Field has been developed as a subsea production facility, where all associated equipment has been placed directly on the seabed, and gas is brought to shore via a 20" subsea pipeline (approximately 83 km from the offshore manifold to the landfall at Glengad). The role of the umbilical is to control and manage conditions within the pipeline, and the injection of pipeline chemicals such as corrosion inhibitors.

2.1.2 Bellanaboy Bridge Gas Terminal (BBGT) surface water discharge pipeline

Treated surface runoff from potentially contaminated areas of the BBGT site are collected and treated before being discharged via a long sea outfall to a discharge diffuser off Erris Head. The outfall pipeline is piggy-backed onto the main subsea pipeline for much of its length, although in places its route does differ slightly. The pipeline is protected by a combination of concrete mattresses and deposited rock filter and armour layers where required.

2.1.3 In-field flowlines and umbilicals

The infield flowlines and umbilicals are at the Corrib Field and link the individual wells to the Corrib Central manifold. The umbilicals control the wells themselves and are used for the injection of a range of chemicals, while the infield flowlines bring gas from the wells to the central manifold. Where required the umbilicals and flowlines at the Corrib Field are protected by rock.

2.2 Physical environment

2.2.1 Bathymetry

The continental shelf is relatively narrow along the north-west coast of Ireland. The Corrib Field at a distance of 65 km offshore, is in an area of approximately 350 m water depth, on the continental slope, or continental margin, at the shelf break.

2.2.2 Waves and tidal regime

The west of Ireland faces the North Atlantic Ocean, and waves travel undisturbed for thousands of miles before reaching the coastline. Greatest anticipated significant wave height in Broadhaven Bay is approximately 6.2 m, based on a water depth of 10 m. The maximum significant waves are from the west and can affect the whole of Broadhaven Bay.

The predominant currents on the western coast of Ireland are formed by the weak, meandering eddies that exist on the south-east periphery of the North Atlantic current. Surface currents are generally controlled by surface fronts, with currents flowing clockwise around the Irish coast. Currents flow poleward in winter, at up to 30 cm/s, but are weaker and more variable in summer.

Nearshore currents generally flow in a south to north direction around the coast of Ireland. The tidal streams off Erris Head are stronger than those at the outer shelf. Within Broadhaven Bay the tidal streams run in and out of the inlets of the Sruwaddacon, North Bay and the southern arm of Broadhaven.

The mean spring tidal range at Broadhaven is 3.0 m, while the neap tidal range is 1.4 m.

2.2.3 Seawater quality

The approximate summer sea surface temperatures range is 13-15°C off Erris Head, with the temperature of the surface layers (20–30 m) remaining relatively constant and well mixed, with evidence of a thermocline developing below this depth. Temperatures near the seabed (c. 90 m) are approximately 11-12°C. At the Corrib Field at c.350 m water depth, seawater temperatures are slightly cooler in the range 9-11°C.

As would be expected in a coastal area with little freshwater input, observed differences in the salinities of the surface waters are relatively small (salinity at 5 m below the surface is between 34.5 ppt and 35 ppt), with small increases through the water column to the seabed (34 ppt to 35.5 ppt).

Low concentrations of trace metals, suspended particulate matter, ammoniacal nitrogen and hydrocarbons are reported in the waters off Erris Head. This reflects the open nature of the marine environment and the limited freshwater input into the area, concentrations of these parameters are lower offshore given the fully marine conditions in the vicinity of the Corrib offshore field and pipeline route.

2.2.4 Seabed sediment characteristics

The seabed surface sediments in the Corrib Field area are silty sands, which overlie buried iceberg scours. The seabed in the area shows evidence of having been trawled, and there are sand ripples due to tidal currents. For a distance of about 35 km along the pipeline route towards the coast there are also ancient iceberg scours filled with silts and sands. In the outer approaches to Broadhaven, there is a stretch of about 15 km of intermittent sands and gravels. Immediately offshore of Broadhaven the seabed sediments consist of sands, with grains of uniform size. Within Broadhaven there are extensive areas of rock outcrop on the seabed associated with areas of boulders, sandy channels are present through the rock.

Low concentrations of trace metals, organic matter and hydrocarbons have been reported in the sediment collected along the pipeline route.

2.2.5 Climatic Conditions

The only greenhouse gases that are anticipated to be emitted from offshore operations in significant quantities is carbon dioxide. The carbon dioxide emissions from maintenance survey activities are limited. Overall, the project supports a strategic fuel switch from solid fuel and oil to natural gas and renewables, and so contributes to a reduction in national greenhouse gas emissions.

2.3 Benthic environment

The benthic communities in the Corrib Field area are typical of a deep water, sandy/muddy substrate area. The communities have moderate to high diversity and are dominated by the tube-dwelling polychaete *(Galathowenia oculate)*. Also common to communities in the area of the Corrib Field are spionid, terebellid and sabellid polychaetes, amphipod and isopod crustacea, opisthobranch molluscs, bivalves and juvenile echinoderms.

The mobility of the sediments inshore in Broadhaven Bay means that there are low numbers of species and individuals present in that area. The exposed nature of the bay influences the intertidal and near-shore communities, and they are relatively species poor because of this. The coarse sand of the seabed is not stable in the long-term and, as such, the communities do not have time to develop before the substrate is moved around by tides and currents. The species that have been recorded are typical of sandy sediments communities, with high contributions to community composition from spionid polychaetes, the amphipods (*Bathyporeia* sp.) and cumaceans.

2.4 Annex IV species in Irish waters

2.4.1 Cetaceans

Irish waters are known to support a diverse range of cetacean species (whales, dolphins and porpoises). Twenty-four cetacean species have been recorded in Irish waters, with harbour porpoise, common, bottlenose, Risso's, Atlantic white-sided and white-beaked dolphins, and long-finned pilot whale, known to breed in Irish waters (Berrow, 2002).

Approximately 18 species of cetacean have been recorded off the northwest coast of County Mayo and are considered to have the potential to occur in the vicinity of the offshore pipeline route at least on a seasonal basis (Gordon *et al*., 1999; O Cadhla *et al*., 2004; RSK, 2010). At Broadhaven Bay in which the landfall is located, nine species of cetacean have been recorded from dedicated monitoring studies undertaken since 2001 (Anderwald *et al*, 2013).

2.4.1.1 Distribution and seasonality

A number of dedicated studies, and surveys undertaken onboard 'ships of opportunity', have provided data on the distribution of cetaceans in Irish waters (e.g. Northridge *et al*., 1995; Tasker *et al*., 1997; Reid *et al*., 2003; O Cadhla *et al*., 2004). In addition, the Irish Whale and Dolphin Group (IWDG) have collected data on the distribution and relative

abundance of cetaceans in Irish waters since 1991. The IWDG casual and constant effort sightings schemes record data mainly from land-based sightings and surveys. Despite this, many gaps in spatial and seasonal coverage still exist, especially off the northwest Irish coast and in all waters outside of the summer months.

Table 2-1 ((adapted from Clark and Charif, 1998, Berrow, 2002, RSK 2001, O Cadhla *et al*., 2004, IOSEA1 (ERT, 2006), Anderwald *et al* 2013, IWDG, 2014 and IUCN, 2019) summarises information on cetacean occurrence in the vicinity of the proposed survey area.

The distribution of marine mammals in Irish waters is thought to be closely linked to the distribution and seasonality of their prey. Baleen whales normally feed on krill and small shoaling fish. Accordingly, their distribution is related to oceanic features such as fronts and upwellings, and areas where prey items aggregate. The diet of the toothed whales (which include dolphins, beaked whales and sperm whale) consists of chiefly of fish and cephalopods. The distribution of toothed whales is also thought to be strongly related to water depth (O' Cadhla *et al*., 2004). Harbour porpoises and bottlenose dolphins are primarily coastal and continental shelf based species. Species such as pilot whales and white-sided dolphins are predominantly found in waters overlying continental slopes and oceanic areas. The deep water found off the west and northwest of Ireland provides a habitat to these species, along with others such as sperm and beaked whales. Along with Cuvier's beaked whale, mentioned in Table 2-1, other species of beaked whales may be sighted in the deep water slope and canyon habitats of the Rockall Trough, west of the Corrib Field. However, sighting usually occur in unfavourable conditions and so cannot be identified to species level, although Northern bottlenose whale (*Hyperoodon ampullatus*), Sowerby's beaked whale *(Mesoplodon bidens*), True's beaked whale (*Mesoplodon mirus*) and Gervais' beaked whale (*Mesoplodon europaeus*) may be present in offshore waters (Wall *et al*., 2013).

Recent incidental monitoring of marine mammals in the vicinity of the Corrib Field during an ocean bottom seismic survey in 2012, and marine mammal monitoring in Broadhaven Bay, tends to support the appraisal of cetacean distributions provided in Table 2-1. Highest numbers of sightings of cetaceans in these surveys occurred during June, followed by August, October and September.

Table 2-1: Cetacean species of the north-east Atlantic margin

Species	IUCN status	Occurrence	Frequency of sightings
Toothed whales (Odontocetes)			
Harbour porpoise *Phocoena phocoena*	Least concern	Common around the entire Irish coast, and present year round. Known to breed in Irish waters. Regularly recorded in Broadhaven Bay.	Peak in August – November.
Bottlenose dolphin *Tursiops truncatus*	Least concern	This species is often associated with coastal or inshore areas, but an offshore population is also considered to be continuously distributed along Ireland's Atlantic Margin. Breeding in Irish waters. Designated species for the West Connacht Coast SAC. Regularly recorded in Broadhaven Bay.	Year round, but peak in summer months.
Common dolphin *Delphinus delphis*	Least concern	One of the most commonly recorded species of cetacean in Irish waters, particularly in offshore areas, and is found throughout the Irish Atlantic Margin. Known to breed in Irish waters. Regularly recorded in Broadhaven Bay.	Peak during spring and summer.
Striped dolphin *Stenella coeruleoalba*	Least concern	Although generally considered to be a warm-temperate oceanic species, a number of sightings occur each year in Irish waters.	Most frequent in summer and early autumn months.
Risso's dolphin *Grampus griseus*	Least concern	Known to breed in Irish waters and recorded year round. Records exist in the vicinity of the Corrib Field area, and the entrance of Broadhaven Bay (at Erris Head).	Peak in April – September.
Atlantic white-sided dolphin *Lagenorhynchus acutus*	Least concern	Known to breed in Irish waters. Predominantly recorded in waters overlying the continental slope, generally not recorded with regularity in coastal waters. Recorded in Broadhaven Bay in 2002.	Summer months.
White-beaked dolphin *Lagenorhynchus albirostris*	Least concern	Known to breed in Irish waters. Generally found in offshore waters off the Irish west coast along the shelf edge and on the continental shelf, occasionally coming close to shore. Recorded in Broadhaven Bay in 2002.	Peak in late summer – autumn.
Long-finned pilot whale *Globicephala melas*	Least concern	Known to breed in Irish waters. This species is often associated with offshore areas, and waters over 1000 m in depth.	Most frequent between April and September.

Species	IUCN status	Occurrence	Frequency of sightings
False-killer whale *Pseudorca crassidens*	Near threatened	Rare visitor to Irish waters.	Uncommon.
Killer whale O*rcinus orca*	Data deficient	Widely distributed species. In the northeast Atlantic, normal distribution is from Iceland-Norway to the Atlantic Margin waters of north-western Britain and Ireland. Occasional sightings in Irish waters. Recorded in Broadhaven Bay.	Most frequent in spring and autumn.
Cuvier's beaked whale *Ziphius cavirostris*	Least concern	Beaked whale species are observed less regularly due to their offshore distributions, and other factors such as their diving physiology, but recent research efforts and stranding data have confirmed their presence in Irish waters. Particularly vulnerable to underwater sound sources.	Strandings peak in spring and summer.
Sperm Whale *Physeter macrocephalus*	Vulnerable	Sperm whales are occasionally observed in Irish waters off the continental shelf.	All year, but sightings more frequent in spring, early summer and autumn.
Baleen whales (Mysticetes)			
Minke whale *Balaenoptera acutorostrata*	Least concern	Widely distributed around Ireland and throughout the Irish Atlantic Margin particularly in shelf and coastal areas. Regularly recorded throughout Irish waters. Recorded in Broadhaven Bay.	Peak May – September.
Blue whale *Balaenoptera musculus*	Endangered	Few sightings in Irish waters, although acoustic monitoring has confirmed that blue whales are present in small numbers throughout the year. Migrate annually along the western seaboard.	Unclear, but thought that November – December might represent peak time.
Fin whale *Balaenoptera physalus*	Vulnerable	The annual movements of fin whales are poorly understood, although acoustic surveys show the species may be detected throughout the year. Annual migration along western seaboard. A single individual was recorded in Broadhaven Bay in 2008.	Unclear, contradictory evidence as recorded more regularly in summer months, although acoustic monitoring data suggest a peak in November – December.

Species	IUCN status	Occurrence	Frequency of sightings
Sei whale *Balaenoptera borealis*	Endangered	Generally considered to be a deepwater pelagic species, surveys have recorded sei whales throughout the offshore waters of the Irish Atlantic margin. Some records of sightings in inshore Irish waters (Visser *et al*, 2010) but thought generally uncommon to the northwest of Ireland.	April – December. They have a northerly distribution in Irish Atlantic Margin waters between April and June and a more southerly distribution in late summer and autumn.
Humpback whale *Megaptera novaeangliae*	Least concern	Relatively uncommon in the waters of north and west Ireland. However, there have been a number of casual sightings in offshore waters off the northwest of Ireland, but chiefly off the Irish south coast (particularly counties Cork, Kerry, Waterford, and Wexford).	Peak between July and January.
North Atlantic right whale *Eubalaena glacialis*	Endangered	Likely to represent a vagrant species on the edge of their range in the northeast Atlantic. Populations historically decimated due to whaling, now extremely rare in Irish waters.	Summer months, if present.

2.4.1.2 *Designated areas and cetaceans*

The West Connacht Coast candidate Special Area of Conservation (SAC) (Site code: 002998) has been proposed for designation under the Habitats Directive for the presence of bottlenose dolphins. The site consists of an offshore area of 66,016 ha off the coast of the Mullet peninsula and counties Mayo and Galway.

Bottlenose dolphin are known to occur within the site throughout all seasons 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 dolphins, with possibly up to 150-200 individuals or more occurring within the site as a whole. The SAC is known to be used for a variety of activities including foraging and resting, and adults closely accompanying calves are commonly observed in summer and autumn months. The SAC lies approximately 1 km from the pipeline route at its closest point, at Erris Head.

Other designated areas for cetaceans at increased ranges from the proposed survey operations are listed in the protected areas section (2.6), and are considered in the Natura Impact Statement (RSK, 2020 a) that accompanies this application.

2.4.2 Turtles

Five species of marine turtle have been recorded in Irish waters, and all are listed under Annex IV of the Habitats Directive. Of these, only the leatherback turtle (*Dermochelys coriacea*; IUCN status: vulnerable), has been recorded with any regularity. Loggerhead (*Caretta caretta*; IUCN status: vulnerable) and Kemp's Ridley turtles (*Lepidochelys kempii*; IUCN status: critically endangered), occur infrequently, sometimes being recorded in winter and spring. Green (*Chelonia mydas*; IUCN status: endangered) and hawksbill (*Eretmochelys imbricata*; IUCN status: critically endangered) turtles are considered vagrant species.

Providing an estimate of the number of leatherbacks foraging within Irish waters is difficult as their numbers may be extremely low. It is thought the northern distribution of leatherback turtles is limited by the position of the 15 °C isotherm (McMahon and Hayes, 2006). As the position of this varies between years, the suitability of Irish waters for foraging leatherbacks may also vary, with favourable and unfavourable years in terms of abundance. Surface water temperature in offshore areas in the vicinity of the Corrib Field are reported to generally range from 14°C in August to 8°C in February (ERT, 2006). Leatherbacks migrate over large distances to feed on gelatinous zooplankton in temperate waters. As a result, sightings are regularly made in the summer along the entire western seaboard of Ireland.

2.5 Other designated receptor species in the vicinity of the project

2.5.1 Seals

Two species of seal breed on the west coast of Ireland, the harbour (common) seal (*Phoca vitulina*; IUCN status: least concern) and the grey seal (*Halichoerus grypus*; IUCN status: least concern).

Grey seals are found around the entire Irish coastline. During the annual breeding season, between September and December, grey seals predominantly stay close to shore. The moulting season follows closely, occurring between the months of November and April. Grey seals are typically the most regularly observed seal species, and marine mammal, observed in Broadhaven Bay (Anderwald *et al.*, 2013). This is likely to be a result of proximity of the site to the Inishkea Islands, which represent the largest breeding and moulting colony of grey seals in Ireland (Ó Cadhla *et al*., 2007).

Adult grey seal are known to forage over large areas and may travel considerable distances from their haul-out sites. It is possible therefore that grey seals from important sites in Galway and Donegal may forage along the entire extent of the survey area.

Important haul-out and breeding areas for harbour seals are found in counties Galway, Sligo and Donegal. Adult harbour seals generally breed in June or July each year. Soon after breeding, in August and September, harbour seals undergo their annual moult. During this time, they spend most of their time ashore. Harbour seals are recorded regularly in Broadhaven Bay, but in much lower numbers than that of grey seals.

The foraging range harbour seals are thought to be much less than that of greys, with most trips only a few tens of kilometres from their favoured haul-out sites. However, more recent studies have found that longer distance trips were not uncommon (ERT, 2006). It would be thus reasonable to assume that harbour seals may forage along the majority of the pipeline, and potentially the vicinity of the Corrib Field.

Both grey and harbour seals are listed as Annex II species, i.e. species of community interest whose conservation requires the designation of SACs. The SACs designated for seals are listed in the protected areas section (2.6) but are further considered in the Natura Impact Statement (RSK, 2020 a).

2.5.2 Otter

The European otter is protected under Annex II and IV of the Habitats Directive. The European population is near threatened on the IUCN Red List (Conroy *et al*., 2007). Dedicated marine mammal monitoring in Broadhaven Bay provides records of two animals in 2011, one sighting of three animals in 2008, and two animals in 2002 (Anderwald *et al.*, 2013). Terrestrial faunal monitoring for the Corrib development, undertaken since 2001 and ongoing, has shown a constant and frequent presence of otters in and around the coastal areas of Broadhaven and Sruwaddacon Bays throughout.

Otters are a primarily terrestrial or freshwater species. As part of their feeding ecology, they may undertake foraging trips in marine environments, but require a source of freshwater to negate the formation of salt crystals in their coat, which can compromise their ability to retain heat. As such, otters are considered unlikely to occur along the survey route and are not considered further as part of the Risk Assessment.

2.5.3 Fish

The offshore and coastal waters around Ireland are productive and support a diverse community of fish, with 377 marine fish species recorded. Important commercial species that occur on the continental shelf off the west coast of Ireland include pelagic species such as mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*), herring

(*Clupea harengus*), and albacore tuna (*Thunnus alalunga*), and demersal species such as monkfish (*Lophius piscatorius*), haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), ling (*Molva molva*) and hake (*Merluccius merluccius*). Deepwater fish species present in the area include blackbelly rosefish (*Helicolenus dactylopterus*), roundnose grenadier (*Coryphaenoides rupestris*) and tusk (*Brosme brosme*). Of the fish populations in Irish waters mentioned here, most are considered of least concern on the IUCN Red List (IUCN, 2019), however, some populations such as the European population of the roundnose grenadier are considered endangered (Cook *et al*., 2015).

None of the species are listed under Annex IV of the Habitats Directive, but the migratory fish, Atlantic salmon (*Salmo salar*; IUCN status: vulnerable (European regional assessment)), sea lamprey (*Petromyzon marinus*; IUCN status: least concern), river lamprey (*Lampetra fluviatilis*; IUCN status: least concern), twaite shad (*Alosa fallax*; IUCN status: least concern) and allis shad (*Alosa alosa*; IUCN status: least concern) all occur on Annex II. Salmon migrate from the west coast of Ireland north towards Greenland (Marine Institute, 2019 a) while the other species are more limited in their migratory pathways in coastal areas. The SACs which include these fish as designated features are listed in the protected areas section (2.6) but are also considered in greater detail in the Natura Impact Statement (RSK, 2020 a) which accompanies this application.

There are some of the important fish spawning and nursery areas for species such as mackerel offshore Ireland and a “Biologically Sensitive Area” (BSA) was established by the EU Commission in 2003 as a result. This BSA is located to the south of the survey area, off the south-west coast of Ireland (Marine Institute, 2019 b). There are spawning grounds off the Mayo coast for many of the demersal species found in the vicinity of the proposed survey area, including haddock, hake, cod (*Gadus morhua*), monkfish and whiting. The spawning period for most species is between late winter and spring. Eggs and young fish are pelagic, and the larvae can stay in the plankton for up to six months, and so the area is also an important nursery ground. The peak spawning for pelagic species such as mackerel is usually late spring / early summer (Coull *et al*., 1998; Marine Institute, 2009; Ellis *et al.*, 2012). However, it should be noted that spawning and nursery grounds are not fixed and may vary spatially over time, as may the spawning period.

2.5.4 Seabirds

A number of seabirds have been recorded in the vicinity of the Corrib Field and Mayo coastal waters. The coastal and offshore waters of Ireland are essential feeding grounds for many seabirds, including non-breeders and passage migrants, throughout the year. Species that have been recorded as present year-round included fulmar (*Fulmarus glacialis*), northern gannet (*Morus bassanus*) and European shag (*Phalacrocorax aristotelis*). Seasonal migrants present included manx shearwater (*Puffinus puffinus*) and storm petrel (*Hydrobates pelagicus*), while passage migrants include great (*Puffinus gravis*), Cory's (*Calonectris borealis*) and sooty (*Ardenna grisea*) shearwaters, and great skuas (*Stercorarius skua*) (Rogen *et al*., 2018). Most of these species are summer migrants, occurring in higher abundance between July and August, however some species such as great-northern diver (*Gavia immer*) occur mainly in winter.

Migrant and resident gull species, such as Sabine’s gull (*Xema sabini*), glaucous gull (*Larus hyperboreus*), both species of black-backed gulls (*Larus marinus* and *Larus*

fuscus), and black-legged kittiwakes (*Rissa tridactyla*) may also occur in the area. However, the areas of proposed survey activities, particularly offshore, are regarded to have lower densities of seabirds than areas to the north and south during the summer (Rogan *et al*., 2018).

Most populations of seabirds around the Irish coast are considered of least concern on the IUCN Red List. However, sooty shearwaters are considered near threatened and black-legged kittiwakes are considered vulnerable (BirdLife International, 2019).

Seabirds present in the area include species listed on Annex I of the EU Birds Directive, and as such have coastal SPAs designated for them. These SPAs are listed in the protected areas section below and are further considered in the Natura Impact Statement (RSK, 2020 a) which also accompanies this application.

2.6 Protected areas

Protected areas in the vicinity of the Corrib Field are shown in Table 2-2. The sites described are those with qualifying marine fauna species that could move into the area of the Corrib Field and had the potential to be impacted. These include long distance foraging and migratory species of birds, fish and marine mammals and megafauna. Nature Reserves, Natural Heritage Areas and National Parks were not considered as they are predominantly designated for terrestrial habitats and species, and these sites were geographically remote from the offshore location of the Corrib Field.

The European protected sites that have been listed in Table 2-2 are designated due to their qualifying receptor interest features of birds, fish and marine mammals that have the potential for pathway impacts as a result of the proposed activities at the Corrib Field. Sites have been included that take into consideration the likely foraging or migratory ranges of these species. Within these ranges are the potential ranges for impacts from for example underwater noise or fuel spill to the sea surface. Typical foraging / migration ranges being considered much greater are used as a worst case range for including protected sites. Typically for resident and semi-resident species of marine mammals the foraging or migratory range has been assumed at approximately 200 km. For migratory fish and the majority of seabirds a similar distance of 200 km has been assumed. For certain species of seabirds however (northern gannet, Manx shearwater and fulmar, European storm petrel, and great skua), these ranges are extended based on the mean maximum estimated breeding season foraging ranges of these species discussed in Woodward *et al*., (2019). These can be up to 1347 km for Manx shearwater. Not all sites designated as SPAs are included. As discussed above, only those sites with designated receptors that have the potential for pathway impacts are included. These are most likely to be as a result of noise / disturbance as a result of the proposed survey activities. As such sites designated for marine birds only include those where species of diving seabirds, or those that spend significant time in or on the sea are included (e.g. species such as puffins razorbills, fulmar, gannets etc).

Figure 2-1 and Figure 2-2 below show the pertinent European sites in relation to the Corrib Field.

Table 2-2: Protected areas along the north-west Irish coast

Site name	Site code	Approximate distance from site to survey area at closest point (km)
Special Area of Conservation (SAC)		
Broadhaven Bay	000472	Overlap (0 km)
Glenamoy Bog Complex	000500	0 km
West Connacht Coast	002998	*c.* 1 km
Erris Head	001501	2 km
Mullet Bay/Blacksod Bay Complex	000470	*c.* 10 km
Owenduff/Nephin Complex	000534	16.5 km
Inishkea Islands	000507	19.5 km
Duvillaun Islands	000495	26.5 km
River Moy	002298	30 km
Killala Bay/Moy Estuary	000458	39 km
Newport River	002144	40 km
Clew Bay Complex	001482	42 km
Mweelrea/Sheeffry/Erriff Complex	001932	61 km
Cummeen Strand/Drumcliff Bay (Sligo Bay)	000627	73 km
Inishbofin and Inishshark	000278	74 km
The Twelve Bens/Garraun Complex	002031	74 km
Ballysadare Bay	000622	76 km
Maumturk Mountains	002008	76 km
Slieve Tooey/Tormore Islands/Loughros Beg Bay	000190	82.5 km
Lough Corrib	000297	86 km
Lough Gill	001976	87 km
Connemara Bog Complex	002034	89 km
Slyne Head Islands	000328	94 km
Kilkieran Bay and Islands	002111	100 km
Lough Melvin	000428	99 km
West of Ardara/Maas Road	000197	101 km
Donegal Bay (Murvagh)	000133	111 km
Rutland Island and Sound	002283	112 km
Lough Eske and Ardnamona Wood	000163	118 km
Galway Bay Complex	000268	130 km
Horn Head and Rinclevan	000147	150 km
Lower River Shannon	002165	166 km
Special Protection Area (SPA)		

Site name	Site code	Approximate distance from site to survey area at closest point (km)
Blacksod Bay/Broadhaven	004037	0 km
Termoncarragh Lough and Annagh Machair	004093	9 km
Mullet Peninsula	004227	9 km
Stags of Broadhaven	004072	9 km
Illanmaster	004074	12 km
Inishglora and Inishkeeragh	004084	13 km
Inishkea Islands	004004	19 km
Duvillaun Islands	004111	26 km
Clare Island	004136	50 km
Bills Rocks	004177	50 km
Ardboline Island and Horse Island	004135	73 km
Inishmurray	004068	76 km
West Donegal Coast	004150	78 km
Cruagh Island	004170	86 km
Inishduff	004115	89 km
Connemara Bog Complex	004181	89 km
Donegal Bay	004151	98 km
Inner Galway Bay	004031	123 km
Inishmore	004152	125 km
Cliffs of Moher	004005	145 km
Tory Island	004073	148 km
Horn Head to Fanad Head	004194	150 km
Mid-Clare Coast	004182	160 km
River Shannon and River Fergus Estuaries	004077	188 km
Loop Head	004119	189 km
Kerry Head	004189	201 km
Inishtrahull	004100	208 km
Dingle Peninsula	004153	220 km
Blasket Islands	004008	243 km
Iveragh Peninsula	004154	248.5 km
Puffin Island	004003	273 km
Skelligs	004007	281 km
Deenish Island and Scariff Island	004175	283 km
Beara Peninsula	004155	289 km
The Bull and The Cow Rocks	004066	300 km

Site name	Site code	Approximate distance from site to survey area at closest point (km)
Irish Sea Front	UK9020328	308 km
Treshnish Isles	UK9003041	321 km
Rum	UK9001341	358 km
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island	UK9013121	364
Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro	UK9014051	397

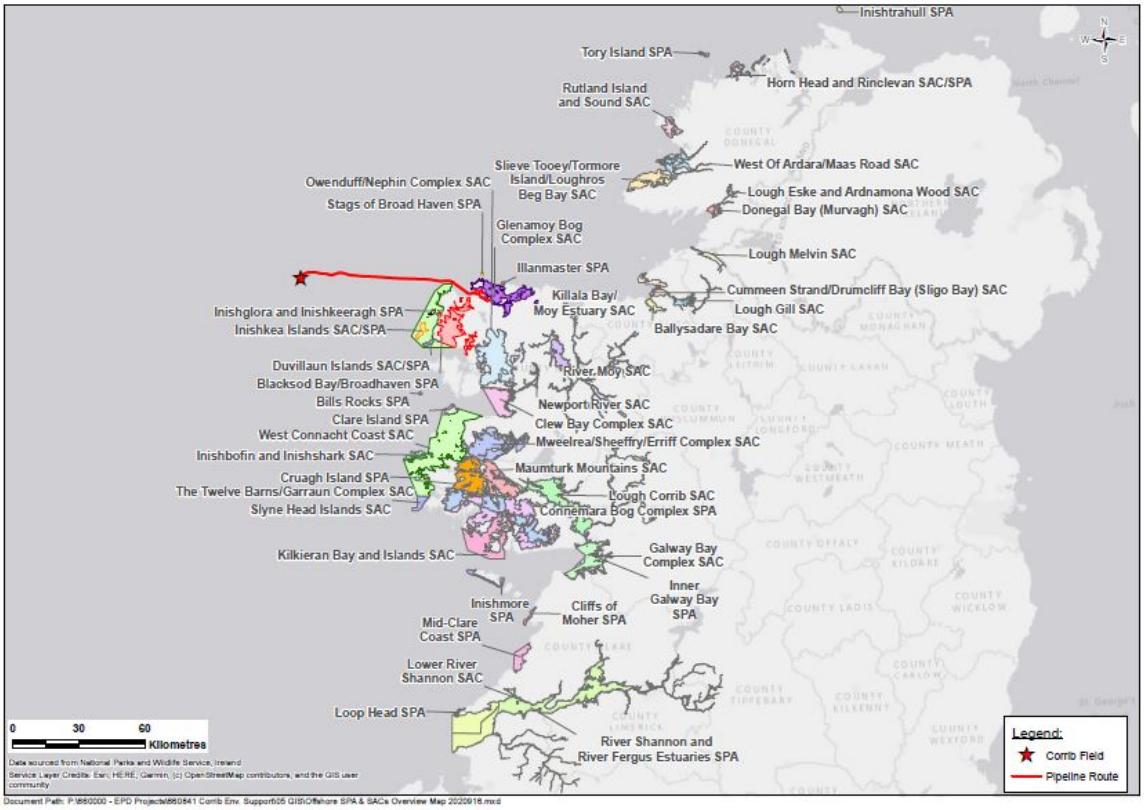


Figure 2-1 European sites in proximity to the proposed infrastructure inspection and maintenance survey programme (within 200 km)

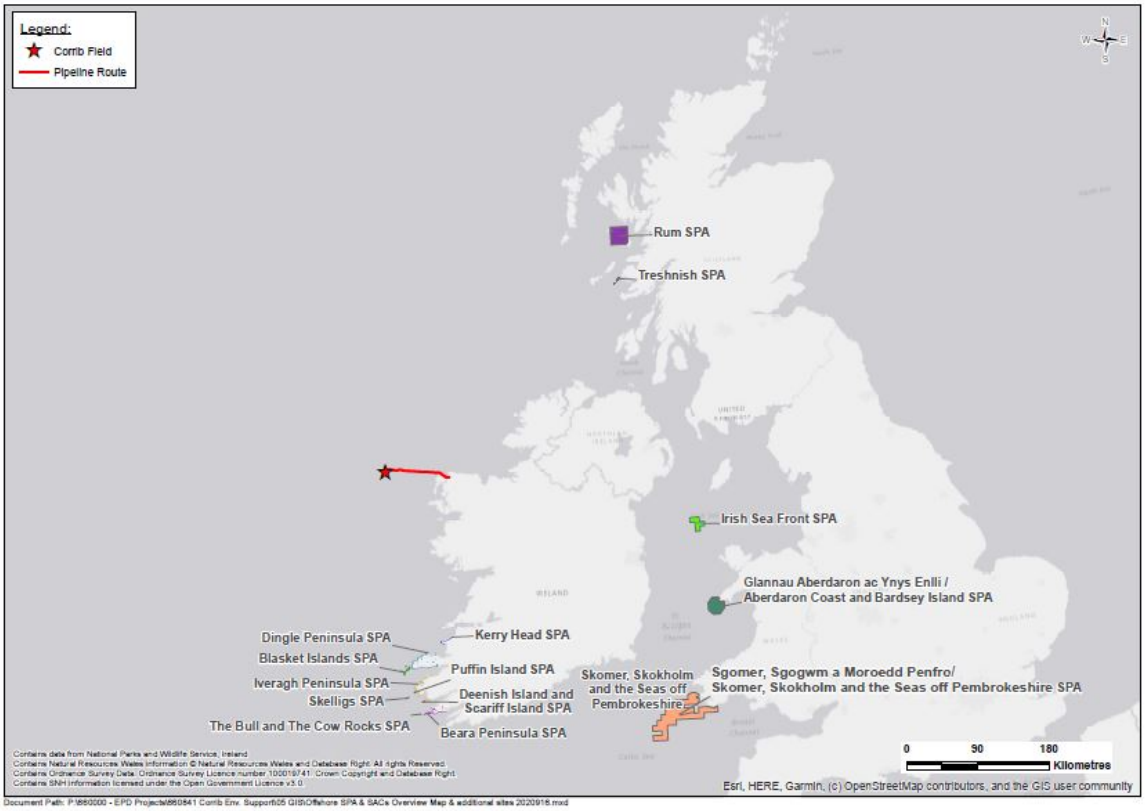


Figure 2-2 Additional European sites in included in the wider area of search for the proposed infrastructure inspection and maintenance survey programme

As discussed in Section 2.4.1, the West Connacht Coast SAC is designated for bottlenose dolphins. The Lower River Shannon SAC is also designated for bottlenose dolphins.

The following 15 SACs are designated for seals:

- Inishkea Islands
- Duvillaun Islands
- Killala Bay/Moy Estuary
- Clew Bay Complex
- Cummeen Strand/Drumcliff Bay (Sligo Bay)
- Inishbofin and Inishshark
- Ballysadare Bay
- Slieve Tooey/Tormore Island/Loughros Beg Bay
- Slyne Head Islands
- Kilkieran Bay and Islands
- West of Ardara/Maas Road
- Donegal Bay (Murvagh)
- Rutland Islands and Sound
- Galway Bay Complex
- Horn Head and Rinclevan.

The following 16 SACs include one or more species of migratory fish (salmon, river and sea lamprey):

- Glenamoy Bog
- Owenduff/Nephin Complex
- River Moy
- Killala Bay/Moy Estuary
- Newport River
- Mweelrea/Sheeffry/Erriff Complex
- Cummeen Strand/Drumcliff Bay (Sligo Bay)
- The Twelve Bens/Garraun Complex
- Maumturk Mountains
- Lough Corrib
- Lough Gill
- Connemara Bog Complex
- Lough Melvin
- West of Ardara/Maas Road
- Lough Eske and Ardnamona Wood
- Lower River Shannon.

The remaining SACs listed are designated due to predominantly terrestrial habitats that are not impacted by the survey activities.

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 biodiversity. They are:

- Mullet Bay/Blacksod Bay Complex (OSPAR site code: O-IE-0002972)

- Cummeen Strand/Drumcliff Bay (OSPAR site code: O-IE-0002973)
- Kilkieran Bay and Islands (OPSAR site code: O-IE-0002979)
- Galway Bay Complex (OSPAR site code: O-IE-0002969).

The Natura 2000 sites, including the OSPAR MPAs, are discussed in more detail in the accompanying Natura Impact Statement (RSK, 2020 a).

Ramsar sites (Wetlands of International Importance) are those designated under the Ramsar Convention[3] typically coincide with other Natura 2000 sites discussed above, specifically with SPAs as Ramsar sites are important for waterbirds. Many Ramsar sites are designated for their inland, terrestrial wetland habitats and so are not impacted by the survey activities.

However, some are coastal. There are five coastal Ramsar sites within a range of approximately 200 km of the Corrib Field area:

- Blacksod Bay and Broadhaven
- Killala Bay/Moy Estuary
- Cummeen Strand
- Trawbreaga Bay
- Inner Galway Bay

These sites coincide with SPAs of similar names, and the importance of their constituent habitats to waterbirds is part of their designation. Only Blacksod Bay/Broadhaven Bay SPA is named in Table 2-2 as the other SPAs/Ramsar sites are not in the immediate vicinity of the survey area (within 200 km) and are not designated for the diving seabirds or those that spend significant time in or on the sea and are considered key receptors within this EIA Screening Assessment.

2.7 Human environment

2.7.1 Fisheries

The area around the Corrib Field is considered to be of moderate value for commercial fishing within an Irish context, and fishing activity occurs all year round, when the weather conditions are suitable. There is a fisheries exclusion zone within the Corrib Field at the end of the pipeline.

Based on records from fisheries observers, the main fishing ground in the Corrib Field area is the “West of Stags” area, with the demersal species the main catch: monkfish *(Lophius piscatorius)*, haddock *(Melanogrammus aeglefinus)*, saithe *(Pollachius virens)*, whiting *(Merlangius merlangus)* and hake (Gerritsen and Kelly, 2019). The main commercially important shellfish caught in the area include Dublin Bay prawn (*Nephrops norvegicus*), squid (*Loligo vulgaris*) and crab (*Cancer pagurus*). The Corrib Field and offshore parts of the pipeline route also lie within the spawning grounds for the Dublin Bay prawn.

Commercially important demersal species such as monkfish, haddock, saithe, whiting, ling and hake are also caught in the Corrib Field area and offshore parts of the pipeline

[3] https://www.ramsar.org/wetland/ireland

route, by Irish, Spanish and French trawlers operating year-round. Towards the end of the pipeline there is medium fishing effort from Irish and international demersal otter trawls (Gerritsen and Kelly, 2019).

Pelagic species are fished by an international fleet of large vessels in spring and again from September to December. Irish pelagic trawls also take place. Pelagic trawl effort within the Corrib Field is spread along the pipeline, with most effort just outside the 12 nm boundary, while international long line effort is focused at the end of the pipeline. Irish pelagic trawl effort follows a similar pattern, with horse mackerel *(Trachurus trachurus)* and mackerel *(Scomber scombrus)* the species landed into Ireland (Gerritsen and Kelly, 2019).

The fisheries nearer to shore focus on shellfish, and pelagic species such as mackerel, herring *(Clupea harengus)* and blue whiting *(Micromesistius poutassou)*. Closer inshore to the east of the Corrib Field there is an area where herring and sprat (*Sprattus sprattus*) spawn.

Inshore fisheries in the area include those vessels operating out of Broadhaven Bay. Within Broadhaven Bay itself the most important fisheries are for crab and lobster (*Homarus gammarus*) that are fished by small, locally-based vessels mostly during the summer months, with weather conditions being restrictive at other times of the year. Potting, dredge fishing and line fishing are the main methods of fishing within the Bay.

Killybegs, Co. Donegal, is the largest port in Ireland for live fish landings and is located to the north east of the Corrib field. Killybegs lands predominately pelagic species, with a small proportion of demersal species. Small ports around Broadhaven Bay land mainly shellfish (Gerritsen and Kelly, 2019).

2.7.2 Shipping

Compared to the south and east coasts of Ireland, the north western coast has a relatively low density of shipping traffic (Figure 2-3 and Figure 2-4). The Mayo coast has only fairly minor ports, used primarily for nearshore fishing and recreational navigation. The port of Killybegs in Co. Donegal to the north east of the Corrib pipeline and Galway, Co. Galway, to the south east are the closest large ports.

Routes between Killybegs and Galway contribute to the shipping along the Co. Mayo coastline (Figure 2-3 and Figure 2-4). Shipping is generally concentrated in coastal waters, with vessels including cargo vessels, fishing vessels involved in nearshore activities and passenger vessels. Limited numbers of personal leisure boats (e.g. high speed crafts and/or sailing vessels) may also be in the coastal, inshore waters, particularly during the summer months.

Tankers and fishing vessels are generally the vessels with routes in offshore waters. The latest vessel density figures show a concentration of vessels around the end of the Corrib pipeline when compared to the surrounding area (EMODnet, 2019; Figure 2-3), mainly related to the fishing areas described above (EMODnet, 2019; Figure 2-4). Most vessels in the vicinity of the Corrib pipeline are likely Irish and international fishing vessels or vessels conducting works related to the Corrib pipeline itself.

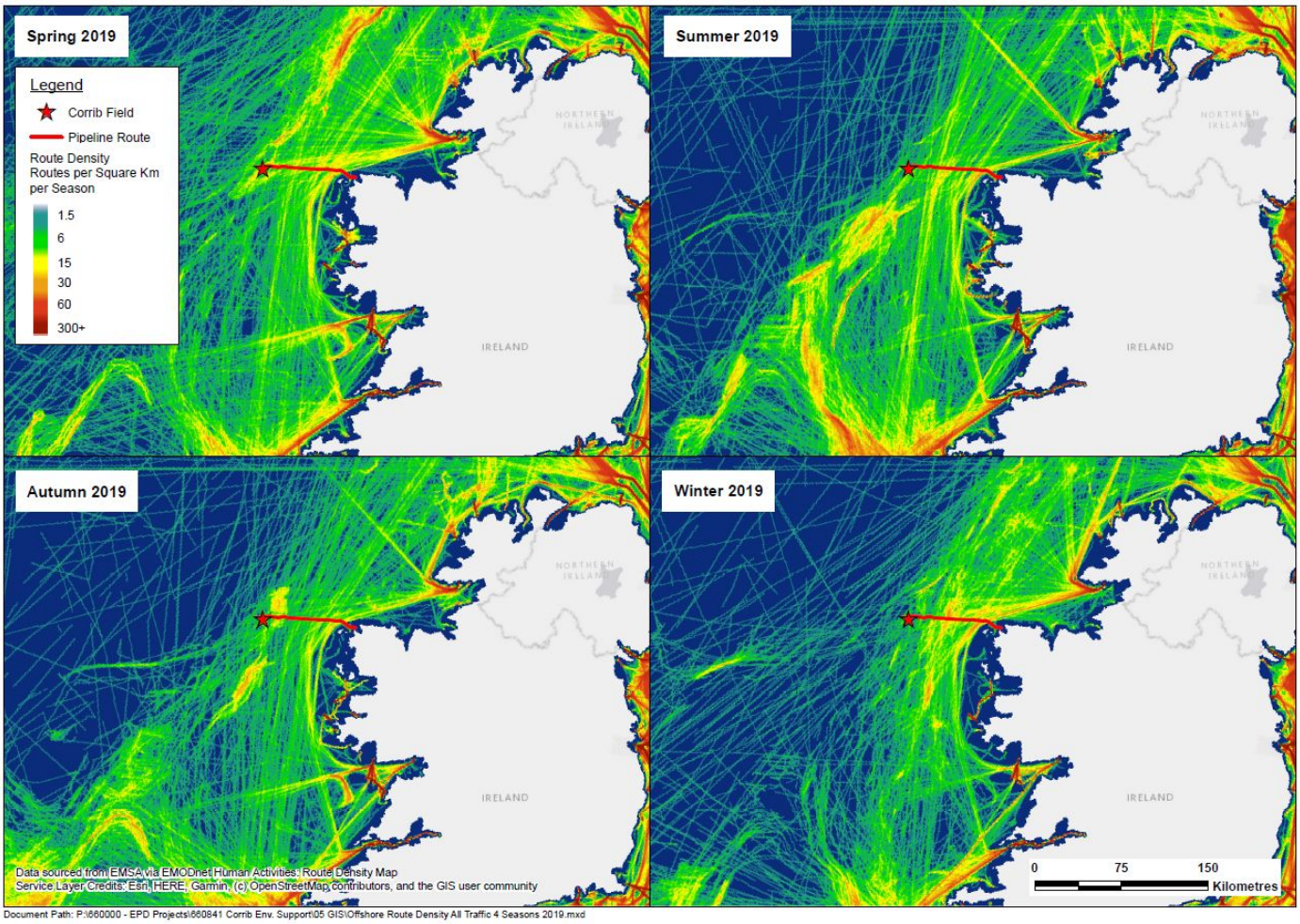
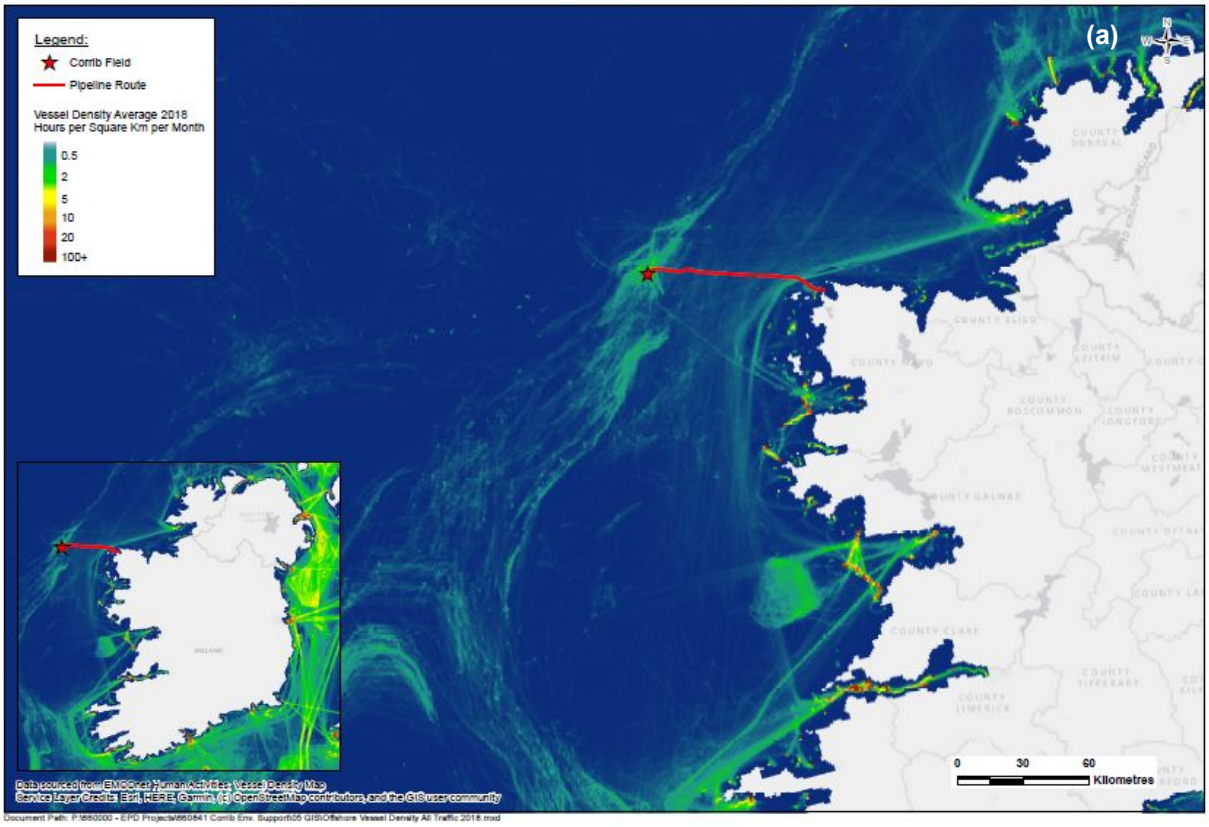


Figure 2-3: Route density around the west coast of Ireland, 2019. Source: EMSA, 2020



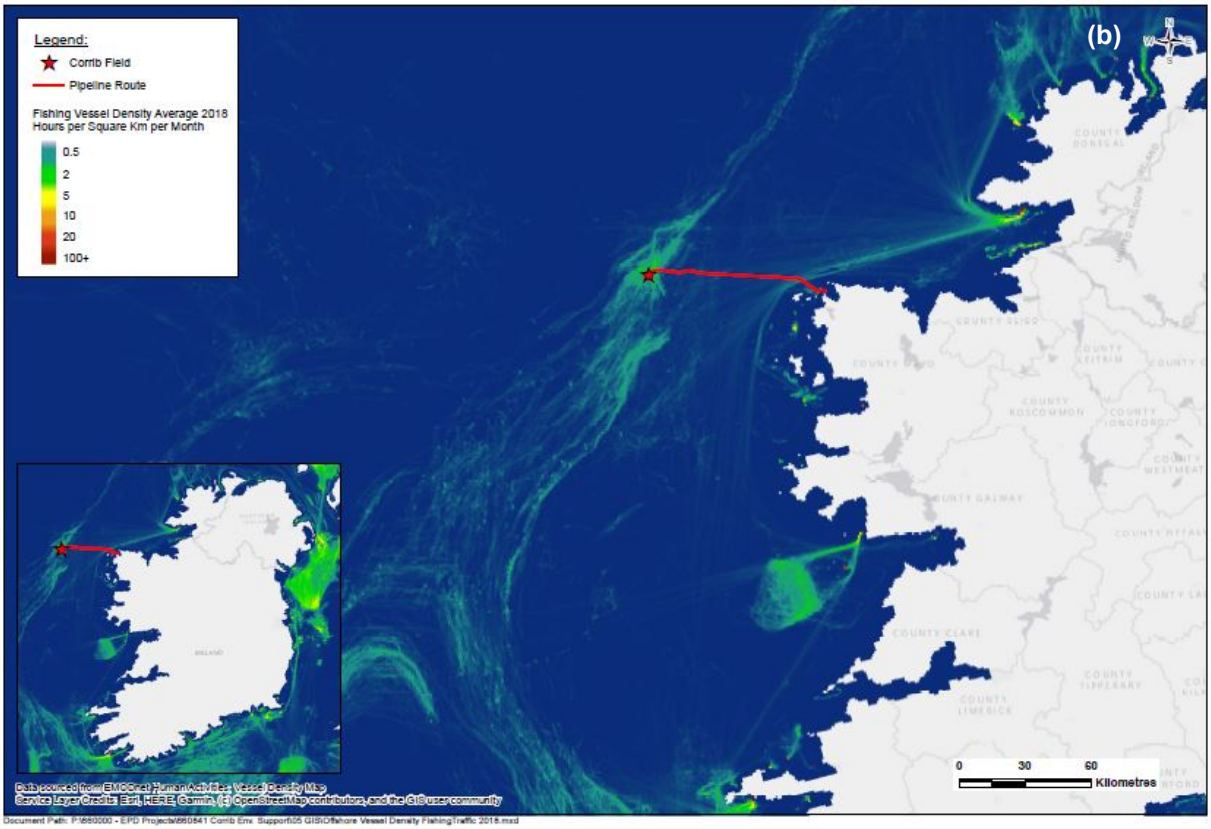


Figure 2-4: Average vessel density maps for the west coast of Ireland in 2018: (a) all vessel density, (b) fishing vessel density. Red star is the Corrib Field location. Source: EMODnet, 2019

2.7.3 Cultural heritage

There are no reported areas with cultural heritage significance in the Corrib Field or along the pipeline route. Nothing of archaeological significance was found during construction of the offshore pipeline from the Corrib Field to the landfall at Glengad.

2.7.4 Other users

There are no known uses of the area for military operations. Limited numbers of personal leisure boats may be in the coastal, inshore waters during summer months and exploration activities for future oil and gas development are ongoing in the offshore acreage in the vicinity of the Corrib offshore field.

3 PROJECT DESCRIPTION

3.1 Introduction

The proposed survey programme will comprise two main components:

- Offshore pipeline and subsea structure inspection and associated repair / maintenance work from the construction / ROV vessel *Edda Sun*. This vessel will be responsible for the survey and maintenance works covering the area of the Corrib offshore field assets as well as seabed infrastructure as far inshore as Broadhaven Bay. Some limited maintenance works will be undertaken where necessary to ensure pipeline integrity and stability on the seabed. This may include localised areas of seabed sediment dredging (using a mini dredge tool) as well as the placement of rock filter bags onto the pipeline.

- Nearshore pipeline inspection using the survey vessel *Leah-C*. This vessel will be responsible for the survey covering the area primarily within Broadhaven Bay as far as the inshore limit of safe navigation, that is the shallowest depth the vessel and equipment can safely be used as defined by Chief Surveyor on the vessel. The Leah-C has a draught of approximately 1.5 m and is unlikely to undertake any survey activities in water depths of less than 2 m.

The offshore and nearshore elements of the work programme will investigate features such as free-spanning and scouring, pipeline burial depth and integrity, as well as cathodic protection measures. The survey will be carried out using a combination of acoustic survey techniques (e.g. multibeam echo sounder, sub-bottom profiler, side-scan sonar). In addition, a visual survey using underwater video / camera imagery and ROV will be undertaken.

The location of the proposed survey works at the Corrib Field, along the offshore pipeline / umbilical / surface water discharge pipeline route is outlined in Figure 3-1.

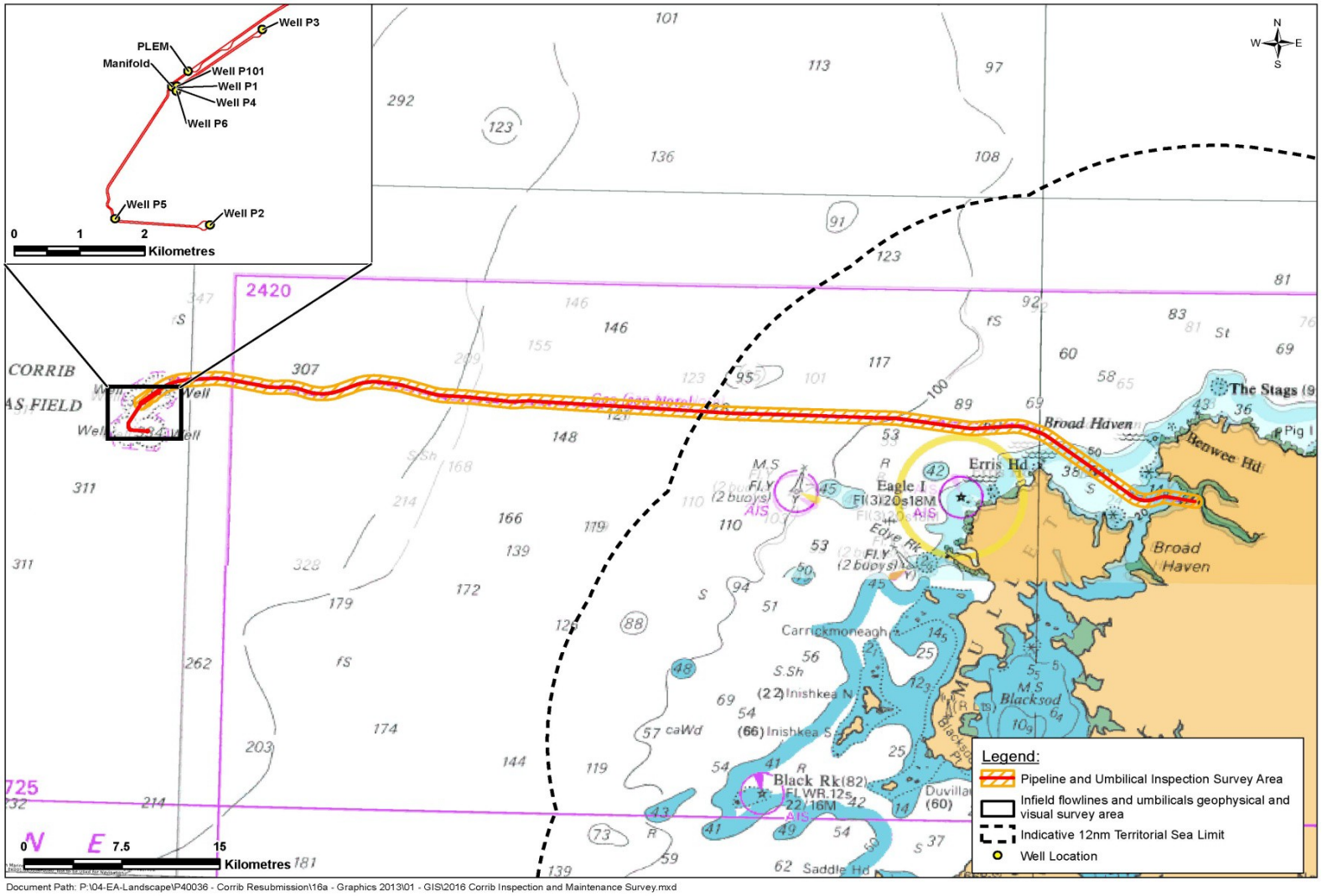


Figure 3-1: Location of Corrib Field, pipeline and umbilical route, as well as the location of the BBGT treated surface water outfall diffuser

3.2 Inspection and maintenance survey programme

3.2.1 General description

The surveys of the pipeline, sections of the umbilical, the BBGT treated surface water outfall pipeline and in-field subsea assets will investigate features such as free- spanning and scouring, and pipeline burial depth and integrity. The survey will be carried out using two vessels; the *Edda Sun* will survey the offshore sections, while the *Leah-C* will survey inshore in the vicinity of Broadhaven Bay. The survey will run between the Corrib Field along the overall extent of the route of the offshore pipeline and BBGT treated surface water discharge pipeline and the landfall at Glengad. In addition, sections of the offshore umbilical will also be inspected (Figure 3-1).

The survey will utilise a range of acoustic survey techniques, namely multibeam echo sounder (MBES), sub-bottom profiler, and side-scan sonar. In addition, a visual survey using vessel deployed underwater video / stills imagery (inshore) and ROV (offshore) will also be undertaken. A range of other sensors may also be used as part of the survey including: Sound Velocity Probes (SVPs) (used to calibrate acoustic survey equipment; pipe tracker, imaging sonar and Obstacle Avoidance Sonar; as well as navigation / positioning sensors including a subsea Ultra Short Baseline (USBL) beacon system, an altimeter, Inertial Navigation System (INS) and Doppler Velocity Log (DVL).

The *Edda Sun* will also undertake limited maintenance activities where required along the route of the pipeline route in the offshore survey area. These works will involve the placement of rock filter units as well as some dredging of seabed sediments using a mini-dredge tool deployed from the survey vessels ROV. These works are to ensure pipeline integrity and stability on the seabed by correcting areas of free-spanning.

The determination of ‘offshore’ and ‘inshore’ areas, for the purposes of this document, has assumed a boundary at a water depth of approximately 20 m below Chart Datum, however, the location of this boundary may be refined closer to the time of the survey. The *Edda Sun* would therefore be responsible for the survey of the subsea infrastructure between the Corrib Field to Broadhaven Bay, while the *Leah-C* would limit its survey operations to within the Bay itself in depths of 20 m or less and would cover the section of the routes close to the landfall.

3.2.2 Survey programme

It is anticipated that the overall programme will be approximately 20 days in duration (dependent on weather conditions), with operations taking place for both vessels from the summer to autumn months of 2021 (between May and September). It is likely that the inshore and offshore elements will overlap during this time period.

During data acquisition, the vessels will follow a pre-determined survey programme that may be subject to change depending on prevailing current and wind conditions.

3.2.3 Vessels

Basic survey vessel specifications are presented in Table 3-1.

Table 3-1: Survey vessel specifications

Parameter	Specification	
Name	*Leah-C*	*Edda Sun*
Owner	Michael Callaghan, Killybegs Co. Donegal – operated by Belcross Enterprises	Østensjø Rederi AS operated by Fugro
Survey main contractor	Ultrabeam hydrographic	Fugro
Type	Multipurpose inshore vessel	Multipurpose survey and construction support vessel
Length (overall)	11 m	88.8 m
Draught (Mean)	1.2 m	6.8 m
Tonnage (Gross)	8.5 t	4953 t

Figure 3-2: Proposed survey vessels

An estimate for atmospheric emissions from the proposed operations to be conducted by the *Edda Sun* is presented below in Table 3-2. Standard industry values for fuel consumption for a typical MSV/Lift Vessel have been assumed. These are 30 tonnes/day (transit) and 20 tonnes/day (operational). These values represent a worst-case scenario but are consistent with those used in the original Corrib offshore EIS (RSK, 2001). The *Edda Sun* is a modern vessel and is fitted with fuel engines and plant and emissions control equipment. Data has not been included for the *Leah-C*. This will be mobilised locally from the port of Ballyglass and will operate on a daylight hours basis within Broadhaven Bay. The emissions from this vessel are not considered to be significant.

The workscope period (operations) on site at the Corrib Field has been assumed at 20 days, with an assumed half a day transit to and from Killybegs for the mobilisation and demobilisation of personnel and equipment.

Based on the weighted values presented below in Table 3-2, greenhouse gas (GHG) emissions from the *Edda Sun* for the duration of the workscope have been estimated at approximately 1390 tonnes. This GHG estimate includes CO_2, CH_4 and nitrous oxides,

with weightings applied to CH_4 and nitrous oxides based on those proposed by the Intergovernmental Panel on Climate Change (IPCC 2013-AR5).

Table 3-2: Estimate of air emissions generated from the *Edda Sun* during the 2021 Inspection and Maintenance Surveys Programme

Survey	Average Fuel Consumption Estimate (tonnes/day)	Period (days)	Fuel Consumption for Survey Period (tonnes)	Total Emissions (tonnes)[1]							
				NO_x	CO	HC	CO_2	SO_2	CH_4	Particulates	GHG (CO_2 equivalent)
***Edda Sun* (transit to and from Killybegs)**	30	1	30	1.77	0.24	0.081	95.1	0.24	0.0081	0.036	98.24
***Edda Sun* (on Operations)**	20	20	400	23.6	3.2	1.08	1268	3.2	0.108	0.48	1291.71
Total emissions				**25.37**	**3.44**	**1.161**	**1363.1**	**3.44**	**0.116**	**0.52**	**1389.95**

[1] Source of emission parameters: 'Methods for Estimating Atmospheric Emissions from E&P Operations' Report No. 2.59/197, E&P Forum, September 1994 (medium speed emission parameters).
NO_x 59 kg/tonne of fuel
CO 8 kg/tonne of fuel
HC 2.7 kg/tonne of fuel
CO_2 3170 kg/tonne of fuel
SO_2 20 x S (assumes a sulphur content for marine diesel of 0.4% by weight). Calculated as fuel usage x 0.4 x 20/1000
CH_4 0.27 kg/tonne of fuel
Particulates 1.2 kg/tonne of fuel

GHGs have been calculated based on those emissions that are considered to be the gases having a direct greenhouse effect namely: CO_2, CH_4, and nitrous oxides. Their respective weighting is given by the Intergovernmental Panel on Climate Change (IPCC 2013-AR5): GHG (tCO_2e – 100-year time horizon, climate feedbacks included) = 1 CO_2 + 34 CH_4+ 298 nitrous oxides.

3.2.4 Survey equipment

Details of the proposed acoustic survey equipment is presented in Table 3-3.

For the offshore survey, the majority of geophysical survey equipment will be mounted to an ROV deployed from the *Edda Sun*.

For the nearshore survey equipment will largely be attached directly to the hull of the *Leah-C* (with the exception of the side-scan sonar transducers and the mini ROV).

A range of other equipment for navigation / positioning and calibration will be used that will have an acoustic signature, as follows:

- A sound velocity probe will be deployed occasionally throughout the 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 sensors.
- Both vessels are likely to have single beam depth echosounders (operating at around 50 kHz) and ultra-short baseline acoustic profiling systems (USBL) for maintaining position and communications with any deployed equipment. USBL systems operate at a frequency of between 19 and 34 kHz at a very low intensity.
- The offshore vessel will also utilise a doppler velocity log (DVL) for accurate positioning and speed determination. This operates at a high frequency of 2 MHz at a very low level of intensity.

The following sections provide additional discussion regarding the primary acoustic survey equipment.

3.2.4.1 Multi-beam echosounder (MBES)

MBES are commonly used to create densely-sampled digital terrain models that can be used to further define topography and assist in oil and gas field development phases, when planning the location of wellheads, platforms, and pipelines, and in maintenance activities which require detailed seabed information.

MBES transmit sound energy and analyse the return signal (echo) that has bounced off the seafloor or other objects. This is done by emitting sound waves from directly beneath a ship's hull (or similar) to produce fan-shaped coverage of the seafloor. The MBES system records the time taken for the acoustic signal to travel from the transmitter (transducer) to the seafloor (or object) and back to the receiver. MBES produce a “swath” of soundings (i.e. depths) to ensure full coverage of an area. The coverage area on the seafloor is dependent on the depth of the water, with coverage typically being two to four times the water depth.

The MBES equipment will be hull mounted on the *Leah-C* for the nearshore survey in the confined waters of Broadhaven Bay, while it is likely to be mounted to the ROV of the *Edda Sun* for the offshore section of the survey. ROV mounting for the deeper water sections of

the survey will result in a relatively short distance between the acoustic source and the seabed allowing for the acquisition of high-resolution seabed data.

Table 3-3: Proposed principal acoustic survey equipment specifications and operational frequency ranges for the proposed 2021 survey programme

Vessel	Specification	Frequency range
Leah-C	**Sub bottom profiler**	
	Preferred option: Neptune T335	3 - 8 kHz
	Alternative option: Geoacoustics TR-1075D	3 - 8 kHz
	Multi-beam echosounder	
	Preferred option: NORBIT WBMS high frequency MBES	400 kHz (typically operating between 350 - 400 kHz)
	Alternative option: R2Sonic 2024	200 - 400 kHz (typically operating between 350 - 400 kHz)
	Alternative option: R2Sonic 2022	200 - 400 kHz (typically operating between 350 - 400 kHz)
	Alternative option: Reson TC2181 single head	190 - 420 kHz (typically operating 400 kHz)
	Alternative option: Teledyne RESON 7125	200kHz or 400kHz (dual frequency available), typical operating 350kHz – 400kHz
	Side-scan sonar	
	Preferred option: Edgetech 4200-MP	Dual frequency 300 kHz and 600 kHz
	Alternative option: Edgetech 4125	Dual frequency 400 kHz and 900 kHz
	Alternative option: Klein 3000H	Dual frequency 445 kHz and 900 kHz
	Mini ROV inspection class	
	Preferred option: BlueROV2	No acoustic signature
	Sound Velocity Probe	
	Valeport Mini SVP/SVS	2.5 MHz
Edda Sun (ROV mounted)	**Multibeam echosounder**	
	Reson Seabat 7125 dual head	400 kHz

Vessel	Specification	Frequency range
	Obstacle avoidance sonar Kongsberg MS1000	675 kHz
	Doppler Velocity Log RDI Workhorse	2 MHz
	Bathymetric system with altimeter Tritech SK704	500 kHz
	Mini USBL Sonardyne Mini Ranger Transponder and responder	19-34 kHz
	Pipe tracker TSS 440	Negligible magnetic field strength

3.2.4.2 Sub-bottom profiler

Sub-bottom profiler systems are used to identify and measure the various marine sediment layers that exist below the sediment / water interface.

These acoustic systems use a technique that is similar to single beam echo sounders and emit an acoustic signal vertically downwards into the water and a receiver monitors the return signal reflected off the seafloor. Some of the acoustic signal will penetrate the seabed and be reflected when it encounters a boundary between two layers that have different acoustic impedance. Acoustic impedance is related to the density of the material and the rate at which sound travels through the material. When there is a change in acoustic impedance, part of the transmitted sound is reflected. The system uses this reflected energy to record a profile of the marine sediment layers beneath.

The sub-bottom profiler will only be used on the nearshore component of the survey, deployed from the *Leah-C.*

3.2.4.3 Side-scan sonar

Side-scan sonar is used to determine the texture, topography and character of the seabed sediments and to detect features such as boulders, outcrops, pipelines, wellheads and other equipment lying on, attached to, or buried immediately beneath the seafloor.

A side-scan sonar transmits sound energy and analyses the return signal (echo) that has bounced off the seafloor or other objects. Side-scan sonar typically consists of three basic components: towfish or hull mounted transducer, transmission cable, and topside processing unit.

In a side-scan, the transmitted energy is formed into the shape of a fan that sweeps the seafloor from directly under the towfish or vessel hull to either side, typically to a distance of 100 metres (depending on factors including water depth, and signal strength). The strength of the return echo is continuously recorded, creating a "picture"

of the ocean bottom. For example, objects that protrude above the seabed create a dark area (strong return) and shadows from these objects are light areas (little or no return). Side-scan sonar is typically used in conjunction with multibeam to meet full bottom coverage specifications.

Side-scan sonar will only be used for the nearshore component of the survey, deployed from the *Leah-C*.

It should be noted that the acoustic sources proposed for the survey are a number of orders of magnitude lower in intensity than those used in conventional seismic surveys.

3.2.4.4 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.

According to the NPWS 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters' (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 will be required for survey work within Broadhaven Bay. However, in line with environmental best practice, soft start procedures will be followed throughout the extent of the survey route (both nearshore and offshore).

3.2.5 Other Inspection /maintenance equipment

In addition to the above, the following equipment may be utilised during the survey and maintenance operations:

- Pathfinder laser profiler – ROV with integrated laser and imaging system with stills and video camera for pipeline integrity and seabed inspection works.
- Tracerco Discovery tool or ARTIMIS Halfwave tool – for checking pipeline wall thickness and integrity (uses the same principles as medical CT scanner), deployed using ROV.
- STS 8 Inch E Piranha Dredger – mounted to a standard STS dredge deployment frame, to be used where pipeline spans have been identified using the equipment above. The mini dredger will undertake limited reprofiling of the seabed in those areas required to ensure full pipeline stability. The mini dredge tool will be deployed from the ROV. In addition to some limited dredging of the seabed sediments in pipeline span locations, it may also be necessary to place rock filter units onto the pipeline as well to provide additional stability and scour protection. These placements will be limited in number and will use appropriately sourced rock.

4 EIA SCREENING ASSESSMENT

Table 4-1 presents the findings of the screening assessment for an EIA based on Annex III of the amended 2014 EU EIA Directive (Directive 2014/52/EU), which sets out the criteria under Article 4 whether a project requires an EIA. In addition, reference is made to the EIA guidance relating to the EIA Directive (European Commission EIA Screening Guidance (2017)), the original text of which was summarised in ERM (2001) and the updates in the 2014 amendments in European Commission (2017) and WYG (2017). Table 4-1 below takes this guidance into consideration and is as per the DCCAE EIA Guidance Screening Table (DCCAE, 2019).

Table 4-1: EIA Screening Assessment Table for the 2021 Corrib Subsea Inspection, Maintenance and Infrastructure Renewal Surveys Programme (Based on DCCAE, 2019)

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
A description of the project activities is provided in Section 3		
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, *etc*)?	Yes – While project is primarily a geophysical / visual survey, there will be limited placement of rock filter unit and some localised seabed dredging in areas of pipeline free-span	No – Limited placement of rock and localised dredging within pipeline free-span
2. Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply?	Yes – Fuel Oil / Diesel / Lube Oil will be used on survey vessels. Use of rock for filter units	No – Limited extent of survey and limited quantities of rock for filter units
3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?	Yes - Vessel fuel / Lube Oil / Hydraulic Fluids etc and other related chemicals	No – Other regulations and safety measures will limit risk from vessel fuel and other related chemicals MSDS sheets will be made available for any chemicals used in the work scope. All chemicals will be (where appropriate) those that are considered to Pose Little or No Risk to the Environment (PLONOR), as well as being registered on the Offshore Chemical Notification Scheme (OCNS) and Harmonised Mandatory Control Scheme

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
		(HMCS) and ranked accordingly based on their toxicity, biodegradation, and bioaccumulation.
4. Will the Project produce solid wastes during construction or operation or decommissioning?	Yes – Relatively small quantities of shipboard solid wastes generated	No – all shipboard wastes will be controlled according to MARPOL 73/78 73/78 Annex V and disposed appropriately onshore.
5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?	Yes – Vessel engines and plant exhausts	No - Low levels of emissions and temporary nature of operations Vessel emissions controlled according to MARPOL 73/78 Annex VI.
6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?	Yes – Underwater noise and disturbance from survey vessel operations and operation of geophysical survey equipment	No – Limited extent of survey area affected. Use of appropriate mitigation measures in the form of soft starts, adherence to NPWS guidance. Equipment frequency with minimal overlap with the auditory sensitivity of receptor species. Temporary nature of operations.
7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal waters or the sea?	Yes – Accidental releases of fuel or chemicals could impact on the receiving environment. Localised releases of suspended sediments from the seabed to the water column	No - Following of industry recognised best practice and relevant regulations will minimise potential risk There are no requirements for refuelling of any deck equipment out of port Maintenance, audits and inspection plans will be in place to mitigate the risk of potential leaks at an early stage In the extremely unlikely event of an oil/diesel spill from the vessel deck equipment, oil spill equipment will be available on-board with training provided to staff A Shipboard Oil Pollution Emergency Response Plan

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
		will be in place on the vessel. Vessel fuelling will be undertaken only under controlled conditions in port Releases of seabed sediments will be localised and of short duration
8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?	Yes - Risks related to vessel operations at sea	No – Following of industry recognised best practice and relevant regulations will minimise potential risk
9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?	No	No – No social changes will result from the survey or maintenance works- aspects like demography, traditional lifestyles or employment will not be affected as the survey / maintenance works are offshore and of short duration
10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?	No	No – Short duration of survey activities and limited spatial scale of impacts results in limited potential for cumulative impacts
11. Are there any areas on or around the location which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?	Yes - West Connacht Coast SAC, Broadhaven BAY SAC and other Natura 2000 sites. Refer to accompanying Natura Impact Statement report (RSK, 2020 a) as well as the summary information provided in Section 2.6).	No – Limited potential for disturbance. Short duration of survey activities.

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
12. Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project?	No – Most important ecological sites around the proposed survey operations are terrestrial in nature	No - Limited potential for disturbance and temporary nature of survey activities. Survey will take place in subtidal waters at all times (minimum water depth of 2 m) and as such there will be no physical disturbance to any sensitive terrestrial or intertidal habitats.
13. Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?	Yes - Marine mammals, fish and seabird use the waters in the vicinity of the proposed survey operations	No – Limited extent in the context of the area used by sensitive species and temporary nature of proposed operations along with appropriate mitigation measures in place
14. Are there any inland, coastal, marine or underground waters on or around the location which could be affected by the project?	Yes - Operation is to be undertaken at sea	No – Likely impacts have been considered to be of only minor overall significance
15. Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project?	No	No – Limited potential for areas and features to be affected due to offshore location and proposed activities
16. Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?	No	No – Limited potential for disturbance as survey activities are temporary and limited to offshore areas
17. Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?	No	No – Limited potential for disturbance as survey activities are temporary and limited to the offshore area and result only in the addition of two survey vessels to the area. Anticipate an additional car journey per day between Ballyglass and Belmullet during the nearshore survey
18. Is the project in a location where it is likely to be highly visible to many people?	No	No – An additional two vessels in the offshore area will be visible to people. Much of the offshore survey will be below the

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
		horizon when viewed from the coast
19. Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?	No – The area to be surveyed is an established offshore pipeline route corridor	No – Limited potential for disturbance as the area is an established offshore pipeline route corridor
20. Is the project located in a previously undeveloped area where there will be loss of greenfield land?	No – surveys an existing marine pipeline route / infrastructure corridor	No - Surveys are to be conducted offshore along an established offshore infrastructure corridor
21. Are there existing land uses on or around the location, e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?	No	No – Limited potential for disturbance as survey activities are temporary and take place in the offshore area
22. Are there any plans for future land uses on or around the location which could be affected by the project?	No	No - Surveys are to be conducted offshore along an established offshore infrastructure corridor
23. Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?	No	No - Surveys are to be conducted offshore along an established offshore infrastructure corridor
24. Are there any areas on or around the location which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project?	No	No - Surveys are to be conducted offshore along an established offshore infrastructure corridor
25. Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?	Yes – The area is used for sea fisheries	No – Temporary nature of operation and consultation with fishing organisations will take place in advance of planned works. The work will be scheduled to minimise the operational duration and limited to a small an area as possible.
26. Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	No	No – Limited emissions of greenhouse gases in an open offshore environment. Not in proximity to any areas where existing legal environmental standards are exceeded. All vessel

Questions to be considered for further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	Yes/No/? Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
		discharges will be in accordance with MARPOL 73/78.
27. Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?	Yes – The survey area has an open aspect to the North Atlantic and is therefore subject to frequent bad weather conditions.	No – Operations are designed to be undertaken in such locations and will be scheduled such that the likelihood of a potential window of suitable weather is maximised

The screening assessment has concluded that in all likelihood that an EIA would not be required. Further consideration of the impacts and suggested mitigation measures for species sensitive to underwater noise and disturbance, including those listed under Annex IV of the EU Habitats Directive 92/43/EEC Article 12, are discussed in Sections 5-7.

5 IMPACT ASSESSMENT

One of the most important environmental concerns arising from the proposed activities are the potential effects of underwater sound on different marine biota, specifically animals protected under Annex IV of the EU Habitats and Species Directive, as well as other receptor species that are potentially sensitive to the underwater noise and disturbance impacts generated from the proposed survey operations.

During the deployment of acoustic survey equipment, there exists the potential for marine life to be disturbed or displaced. In order to assess the potential impacts of acoustic geophysical surveys on receptor species, the characteristics of the sound source, sound propagation, the auditory sensitivity of the biota, and mitigation measures all need to be considered.

5.1 Sound source characteristics

5.1.1 MBES

MBES is proposed for use along the entire length of pipeline, from the Corrib Field manifold and survey of the infield assets, to the landfall, to undertake the inspection, maintenance and renewal survey work. The MBES system proposed for use in shallow water on the *Leah-C* will operate at a relatively high frequency range (200 - 400 kHz), compared to lower frequencies units designed for deep water works (higher frequency ranges are often favoured where possible to allow for the acquisition of higher resolution data).

MBES survey work is also proposed to be carried out using the *Edda Sun* and its associated ROV capabilities. The MBES system in this instance will be mounted on an ROV, allowing for the use of a higher frequency (400 kHz) than could normally be used from a vessel mounted device in deeper waters areas, such as those present in 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 range of frequencies for this MBES equipment are considered to be outside the hearing range of the cetaceans and pinnipeds known to be present in the Corrib Field area (see Table 5-1). The frequency range also lies outside the known auditory range of migratory fish species, such as salmon and river and sea lampreys (see Table 5-2). The migratory fish that are likely to be in the vicinity of the proposed survey activity do not have particularly sensitive hearing (Nedwell *et al.,* 2003, 2006; Popper, 2005). The noise intensity will decrease as it propagates from the source due to spherical spreading, in addition attenuation of these high frequency sounds will be rapid due to scattering and absorption in the water column - much more quickly than would be observed for sound sources of lower frequency.

5.1.2 Sub-bottom profiler

A sub-bottom profiler system is proposed for use to assess pipeline burial depth and integrity within Broadhaven Bay. The systems proposed for use on the *Leah-C* will operate in relatively low frequency ranges (3 – 8 kHz), compared to other forms of high resolution geophysical survey equipment. This frequency range lies outside of the hearing range of some toothed whales (particularly beaked whales) and porpoise species, although overlaps with that of baleen whales and some toothed whale species, as well as pinnipeds. This frequency range also lies outside the auditory range of migratory fish species, such as Atlantic salmon and river and sea lampreys (Simpson and Bruintjes, 2016; Mickle *et al.*, 2018).

Sound energy generated by the use of the sub-bottom profiler will be directed downwards to the seabed (from a hull mounted transducer on the *Leah-C*), and the pulse duration of sub- bottom profilers is extremely short, in the order of tens to hundreds of milliseconds (Nedwell *et al.*, 2008).

Based on the proposed model of sub-bottom profiler for use during the inshore survey (see Table 3-3), the peak source level is expected to be in the range of 214 dB re: 1µPa @1 m. The Sub-bottom profiler is only proposed for use on the nearshore survey (deployed from the *Leah-C.*

5.1.3 Side-scan sonar

The proposed side-scan sonar equipment will be either hull mounted or deployed as a towfish for the nearshore (inshore) sections of the survey from the *Leah-C*. This equipment can operate at a range of frequencies depending on water depth, ranging from between 300 and 900 kHz. The selection of frequency will depend on water depth, with lower frequencies recommended for deeper water and higher frequencies for shallower depths. Operating at typical operational frequencies the maximum expected amplitude will be c. 200- 230 (225 likely maximum) dB re: 1µPa @1 m.

The range of frequencies 300-900 kHz available on this equipment are considered to be outside of the peak hearing thresholds of most cetaceans and pinnipeds (Richardson *et al.*, 1995; Southall *et al*., 2007). The frequency range also lies outside the known auditory range of migratory fish species, such as Atlantic salmon and river and sea lampreys (Simpson and Bruintjes, 2016; Mickle *et al*., 2018). 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.

5.1.4 Other acoustic survey equipment

The obstacle avoidance sonar, sound velocity probes, doppler velocity log and altimeter systems proposed for use operate at relatively high frequencies (see Table 3-3), compared to that of much of the other equipment in use. 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 activity 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.

The Sound Velocity probes 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 operating 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, such as the sub-bottom profiler (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 to 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.

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

5.1.5 Pipeline mini dredging tool

The Piranha STS 8 inch mini-dredge tool will be used in areas where localised reprofiling of the seabed sediments is required in order to ensure that pipeline integrity on the seabed is maintained. The mini-dredge tool can operate in both hydraulic and electronic pump suction modes. The main processes that would contribute to noise associated with this type and scale of dredging of the seabed sediments are, pump noise, and any noise from the from the vessel itself. In general, dredging operations produce continuous, broadband sound concentrated at or below 1 kHz. Sound pressure levels can vary widely depending on the type of dredging and the environmental conditions. Noise levels also depend on the materials being extracted, with harder sediment extraction generating higher noise levels than loose or soft sediment extraction. Estimated source levels for dredging range between 168 and 186 underwater dB at 1 m. Such source levels for full-scale dredging works can be considered similar to those produced from drilling operations, however the levels likely to be produced from the proposed operations need to be considered in context. The mini dredge tool is a small piece of plant, using a small electric or hydraulic pump. Material does not need to be extracted back to the surface for complete removal, but will settle back to the seabed, as such the pumps are relatively low powered. Works will be localised to only those localised small sections of the pipeline route that have previously been identified as requiring dredging works. Typical dredging works are of a relatively low frequency source that would be audible to marine mammals and also possibly to fish. The exact frequency of noise from the proposed equipment is not known, although is likely to be of a higher frequency due to its much smaller size and speed of operation. The intensity of the noise will also be significantly lower than for full-scale dredging equipment. However, for the purposes this assessment a worst-case is considered. The lower frequency of the sound source associated with the mini dredge operations would not be expected to attenuate as rapidly in the water column though as the high frequency noise associated with shallow geophysical survey equipment, however the operation of the equipment will be for relatively short durations at a few

localised places along the route of the offshore pipeline and will form a relatively small proportion of the overall work scope.

5.1.6 Survey vessels

Noise levels for merchant shipping compiled from a number of academic studies are published in Richardson *et al.,* (1995). These estimate source levels of 160-190 dB re 1µPa-m for merchant vessels under transit.

The survey vessel itself will have an acoustic signature that is similar to that of a merchant vessel (Table 5-1). During the survey it will not be operating at transit speeds for much of the operations and as such the vessels engines will be operating at much lower revolutions and as a consequence a much lower level of source intensity comparatively as it progresses along the route of the offshore pipeline and umbilical.

In the event that the vessel uses dynamic positioning in order to maintain precise position on station then there will be occasional use of thrusters and main engines resulting in higher intensity underwater noise of short duration.

Vessel noise during dynamic positioning station keeping operations is of a similar low frequency broadband level, with sound levels of between 180 to 197 dB re 1µPa-m during thruster usage (Talisman Energy, 2006; Wyatt, 2008; & Xodus, 2014). Noise levels during dynamic positioning station keeping will vary with climatic and tidal conditions, which affect a vessels ability to maintain position, since these factors change the amount of thrust required to keep the vessel in position. In lower or moderate wind, sea state and current; the noise levels can be expected to be lower than in more challenging conditions. The work scope has been proposed for the time of year when the likelihood of a suitable window of good weather conditions is maximized. Overall vessel noise is considered to be of a relatively low frequency that would not likely be audible to small cetaceans such as dolphins (qualifying features of the closest SAC) but would be within the hearing ranges of large cetaceans and pinnipeds. These relatively low levels of intensity will attenuate relatively rapidly in the relatively deep water at the Corrib Field and along much of the route of the offshore pipeline to around 100 dB at 1km distance (by spherical spreading alone). These relatively low intensity levels of underwater noise and the predictable stationary nature of the operations will not result in a significant disturbance to marine mammals and seabirds.

The *Leah-C* will also have an underwater acoustic signature, the vessel having two marine diesel engines as the primary sources. The sound source from the *Leah-C* will be relatively small and of a higher frequency than that of a large commercial vessel such as the *Edda Sun*. The sound will not however be the higher frequency sound that would be expected from an outboard driven high speed vessel. Engine revolutions would be quite slow as the vessel would be moving at low speeds while conducting survey operations in Broadhaven Bay. She does not have dynamic positioning capabilities and as such would not impart the higher frequency bursts of sound from thrusters during station-keeping.

Table 5-1: Sound sources from various maritime activities

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 400	<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 and Nice, 1996.

5.2 Sound propagation

In general sound sources that have high sound pressure levels (intensity) 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 (i.e. side- scan sonar and echo sounder) tend to have greater attenuation over distance. The overall degree of attenuation is dependent on the propagation conditions (propagation is impacted by varying pressure, temperature and salinity). Additionally, spherical spreading loss (the reduction in intensity caused by the spreading of waves into an ever increasing space) results in signal intensity dropping quickly.

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).

An animal's ability to detect sounds produced by anthropogenic activities depends on the amount of natural ambient or background sound. Wind, precipitation, vessel traffic, and biological sources all contribute to ambient sound.

5.3 Auditory sensitivity of key receptor species

Section 2.2 lists the species of marine mammal which may be present in the vicinity of the proposed survey area. These species have differing auditory ranges, and hence are not equally sensitive to the same noise sources. Table 5-2 (adapted from NPWS, 2014 and Southall *et al*., 2007 (updated in Southall *et al*., 2019) presents the estimated auditory bandwidths for a range of marine mammals, and species that may be present in the vicinity of the proposed survey activities.

Table 5-2: Estimated auditory bandwidths for marine mammals

Cetaceans Low frequency 7 Hz-22 kHz	**Cetaceans Mid-frequency 150 Hz-160 kHz**	**Cetaceans High frequency 200 Hz-180 kHz**	**Pinnipeds in water 75 Hz-75 kHz**
	Peak sensitivity ~ 15 kHz	**Peak sensitivity 16 to 140 kHz**	
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoises	All species
Humpback whale *(Megaptera novaeangliae)* Blue whale *(Balaenoptera musculus)* Fin whale *(Balaenoptera physalus)* Sei whale *(Balaenoptera borealis)* Minke whale *(Balaenoptera acutorostrata)*	Sperm whale *(Physeter macrocephalus)* Killer whale *(Orcinus orca)* Long-finned pilot whale *(Globicephala melas)* Beaked whale species Dolphin species	Pygmy sperm whale *(Kogia breviceps)* Harbour porpoise (*Phocoena phocoena)*	Grey seal *(Halichoerus grypus)* Harbour seal *(Phoca vitulina)*

5.3.1 Cetaceans

Baleen whales are reported to have hearing sensitivity ranges in the region of 10 Hz to 20 kHz, with greatest sensitivities usually below 1 kHz (Evans, 1998). Source frequencies associated with high resolution geophysical surveys typically fall outside of this hearing range (Table 5-2). Low frequency output associated with some types of acoustic survey equipment, such as seismic surveys and low frequency sub-bottom

profilers, do however overlap with the hearing range of baleen whales, which has the potential to mask long distance communication between whales over significant distances, and prevent the detection of other faint sounds (Evans and Nice, 1996).

Toothed whales rely on sound for echolocation, foraging and communication. The auditory sensitivities range for most species is considered to be from 75 Hz to 180 kHz, with greatest sensitivities around 20 kHz.

Observations undertaken during low frequency acoustic surveys (seismic surveys) in UK and adjacent waters were analysed to examine effects on cetaceans (Stone and Tasker, 2006). Sighting rates, distance from sound source and orientation were compared for periods when airguns were active and when they were silent. The results indicated that different taxonomic groups of cetaceans may adopt different strategies in response to acoustic disturbance from seismic surveys. Some small toothed whales (odontocetes) move out of the immediate area, while the slower moving baleen whales (mysticetes) orient away from the vessel and increase their distance from the source but may not move away from the area completely.

There are various potential effects of exposure to sound from anthropogenic activities on marine mammals 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.* (2019) updated the 2007 study which carried out an extensive review of the available literature and formulated scientific recommendations for marine mammal exposure criteria based on peak pressure known or assumed to elicit the onset of TTS. For low frequency hearing cetaceans (typically baleen whales, with an auditory sensitivity range estimated at 7 Hz to 22 kHz) and high frequency hearing cetaceans (which would include bottlenose dolphins, and an auditory sensitivity range estimated at 150 Hz to 160 kHz), the sound pressure level (SPL) for TTS was set at 224 dB re 1µPa (peak) and 230 dB re 1µPa (peak) for PTS. The sound exposure level (SEL) for TTS onset is 170 dB re 1µPa2^{-s} and 185 dB re 1µPa for the onset of PTS. For very high frequency cetaceans, which includes the harbour porpoise, Southall et al. (2019) set the sound pressure level (SPL) for TTS onset at 196 dB re 1µPa (peak) and 202 dB re 1µPa (peak) for onset of PTS. The SEL for TTS onset is 140 dB re 1µP^2-s and 155 dB re 1µPa for the onset of PTS.

The fundamental difference between these two parameters is that SPL can be an instantaneous value and SEL is the accumulated sound 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 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).

5.3.2 Seals

The estimated auditory bandwidth for seals is thought to be in the range of 75 Hz – 75 kHz (Table 5-2). 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 (a 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. For seals (phocid carnivores in water) (PCW) (grey and harbour seals) Southall et al. (2019) sets the SPL TTS onset at 212 dB re: 1 µPa (peak) and 218 dB re: 1 µPa (peak) for PTS onset. The SEL for TTS onset is 170 dB re 1 µP2-s and 185 dB re 1 µP2-s.

5.3.3 Fish

The auditory sensitivity of migratory fish is not well studied. However, salmonids (e.g. salmon and trout, including sea trout *(Salmo trutta trutta)*) 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).

All fish have ears to detect sound however through their otolithic organs, which respond to particle motion of the surrounding fluid. Many fish are also able to detect sound pressure with a swim bladder which re-radiates the sound energy as particle motion to the otolithic organs (herring as an example). These fish generally have lower sound pressure thresholds and wider frequency ranges of hearing than those that rely on particle motion detection by the otolithic organs alone (Popper *et al*., 2014). Whereas other fish have a swim bladder, but it is not used in hearing (such as Atlantic Salmon) making them less sensitive to sound.

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 Bruintjes, 2016; Mickle *et al*., 2018). As all lamprey species are through to lack hearing specialist structures, the hearing sensitivity of river lamprey is considered similar to sea lamprey.

5.3.4 Seabirds

The auditory sensitivity of seabirds is not well studied. The potential exposure of birds to underwater noise varies greatly according to 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 degree of exposure to underwater noise.

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 survey and the locations in which it is taking 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 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 survey's acoustic sources are expected to attenuate rapidly in water. Furthermore, surface-based acoustic sources will target sound directly downwards 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 either near the ROV (close to the seabed and therefore highly unlikely or not possible; see below), or almost directly under the hull of the moving vessel or towfish in the case of the inshore survey. Both of these scenarios are 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 for much of the survey offshore (outside Broadhaven Bay): the peak source noise levels from the ROV will be largely restricted to near the seabed in deep water (>150 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 *(Morus bassanus)* and eider duck (*Somateria mollissima*) 40 m; guillemots (*Uria aalge*) 50 m; puffins (*Fratercula arctica*) 70 m; BirdLife International, 2014). Two species, the guillemot and the razorbill *(Alca torda)*, 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 unlikely 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 the 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 survey 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).

5.4 Underwater acoustic impact of survey on Annex IV marine fauna

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.

5.4.1 Cetaceans

The hearing range of most toothed whales is unlikely to overlap with the type of MBES and side-scan sonar equipment to be used in the proposed survey; however, they may be sensitive to the operational frequencies of the sub-bottom profiler unit proposed for use from the *Leah-C* (3 - 8 kHz).

The lower frequencies generated by SBP equipment has the potential to cause localised short-term impacts on behaviour, possibly resulting in avoidance at close proximities (Nedwell *et al*., 2008). However, it is unlikely that this would be considered a significant disturbance. Considering the natural avoidance behaviour, the peak source level of the sound source (214 dB re: 1µPa @1 m), and the SPL (230 dB re: 1 µPa) and SEL (198 dB re 1µPa 2^{-s}) for injury it is unlikely that injury would occur as an animal would need to locate in the very small zone of ensonification and stay in that zone associated with the vessel for a period of time. The risk to cetaceans from use of this lower frequency acoustic equipment is further reduced by the orientation of the sound source (hull mounted in relatively shallow water on the *Leah-C*). As previously noted the equipment and resulting sound waves are directed downwards to the seabed, reducing the area impacted by noise. In addition, the pulse duration of sub-bottom profilers is extremely short.

Cetaceans which use higher frequencies, such as harbour porpoise, may be sensitive to certain frequencies within the operational capability of the MBES systems. 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 200 kHz), 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 that a strong avoidance reaction might occur at up to a distance of 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 (Section 5.2).

The proposed side-scan sonar equipment for the inshore survey operates at relatively high frequencies (between 300 - 900 kHz), the preferred equipment between 300 and 600 kHz. These higher frequencies are outside of the peak hearing thresholds of most cetaceans and pinnipeds and beyond the upper limit of harbour porpoises and bottlenose dolphins peak hearing threshold (Richardson *et al*., 1995; Southall *et al*., 2007).

The maximum SPL at 1 m distance for the side scan sonar proposed for the survey is estimated to be approximately 225 dB re 1µPa.

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.

Further to this, the employment of mitigation measures outlined in Section 6 will mitigate against potential impacts.

5.4.2 Turtles

Small-scale behavioural experiments on loggerhead and green turtles have indicated that exposure to seismic sound levels over 155 dB resulted in increased swimming activity, and at over 164 dB, individuals began to exhibit erratic swimming patterns, possibly indicative of an agitated state (McCauley *et al*., 2000).

It is considered unlikely that turtle species will be encountered within the survey area during the proposed works. However, should any individuals be present, appropriate mitigation measures (outlined in the Section 6) will reduce potential impacts.

5.5 Underwater acoustic impact of survey on other designated species

5.5.1 Seals

The hearing range of seals is unlikely to overlap with the type of MBES, or the operating range of the side-scan sonar, and ROV positioning equipment proposed for use in the survey, however, they may be sensitive to the operational frequencies of the proposed sub-bottom profiler on the inshore part of the survey. The USBL transponders may also be audible to seals, however due to the very low intensity at which this equipment operates, impacts are considered negligible.

The maximum amplitude of the proposed sub bottom profiler is expected to be 214 dB re: 1µPa @1 m, and the amplitude will drop off rapidly from the source. Given the SPL threshold for TTS onset for seals (phocid carnivores in water) according to Southall *et al.,* (2019) is 212 dB re: 1 µPa (peak) and 218 dB re: 1 µPa for PTS onset, the potential for injury to seals from the acoustic sound sources proposed for these surveys is low, particularly given the projected rate of attenuation for the sound source, and especially for the offshore component of the survey (where SBP will not be used). In addition, as the frequency of occurrence of seals decreases with increasing distances from areas of known coastal sensitivity.

Although energy levels will drop off rapidly from the source of the sub-bottom profiler, the sound will be detectable to seals. Detection could be at a distance of tens of kilometres from source. If animals are closer to the source, then it is likely that animals responses could be in the form of avoidance (Thompson, 1998).

The maximum amplitude of the proposed side-scan sonar equipment proposed for the inshore survey component is 225 dB re: 1µPa @1 m (when operating at typical frequencies of around 500 - 600 kHz). The equipment proposed for usage on the inshore survey can operate between 300 - 900 kHz are well outside the audible range for grey

seals. Attenuation of the sound source through spherical spreading and also through increased absorption associated with source levels at higher frequencies, will result in the source amplitude rapidly decreasing with distance and therefore the potential for injury to seals from the acoustic sound sources proposed for this component of the survey is considered to be extremely low.

Appropriate mitigation will decrease impacts, such as the implementation of soft start procedures and the presence of a qualified MMO (see Section 6 for detailed information regarding mitigation).

5.5.2 Fish

Given knowledge on the known sensitivity of various fish species to underwater noise, significant impacts to migratory fish species from the proposed survey are considered highly unlikely. However, they are briefly considered here, as it is possible that these migratory species of fish may occur in inshore areas during the time of the proposed survey, and within relatively close proximity to acoustic survey sound sources.

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). Atlantic salmon are also highly mobile and relatively large, and therefore easily able to undertake avoidance behaviour and return following cessation of the survey.

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 impact on fish species, particularly given the frequency levels and intensity of the equipment to be used and that soft start procedures will be applied.

5.5.3 Seabirds

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 survey vessels 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.

5.5.4 Indirect impacts on prey species

This assessment focusses on the impacts on migratory species of fish listed under Annex II of the Habitats Directive, but also considers other species of fish including those which are likely to be prey species for cetaceans, seals and seabirds in the vicinity of the proposed activities. Impacts to the behaviour of prey species for such receptors can result in indirect impacts to the predators.

A number of species of fish, in particular those whose auditory apparatus are closely linked with a swimbladder (e.g. herring), are considered to be more sensitive to underwater noise than species which have less reliance on hearing structures (Nedwell *et al.*, 2004).

Studies on smaller species of fish that are expected to be prey species for marine mammals and 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. Impacts on larger species such as salmonids, which could also be important prey for marine mammals, 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 survey.

Due to the localised extent of the impact the overall proportion of the prey species population that is affected is likely to be minimal. The use of soft start procedures will mitigate the direct impacts on prey species of fish by gradually increasing the intensity of the equipment over time. Marine mammals and 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, with the ability to adjust their foraging grounds to follow prey movements. Therefore, the localised and short duration impacts on prey species will not have a significant indirect impact on the marine mammal and seabird populations in the vicinity.

5.6 Other potential impacts of survey

The physical presence of the survey vessels could have potential impacts on the human environment, such as interaction with offshore and coastal fisheries. Interaction may include the potential for collision of survey vessel with a fishing vessel or entanglement of towed equipment with fishing nets/lines. It may also involve the displacement of a fishing vessel from a preferred area. However, due to the short duration of the survey and the limited number of vessels (one in the inshore area and one in the offshore area), the impact is considered negligible. Communication with other marine users will help further avoid any potential interactions or impacts.

The levels of carbon dioxide and other greenhouse gases emitted by the marine vessels during the survey are discussed in Section 3.2.3 and are not considered to be significant and with minimal effects on climate change. Impacts from the vessels in terms of standard emissions and discharges during operation will be minimised where possible using measures such as 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.

Overall vessel noise from the *Edda Sun* is considered to be of a relatively low frequency that would not likely be audible to small cetaceans such as dolphins but would be within the hearing ranges of large cetaceans and pinnipeds. The underwater noise levels from the *Leah-C* are likely to be of a broader spectrum of frequencies that would be audible to a range of species, but at a low level of intensity. These relatively low levels of intensity will attenuate relatively rapidly in the deep water at the Corrib Field and along much of the route of the offshore pipeline to around 100 dB at 1km distance (by spherical spreading alone). These relatively low intensity levels of underwater noise and the predictable stationary nature of the operations will not result in a significant disturbance to marine mammals and seabirds.

The operation of the mini-dredge tool will be audible to small cetaceans and fish, based on a worst case assumption of amplitude and frequency from full-scale suction dredging for construction or navigational works. Actual source levels and frequency will depend on a number of factors including the nature of the seabed sediments, the size and power of the pumps and the speed at which they operate. Works will be limited in spatial extent and duration and due to the size of the dredge tool are considered to be of a low intensity and as such will not result in significant disturbance to marine faunal receptors.

The use of a mini-dredge tool and also the placement of any rock-filter units as part of any pipeline stabilisation works will result in the loss/alteration of limited areas of seabed habitat as well as the suspension of seabed sediments into the water column in those areas where seabed reprofiling beneath the pipeline is required in order to correct areas of free span. While these areas of dredging works are limited in number and localised, resulting in the removal of relatively low quantities of seabed sediments. It is understood that seabed sediment will be displaced, rather than removed to the surface. The dredging operations will result in localised suspension and resettlement of suspended sediments, which will result in increased turbidity for a short period as well as both temporary and a degree of permanent smothering of benthos, as well as permanent alteration to the seabed. These changes will be limited in spatial extent to the immediate vicinity of the reprofiling works, while any increases in water column turbidity will be localised and of short duration.

The placement of filter units will result in the loss of benthic habitat in the immediate footprint of the units as well as introducing additional hard substrate into the environment. This placement will be limited in extent and will help prevent further loss of benthic habitat through scour of sediments. Any introduced rock will be appropriately sourced and washed/graded prior to placement.

5.6.1 Accidental Events

Accidental events may also occur. A fuel oil spillage along the survey route, particularly from the larger *Edda Sun* offshore survey vessel, could potentially result in a spill. The likelihood of such an event occurring is considered to be very low. All vessels will have appropriate spill contingency plans in place to deal with such events with the aim of reducing environmental damage as far as possible. In addition, vessel fuelling will take place in port and all deck machinery will only be refuelled within a bunded area. There

is the potential for a spill of hydraulic fluid to the deck of the vessel from the ROV and its associated equipment.

While it is accepted that such spillages of fuel or hydraulic oils could have a significant effect on the environment, including designated species, the protocols and procedures in place to prevent this occurrence and the low probability of such an event occurring mean that the overall significance of this impact is determined as minor (very unlikely).

5.7 Cumulative impacts

Due to the nature of the proposed activities, and the widespread use of underwater acoustic devices on other vessels in the area, there is potential for cumulative underwater sound impacts. Cumulative impacts may arise as a result of operation of underwater acoustic sources on both the *Leah-C* and the *Edda Sun*, and from increased levels of vessel movements.

Cumulative noise impacts associated with such underwater survey operations as those projects proposed are more difficult to quantify than effects attributed to other activities. This is because the energy from the sound sources dissipate and soon disappear when the activity is stopped. Unlike other activities that are tangible in nature, any cumulative impact that maybe attributed to acoustic surveys is intangible and can only be measured as impacts associated with receptor animals in the environment.

In addition to the proposed survey operations discussed in this report, flexible flowline replacement works are also proposed in 2021 at the P6 wellhead at the Corrib field (RSK, 2020 b). An application has been submitted to the DCCAE for these works. The works will also involve As-found and As-left geophysical surveys at the field, yet these will be very short in duration (approximately one day for each). Furthermore, as the same vessel contractors will be used for both the survey operations proposed in this report and the works proposed in RSK, 2020 b, the activities cannot take place simultaneously. This will therefore significantly reduce the likelihood of cumulative impacts.

In addition to the proposed works at the P6 wellhead an additional work scope is proposed at the Corrib Field central manifold / P1 wellsite. This work is the Channel B EDU and electrical jumper repair programme. This will take place over a period of approximately 5 days between April and September 2021. These works are proposed to take place immediately prior to this proposed pipeline inspection and maintenance survey programme and will use the same support vessel (*Edda Sun*). The Channel B work programme will be carried out using ROVs and any surveys required will be by underwater video. No acoustic survey sensors are proposed.

It is also recognised that the scheduling of these 2021 inshore and offshore surveys may result in a degree of unavoidable overlap between the two programmes. However, this overlap will be of as short duration as possible and will also mean that the overall duration of disturbance from the combined programme is decreased. It is also anticipated that the two surveys (inshore and offshore) will not be in close proximity for a long period of time.

A review of current applications for offshore works that are currently at the consultation stage has been undertaken and which have the potential to result in impacts within the vicinity of the Corrib Field area (within approximately a 200 km radius of the survey area - i.e. the offshore pipeline route from the Corrib Field to the Glengad landfall). This area

within approximately 200km of the Corrib Field and offshore pipeline route survey area for the project and cumulative impacts is broad enough to encompass much of the typical foraging and migratory ranges for the primary receptor species.

This information is publicly available from the Department of the Environment, Climate and Communications and the Department of Housing, Planning and Local Government. This review has identified a further project that has the potential to take place during a similar timeframe as the proposed survey activities.

The following project was identified:

- Woodside Energy (Ireland) Pty Ltd plans to conduct a geotechnical investigation involving the collection of cores from up to 22 shallow boreholes distributed throughout the Irish Atlantic Margin at water depths ranging from approximately 50 to 2,600 m. It is anticipated that these survey operations will take place during the summer months 2021 (depending on regulatory approval and contractor availability) and will be of approximately 40 days duration. An Appropriate Assessment has been undertaken so far for this project, and the latest period of public consultation closed on 2nd May 2020.

As there is potential for additional projects to take place in proximity to the offshore Corrib survey area off the west coast of Ireland within a similar timeframe to these proposed survey works programme, 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 survey area. It is appreciated that the likelihood for the projects to occur over the same time periods is very unlikely as the durations of the individual projects are short and the exact timings of other works is defined only within a range of dates.

The potential impacts from underwater noise on marine mammals will be as outlined in Section 5.4.1 and 5.5.1. These species are mobile, with the ability to move in any direction and over long distances in an open marine environment, whilst the frequencies of the survey equipment are outside the peak hearing thresholds of the common cetaceans and seals in the area. Therefore, it is unlikely there will be a cumulative impact on Annex IV marine mammals, or any other designated marine mammal species.

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 all works undertaken as part of the Corrib offshore gas development, efforts will be made to schedule the works over different weeks.

The impact of noise from additional vessel operations involved in this survey programme will be limited. The key receptors would be cetaceans and seals in the vicinity of the proposed activities.

While there exists a possibility that a number of survey projects could occur off the western coasts of Ireland with overlapping timescales, as all projects are of short-duration and take place in open marine areas allowing for rapid attenuation of underwater noise,

as well as allowing scope for animals to avoid the operations and also avoid undue potential for entanglement, collision risk or entanglement.

All project operators will apply appropriate mitigation measures to protect/prevent animals from undue exposure to marine noise and the risk of collision/entanglement. Therefore, this scope of works in-combination with the other proposed survey activities from the Corrib development, and the potential for other surveys being undertaken by Woodside Energy, is unlikely to result in significant cumulative impacts on key receptor species.

5.7.1 In-combination effects

Within the survey operations themself there is the potential for in-combination effects on receptors. Multiple pathways of the proposed surveys may interact and effect a single receptor.

Table 5-3: Receptors and impacts of the flowline replacement project

Impact \ Receptor	Cetaceans	Seals	Turtles	Fish	Seabirds	Seabed and benthic habitat	Water Quality	Human Environment (Fisheries & Shipping)
Underwater acoustic impact								
Disturbance due to physical presence of vessels & ROV								
Collision risk due to physical presence of vessels & ROV								
Impact from standard vessel emissions and discharges							*	

Shading indicates an impact on receptor.

* Impacts to water quality will also have indirect on all species in the water column, however, discharge and emission amounts are small and so even in combination will have a negligible direct impact on the water quality and the species in the water column.

Marine mammals (cetaceans and seals) and fish are most at risk from in-combination effects, as they interact with both the vessel and the sound sources,. The impact from underwater sound from survey operations combines with the potential disturbance from, and collision risk due to, the physical presence of the vessels and ROV; however, because these impacts affect a localised area, and as marine mammals and fish are mobile species able to disperse from noise sources, the in-combination effect of the two pathways remains negligible, especially in light of the mitigation measures associated

with marine mammals. While the in-combination effect from these impacts may also affect turtles, given the unlikely presence of turtles in the survey area, it also remains negligible.

5.8 Transboundary effects

As there are no international boundaries within the area (other than the westward limit of Irelands Exclusive Economic Zone (EEZ) where it transitions into international waters) in which impacts from this survey programme occur (approximate 200 km radius), no transboundary effects are expected. This is due to the limited spatial scale of the project and its likely impacts as described in the above sections, and the location of the project on the west coast of Ireland with an aspect open to the Atlantic.

6 MITIGATION MEASURES

The NPWS "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters" (NPWS, 2014) provides mitigation measures for the protection of Annex IV and certain other sensitive species from geophysical acoustic surveys in Irish waters, including seismic surveys and multibeam, single beam, side-scan sonar and sub-bottom profiler surveys. These measures are outlined in the sections below.

6.1 NPWS guidance

These mitigation measures are applicable to:

- all seismic surveys (including the testing and full operational use of airguns, sparkers, boomers and vertical seismic profiling (VSP) or checkshot systems) in inshore and offshore Irish waters;
- all multibeam, single beam, side-scan sonar and sub-bottom profiler (e.g., pinger or chirp system) 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.

The following mitigation measures will be employed during the survey in order to minimise the potential for impact to Annex IV and certain other sensitive species potentially present within and in proximity to the survey area, in accordance with the NPWS Code of Practice (NPWS, 2007) (updated by the NPWS Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014). These measures are specified by the NPWS for water depths of up to 200 m.

The mitigation measures outlined below will be in implemented for the entire extent of the pipeline and over vessels, in line with best practice.

6.1.1 General Mitigation

Generic mitigation measures that will be in place to minimise the impact of sound generated from the proposed activities are as follows:

- Use of the lowest equipment output possible in order to obtain the required data quality;
- At the start of proposed activities, power will increase slowly from a low intensity (a 'soft start') to encourage avoidance reactions by marine mammals, fish and marine reptiles;
- A qualified and experienced Marine Mammal Observer (MMO) will be present onboard both the nearshore and offshore geophysical survey vessels. The MMO will have undergone marine mammal observation training (JNCC or equivalent) and have spent a minimum of six weeks of marine mammal survey experience at sea over a three-year period;
- The MMO must submit a report, as outlined in NPWS code of practice, within 30 days of completion of the proposed activities to the relevant Licensing Authority, and copy the report to the NPWS;

- The geophysical vessel operator must provide a report (including a daily log) on the operation of survey equipment that will indicate the soft starts and their duration to the MMO. This information will be made available to NPWS;
- The MMO must use a distance measuring stick, reticle telescope or binoculars to ascertain distances to marine mammals;
- Vessel(s) working in or in vicinity to Broadhaven Bay SAC will operate in accordance with the Vessel Code of Conduct for Inspection and Maintenance Surveys (Document No. COR-14-SH-0227, 2018). This document forms part of the Operators Environmental Management Plan (EMP) and details specific measures for vessel operators to avoid impacts to marine mammals (particularly small cetaceans). Where at all possible when operating acoustic geophysical survey equipment, the *Leah-C* will work in an inshore to offshore direction, in an effort to retain an open aspect for animals to leave the confines of Broadhaven Bay, rather than animals wishing to increase their distance from the sound sources having to head further inshore.

In addition, a number of aspect-specific mitigation measures will be in place and are described below.

6.1.2 Mitigation for cetaceans, seals and other marine megafaunal species from multibeam, single beam, side-scan sonar & sub-bottom profiler surveys as well as when operating the mini-dredge tool

6.1.2.1 Pre soft start scans (pre-start monitoring)

Sound-producing activities will only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.

- Effective visual monitoring determines the presence or absence of megafaunal species before sound-producing activities commence, and should be undertaken in good weather conditions, where the sea state is low and visibility is good (no fog, heavy rain).
- MMOs should survey the area for the presence of species **30 minutes** before the onset of the soft start.
- A minimum distance of **500 m** is required between the centre of the sound source and the nearest species before soft start can commence.
- If species seen within **500 m** of the centre of the sound source the start of the sound source(s) should be delayed until they have moved away, allowing adequate time after the last sighting for the animals to leave the area (**30 minutes**).
- An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

- Soft start should commence after a **500 m** area around the vessel has been confirmed clear of species for **30 minutes**. It is not thought possible that soft start can be applied to the use of the mini dredge tool

6.1.2.2 Soft start / ramp up procedure

- In commencing an acoustic survey operation using the above equipment, the following soft start (or ramp up) must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:
    a) Where it is possible according to the operational parameters of the equipment concerned, the device's acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of **20 minutes**.
    b) This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period (e.g., output peak sound pressure level of 170 dB→180 dB→190 dB→200 dB→200+ dB over **20 minutes**).
    c) Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched "on" and "off" in a consistent sequential manner over a period of **20 minutes** prior to commencement of the full necessary output.
- In all cases where a ramp up procedure is employed the delay between the end of ramp-up and the necessary full output should be minimised to prevent unnecessary high-level sound introduction into the environment.
- Once the ramp up procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if species occur within a **500 m** radial distance of the sound source, i.e., within the Monitored Zone.

6.1.2.3 Break in sound input

- If there is a break in sound output for a period greater than **30 minutes** (e.g., due to equipment failure, shut-down, survey line or station change) then all pre-start monitoring and a subsequent ramp up procedure (where appropriate following pre-start monitoring) must be undertaken.
- For higher output survey operations which have the potential to produce injurious levels of underwater sound (see Sections 2.4 and 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter **5 - 10 minute break** limit after which period all pre-start monitoring and a subsequent ramp up procedure (where appropriate following pre-start monitoring) shall recommence as for start-up.

6.2 Mitigation of other impacts

There will be fisheries liaison procedures in place to mitigate interaction with fisheries, or other marine users. This includes liaison with relevant fisheries and other maritime organisations to communicate the survey schedule and enable activities to be planned accordingly.

The impacts from vessel emissions and discharges will be mitigated by the following measures:

- Regular maintenance of all onboard engines to minimise emissions, in line with:
    - Maritime Registry of Shipping (MRS);
    - MARPOL 73/78 Annex VI (as appropriate); and,
    - any other similar requirements.
- Management of discharges in accordance with the requirements of MARPOL 73/78 as appropriate, with the biochemical oxygen demand of sewage and galley waste discharges reduced to 50 mg/l and macerated to less than 25 mm, using a treatment process before release.

6.3 Accidental events

6.3.1 Spillage of fuel or Chemicals

The following measures will be in place to mitigate against accidental spills:

- Refuelling of vessels will not be undertaken at sea, but in port where spills, although unlikely to happen, can be responded to more easily, and will reduce the risk of any exposure to marine life;
- The vessels will operate with strict safety, navigational, operating and communications procedures in place in order to avoid collisions. These will include use of Automatic Identification System (AIS) tracking, adherence to the Collision Regulations, communication with other vessels, and 24 hour look ahead plans;
- The fuel to be used by vessels is regular marine grade oil (MGO) and not heavy fuel oil (HFO) that could represent a greater environmental hazard if spilled;
- The *Edda Sun* has a deck drainage containment and separation system in the event of a spill of oil on deck. Hydraulic fluids used by the ROV and ROV handling equipment have been selected partly based on their environmental credentials, being inherently rapidly biodegradable and having passed stringent LC 50 and EC 50 tests to determine their toxicity to aquatic life.
- Onboard the vessel, the valves between fuel tanks will be kept closed, thereby minimising potential for complete fuel loss. Refuelling will occur according to a specific procedure;
- Maintenance, audits and inspection plans will be in place to mitigate the potential risk of an oil leak at an early stage;
- Shipboard Oil Pollution Emergency Plans (SOPEP), spill mitigation equipment and other facilities are kept onboard all vessels in order to contain or minimise

spills; all the vessel crews have been trained in the use of the plans and equipment; and

- The Emergency Response Plan will set out how all spill response resources (personnel, command structure, equipment, etc.) will interface, including co-ordination between other seismic survey operators, if applicable.

6.3.2 Potential for vessel collision or equipment entanglement with marine fauna

The vessels working on the Corrib Project will operate in accordance with the Vessel Code of Conduct for Inspection and Maintenance Surveys (Document No. COR-14-SH-0227, 2018). This document forms part of the Operators Environmental Management Plan (EMP) and details specific measures for vessel operators to avoid impacts to marine mammals (particularly small cetaceans). Where at all possible when operating acoustic geophysical survey equipment as part of the surveys the principles of the vessel Code-of-Conduct will be followed as a matter of good environmental practice. The Vessel code of Conduct describes the measures to be taken regarding vessel speed and course changes, as well as the importance of maintaining a watch for animals to ensure that the potential for interactions with large species of marine fauna (including Annex IV species) are minimised. As part of the mitigation for undertaking an underwater acoustic survey an MMO will be present keeping watch for marine fauna during daylight hours. They will advise vessel crew of any animals that are sighted, so that the appropriate actions can be taken.

7 RISK ASSESSMENT

7.1 Introduction

Impacts expected to occur despite the mitigation measures proposed are often referred to as 'residual impacts' and are covered in the first part of the risk assessment (Section 7.3). Those impacts that have the potential to occur as a result of accidental events are discussed in the second part (Section 7.4).

The following sections provide risk assessment matrices, where the proposed survey programme has been broken down into a number of activities, and impacts are identified for each activity. Activities which have potential impacts are identified as 'aspects'. The types of potential impacts have been identified for each aspect. Consideration has been given to mitigation or control measures incorporated into the design of the activities, which reduce the potential impacts. This may result in the potential for impact to be eliminated. In other cases there remains a possibility for impact, in spite of the mitigation measures. The remaining impact is estimated where possible and listed as a predicted impact.

7.2 Evaluation of relative significance

The evaluation of the relative significance of the effects is shown in Table 7-1. The relative significance of a predicted impact is summarised from a scale from significant through to negligible (or beneficial). The evaluation considers the vulnerability, temporal sensitivity and recoverability of Annex IV species and the geographical extent of the effect. Criteria for assessing the significance of predicted impacts have been closely defined.

Table 7-1: Assessment of the significance of impact

Significance category		Severity of impact (after implementation of mitigation measures)
I	Significant	Substantial adverse changes in the ecology of Annex IV species, and/or a reduction in population number. These changes are well outside the range of natural variation. The recovery of affected species may be protracted.
II	Moderate	Moderate adverse changes in the ecology of Annex IV species. These changes may exceed the range of natural variation. The potential for recovery is good. It is recognised that a low level of impact may remain.
III	Minor	Minor adverse changes in the ecology of Annex IV species. These changes may be noticeable but fall within the range of natural variation. Effects are potentially short-lived, with a short-term recovery. It is recognised that potentially a low level of impact may remain.
IV	Negligible	Changes in the ecology of Annex IV species that are unlikely to be noticeable (i.e. well within the scope of

Significance category		Severity of impact (after implementation of mitigation measures)
		natural variation).
V	Beneficial	Changes resulting in positive, desirable, or beneficial effects to Annex IV species ecology.

Note: The definitions are intended to categorise predicted impacts following the implementation of mitigation measures or controls. An impact that would have been 'Significant' without action by the Project may be assessed to be 'Moderate', 'Minor', or 'Negligible', after effective mitigation or control measures are in place.

7.3 Residual risk assessment

This section summarises the aspects, potential impacts, mitigation measures, predicted impacts, and significance of the predicted impacts for the proposed activities.

It should be noted that the risk assessment focuses on the hazards and risks posed to Annex IV species as a whole (cetaceans, marine turtles and pinnipeds), and is not species specific. Furthermore, the assessment is based on a number of assumptions that should be considered when interpreting the risk assessment:

- Some Annex IV species are easier / more difficult to detect. In the case of cetaceans, smaller species such as the harbour porpoise can be difficult to detect in sea states of more than 2 on the Beaufort scale.
- It is likely that some of the species discussed in Section 2.4 and 2.5 will not be in the proximity of the survey area during the survey. This may be due to seasonality, which means animals may not be present at the time of the survey, or due to the fact the some of the species discussed are uncommon to Irish waters.
- The assumption has been made that Annex IV species will leave the area during the survey as a result of the 'soft start' approach. Some species, including cetaceans, have been known to approach geophysical vessels during acoustic survey activities.
- The assessment is based on use of soft start procedures. There is the possibility that the soft start procedures may not be sufficient for a particular species, or an individual animal to vacate the area before commencement of full scale operations (maximum output of survey equipment).

Table 7-2 presents the aspects, potential impacts, mitigation measures, predicted impacts and an assessment of the significance of the predicted impacts for the normal scheduled operations associated with the survey. The impacts of accidental events are considered separately (see Table 7-3).

Table 7-2: Residual risk assessment of potential impacts, proposed mitigation measures and predicted impacts

Aspect *Potential impact*	Mitigation measures	Significance
Mobilisation of survey vessels from port to site *Physical and acoustic presence*	The survey will be scheduled to minimise the duration of the *Leah-C* and *Edda Sun* at sea. Activities will be confined to as small an area as possible to minimise acoustic and visual presence. Vessel(s) will operate in accordance with the inspection and maintenance survey vessel Code of Conduct (Document No. COR-14-SH-0227, 2018) for operations within and adjacent to Broadhaven Bay SAC.	**Minor** For any reduction in Annex IV species abundance from an area, rapid repopulation is likely, as responses by animals is likely to be behavioural and temporary in nature. No changes in overall species abundances are anticipated. Likelihood of collision with animals considered extremely low. Residual risk of visual / acoustic presence of vessel traumatising Annex IV species is low.
Physical presence of the geophysical survey vessels, ROV, MBES, sub-bottom profiler, side-scan sonar, or stills/video camera system and mini dredge tool *Physical presence and potential for interaction*	The work will be scheduled so as to minimise the duration of project activities and to confine activities to as small an area as possible (i.e. directly over the pipeline and umbilical route, and other seabed assets being surveyed). Dedicated MMO and vessel crew will monitor and report immediately any interactions with Annex IV species that cause concern. With the potential exception of the side-scan sonar towfish on the inshore survey, acoustic survey equipment will be mounted directly to the hull of the *Leah-C*, or to the ROV of the *Edda Sun*, reducing the likelihood of interaction (such as entanglement) with Annex IV species.	**Minor** No known records of similar animal entanglement. Residual risk of acoustic source from presence of vessel traumatising Annex IV species is low. For any reduction in Annex IV species abundance, rapid repopulation is likely as responses by animals will be behavioural and temporary in nature. No changes in overall species abundances are anticipated. Likelihood of collision or entanglement with animals considered extremely low.

Aspect *Potential impact*	Mitigation measures	Significance
	The camera system and rock filter units will be lowered to the seabed using a taut vertical cable, reducing the likelihood of interaction (such as entanglement) with Annex IV species Vessel(s) will operate in accordance with the inspection and maintenance survey vessel Code of Conduct (Document No. COR-14-SH-0227, 2018) for operations within and adjacent to Broadhaven Bay SAC.	
Operation of geophysical survey equipment and mini-dredge tool *Acoustic disturbance*	The work will be scheduled so as to minimise the duration of project activities and to confine activities to as small an area as possible to minimise extent of acoustic presence. Soft start procedure will ensure controlled build-up of acoustic energy output is undertaken in consistent stages, providing a steady and controlled graduation acoustic source levels that will allow animals the opportunity to vacate the area. Dedicated MMO and vessel crew on survey vessels will monitor and report immediately any interactions with Annex IV species that cause concern.	**Minor** For any reduction in Annex IV species abundance, rapid repopulation is likely, as impacts are expected to be limited to behavioural (likely to be temporary) responses or temporary disturbances. Residual risk of traumatising Annex IV species is low.
Vessel operations / routine emissions and discharges *Water quality and toxicological effects.*	All waste will be handled in accordance with the vessels waste management plan, which will operate in accordance with all national and international legislation/regulations and corporate guidelines. Compliance with MARPOL 73/78. The work will be scheduled so as to minimise the duration of project activities and to confine activities to as small an area as possible. Air emissions will be minimised through regular maintenance of all engines onboard, in line with Maritime Registry of Shipping (MRS), MARPOL 73/78 Annex VI and other similar requirements.	**Minor** Potential attraction of Annex IV species to the area, due to potential attraction of prey species (vertebrates and invertebrates) at certain times (during discharges). There is a chance for this to result in an increased potential for laceration with propeller / interaction with the vessel or equipment, although the likelihood of this is considered to be extremely low.

Aspect *Potential impact*	Mitigation measures	Significance
	The use of the mini dredge tool for localised seabed reprofiling will result in some suspension of seabed sediments into the water column. This will occur only at those areas where free spanning of the pipeline requires this. Dedicated MMO and vessel crew on survey vessels will monitor and report immediately any interactions with Annex IV species that cause concern.	All vessel discharges will be in compliance with MARPOL 73/78. There is not considered any potential for bioaccumulation of toxicity in marine fauna as a consequence of routine vessel discharges Releases of suspended sediments will be extremely localised and of short duration. Volumes of sediment released will be minimised

7.4 Accidental events – risk assessment

The proposed survey has the potential to affect Annex IV species within a relatively localised area in the vicinity pipeline route. However, accidental events such as a large oil or chemical spill, has the potential to affect a wider geographical area.

This following table summarises the aspects, potential impacts, mitigation measures, and predicted impacts to Annex IV species from accidental events, which may occur during the planned survey. The potential for accidental events to occur during planned activities have also been considered and summarised in Table 7-3.

Table 7-3: Accidental events: risk assessment of potential impacts, proposed mitigation measures and predicted impacts

Aspect ***Potential impact***	**Mitigation measures**	**Predicted impact / significance**
Vessels operations, fuel and oil spills from the vessel Vessel Collision – Loss of fuel inventory *Water quality and toxicological effects*	No refuelling of the vessels will take place at sea. Refuelling operations will be managed through detailed vessel specific procedures and be supported by emergency response plans. The use of well-maintained and modern vessels, with modern navigational systems to identify / avoid obstacles. All fuels and chemicals aboard the survey vessels will be stored according to regulations and manufacturer's directions. Material Safety Data Sheets (MSDSs) for all chemicals stored onboard will be readily available. Procedures will be in place for dealing with spills and leaks. Vessel decks will have measures in place to contain fuel / lubricant / chemical leaks, such as bunding and oil / water separators. Spill response equipment will also be present on board vessels and personnel will be trained in its usage. Hydraulic fluids have been selected based on their environmental credentials (low toxicity and inherently biodegradable). The vessels will operate with strict safety, navigational, operating and communications procedures in place in order to avoid collisions. These will include use of Automatic Identification System (AIS) tracking, adherence to the Collision Regulations, communication with other vessels, and 24 hour look ahead plans. Use of marine grade oil (MGO), rather than traditional heavy bunker fuel. In the event of a release of oil, this will disperse more readily in the offshore environment.	**Minor** In the event of significant loss of fuel in an open offshore environment, spills would be rapidly dispersed and diluted with little long-term residual impact. Any reduction in Annex IV species abundance would be low and rapid repopulation is likely. The effect on prey and food sources of Annex IV species would be localised and recovery would be expected to be short-term.

Aspect ***Potential impact***	**Mitigation measures**	**Predicted impact / significance**
Accidental loss of equipment during operations Vessel collision risk with Annex IV species *Physical presence and potential for interaction*	Acoustic survey equipment will be mounted directed to the hull of the *Leah-C*, or to the ROV of the *Edda Sun*, reducing the potential for entanglement and loss of equipment. Vessel(s) will operate in accordance with the inspection and maintenance survey vessel Code of Conduct (Document No. COR-14-SH-0227, 2018) for operations within and adjacent to Broadhaven Bay SAC. Sightings of Annex IV species in the vicinity of the Corrib Field are comparatively low due to the distance offshore. Risks of vessel collision will be minimised due to the vessel operating in accordance with the principles of the Vessel Code of Conduct (Document No. COR-14-SH-0227, 2018). In addition, an MMO will be present at all times keeping watch during daylight hours.	**Negligible** In the event of a loss of equipment, which ultimately could not be recovered, there is a possibility that survey equipment may become entangled in other seabed obstacles and/or fishing gear, which in turn may provide a potential source of entanglement to Annex IV species. Due to the measures described, the likelihood of an occurrence of a project vessel striking any Annex IV animals is considered to be very unlikely.

8 CONCLUSIONS

This assessment has undertaken an initial screening assessment for an EIA and considered the potential impacts to Annex IV species associated with the proposed survey programme. Potential impacts to Natura 2000 sites and any species or habitats that are included as designating features of these sites are considered in the Natura Impact Statement report in support of an Appropriate Assessment (if required), which also accompanies this application.

The auditory ranges of the majority of cetaceans and seals are unlikely to overlap significantly with the operating frequencies of the MBES equipment proposed for this survey. While there is the potential for the lower frequency sound from the sub-bottom profiler, and potentially from the side-scan sonar (both used only on the inshore parts of the survey) to result in some avoidance behaviour at close ranges, it is important to consider that the source levels at which this equipment operates are considerably less than the lower frequency and higher source levels used in exploration seismic surveys.

Impacts will be mitigated by the use of soft start procedures and MMO's, and the surveys will be carried out following the NPWS best-practice guidance: "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters" (NPWS, 2014).

The disturbance to animals by the direct presence of the survey vessels are also not considered likely to result in any significant impacts. Vessels will be relatively slow moving, and not prone to sudden or erratic changes in direction. Animals will therefore have the opportunity to move away from approaching vessels. MMO's will be present on board the survey vessels and when working within Broadhaven Bay they will operate according to the inspection and maintenance survey Code-of-Conduct for vessels and personnel operating within and adjacent to Broadhaven Bay SAC (Document No. COR-14-SH-0227, 2018). This outlines specific guidance for vessels to avoid disturbance or injury to marine mammals (in particular, small cetaceans).

The works to correct any free-span issues along the offshore pipeline are understood to be an overall minor component of work scope, that will impact on only a few localised areas over a short time period. The dredge tool is an ROV deployed tool of low power and the volumes of sediment that are required to be removed and that will potentially be resuspended are also low.

The screening assessment has concluded that this project would not require an EIA. The impact assessment for Annex IV and other designated / protected species has concluded that the shallow geophysical survey techniques and any direct disturbance from the vessels themselves are not likely to have an adverse effect on the species that have been identified as key receptors within the zone of influence of the proposed works. Additionally, the other activities which are part of the survey work, including the wellhead repair, are unlikely to result in adverse effects. Any impacts that do occur will be limited to short-term avoidance behaviour of minor or negligible magnitude, with no lasting ecological effects.

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APPENDIX 1

Shell E&P Ireland Ltd

Corrib Gas Pipeline

Operational Impacts of the Corrib Gas Pipeline

Appendix A to the Cover Letter:

Roadmap for EIS Documentation

P40036

JULY 2015

RSK GENERAL NOTES

Project No.: P40036/04

Title: Corrib Gas Pipeline
Operational Impacts of the Corrib Gas Pipeline Roadmap for EIS Documentation

Client: Shell E&P Ireland Limited

Date: 28th July 2015

Office: Helsby

Status: Final

Author	Wendy Hogben/ David Watson	**Technical reviewer**	W.Hogben
Signature		Signature	
Date:	28th July 2015	Date:	28th July 2015

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.

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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 INTRODUCTION

The Corrib Gas Field Development is divided into a number of distinct but inter-related and inter-dependent elements as follows:

- Offshore seabed installation (subsea wellheads and manifold at the Gas Field);
- Offshore gas pipeline (between wellheads and landfall);
- Onshore gas pipeline (between landfall and gas terminal at Bellanaboy); and
- Bellanaboy Bridge Gas Terminal (BBGT).

The Corrib Pipeline includes both onshore and offshore, between the Corrib Gas Field and the BBGT received Ministerial Consent under Section 40 of the Gas Act in April 2002. SEPIL applied for consents for a modified route for the onshore gas pipeline in February 2009, including an application to the Minister for Department of Communications, Energy and Natural Resources (the "Minister").

Further modifications to the proposed onshore gas pipeline development, requested by An Bord Pleanála in November 2009, necessitated the preparation of a new/revised application to the Minister, including a revised Environmental Impact Statement (EIS) for the onshore gas pipeline. This revised application was submitted in June 2010. As the consents processes under the Gas Act apply to the Corrib Pipeline in its entirety (both onshore and offshore), a revised 2010 Supplementary Update Report in respect of the offshore section of the Corrib Pipeline for the 2001 Offshore EIS was also submitted, as outlined in Table 1. Additional information was also submitted to the Minister as part of the application, as listed in Table 1. A new consent was required for the Corrib Pipeline in order to implement the proposed modifications to the onshore pipeline route. This was granted on 25 February 2011 (the 2011 Section 40 Consent).

Table 1: Documentation submitted in respect of the Corrib Pipeline (2011 Section 40 Consent)

Project Element	Environmental Impact Statement / Natura Impact Statement
Offshore Seabed Installation Offshore Gas Pipeline	▪ Corrib Offshore Field to Terminal EIS October 2001 ▪ Offshore Supplementary Update Report May 2010
Onshore gas pipeline between landfall valve installation at Glengad and the Bellanaboy Bridge Gas Terminal	▪ Corrib Onshore Pipeline EIS May 2010, including Appendix P Natura Impact Statement (NIS)
Offshore and Onshore Pipeline	Additional Information ▪ (a) Non-Technical Summary; ▪ (b) Additional Information to the May 2010 Onshore Pipeline (Volume 1) (which included an Errata and Addendum to the EIS) ▪ (c) Geotechnical Data package (Sruwaddacon Bay Ground Investigation Data) 2010 (Vol. 1, 2 and 3), and ▪ (d) Engineering Integrity Material

The likely significant impacts of the construction and the operation of the Corrib Pipeline from the offshore facilities to the BBGT were fully considered and assessed in the documentation listed above.

SEPIL is applying for consent to operate an upstream pipeline, which includes both offshore and onshore elements, under Section 40 of the Gas Act (as amended) from the Minister of Communications, Energy and Natural Resources.

1.1 Purpose of this Roadmap Document

This Roadmap Document simply indicates where the information concerning the impacts associated with the operation of the Corrib Pipeline have been considered, this includes both offshore and onshore elements which have been considered and assessed in the documentation listed in Table 1.

The key information, extracted from the above documentation, includes:

- A description of the potential impacts[1] of the operation of the Corrib Pipeline on the environment.
- A summary of residual impacts[2] and a description of the mitigation measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects.

Table 2 lists all environmental aspects for which there was potential for impacts during the operation of the Corrib Pipeline. It sets out where these aspects were primarily but not exclusively considered in the EIS documentation. Table 3 (provided in Section 2 of this document) lists those aspects/activities for which residual operational impacts are anticipated. Where no residual impacts were predicted, these are not outlined further in this Roadmap Document. The 2001 Offshore EIS, 2010 Offshore Supplementary Update Report (SUR) and 2010 Onshore EIS all listed the key residual impacts within their respective summary chapters, (Section 16, Section 16 and Section 18 respectively). For ease of consideration and review , cross referencing these documents is provided throughout Table 3. Direct extracts are taken from the respective EIS documentation and as such in some cases refer to construction vessels. Where such impacts are identified they are clearly applicable to the use of both construction and operational vessels.

[1] Potential impacts are those which could potentially occur if no mitigation measures were in place

[2] Residual impacts are those impacts after implementation of mitigation measures

Table 2: Operational Impacts of the Corrib Pipeline

Aspect	Offshore Pipeline	Reference	Onshore Pipeline	Reference	LVI	Reference
Human/Socio Economic	√	Chapter 6 2001/2010 Offshore EIS/SUR*	√	Chapter 6 2010 Onshore EIS	√	Chapter 6 2010 Onshore EIS
Ecology	√	Chapter 7 2001/2010 Offshore EIS/SUR	√	Chapters 12 -14 2010 Onshore EIS	√	Chapters 12 2010 Onshore EIS
Soils & Geology	√	Chapter 8 2001/2010 Offshore EIS/SUR		Chapter 15 2010 Onshore EIS		Chapter 15 2010 Onshore EIS
Water/Hydrology	√	Chapter 9 2001/2010 Offshore EIS/SUR		Chapter 15 2010 Onshore EIS	√	Chapter 15 2010 Onshore EIS
Air	√	Chapter 10 2001/2010 Offshore EIS/SUR		Chapter 8 2010 Onshore EIS		Chapter 8 2010 Onshore EIS
Noise	√	Chapter 11 2001/2010 Offshore EIS/SUR		Chapter 9 2010 Onshore EIS	√	Chapter 9 2010 Onshore EIS
Landscape		Chapter 12 2001/2010 Offshore EIS/SUR		Chapter 10 2010 Onshore EIS	√	Chapter 10 2010 Onshore EIS
Climate		Chapter 13 2001/2010 Offshore EIS/SUR		Chapter 8 2010 Onshore EIS		Chapter 8 2010 Onshore EIS
Cultural Heritage		Chapter 14 2001/2010 Offshore EIS/SUR		Chapter 16 2010 Onshore EIS		Chapter 16 2010 Onshore EIS
Waste	√	Chapter 15.2 2001/2010 Offshore EIS/SUR		Chapter 11 2010 Onshore EIS	√	Chapter 11 2010 Onshore EIS
Traffic		Chapter 15.3 2001/2010 Offshore EIS/SUR	√	Chapter 7 2010 Onshore EIS	√	Chapter 7 2010 Onshore EIS
Agriculture		N/A	√	Chapter 11 2010 Onshore EIS	√	Chapter 11 2010 Onshore EIS

Legend: √ refers to Residual Impact. Reference refers to where aspect is primarily but not exclusively considered in the EIS documentation. **Note:** The shaded grey areas relate to where aspects were considered to have no residual impact or not applicable for assessment e.g. agriculture not relevant to the offshore pipeline. * Supplementary Update Report.

2 SUMMARY OF RESIDUAL IMPACTS

Table 3 provides a summary of predicted residual impacts and a description of the mitigation measures included in the EIS documentation submitted with the Section 40 Consent to Operate application, such as the 2010 Onshore EIS, the 2001 Offshore EIS and the 2010 Offshore Supplementary Update Report and Additional Information.

Table 3: Residual Operational Impacts of the Corrib Pipeline

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
Human Beings	Section 6.5.2 During normal operations, there will be no employment opportunities associated with the offshore development, except for those associated with the long-term maintenance and monitoring of the offshore pipeline and production facilities. These activities will require the employment of specialist contractors at regular intervals.	Section 6.7.2 No mitigation measures are considered necessary.	**POSITIVE** Section 6.7.2 Proposed development is likely to have an overall positive economic impact on the existing residential community through enhanced use of local services and goods.	2001 Offshore EIS, Section 6 Human Beings
Air Quality	Section 10.5.2.6 Once the pipeline and subsea equipment are in place, scheduled releases to the atmosphere are not anticipated as a result of routine operation. Occasionally, there will be small atmospheric emissions from marine vessels used for inspection surveys of the pipeline.	Section 10.7 Combustion emissions associated with transportation will be minimised through appropriate vessel selection and vehicle management plans. A programme of regular maintenance will be put in place to ensure that fuel use is as efficient as possible and emissions are within acceptable limits. Regular pipeline inspections and examinations using pipeline integrity gauges (PIGs), surface gas detectors (onshore) and inspections of the offshore route using survey vessels, will ensure that the integrity of the pipeline is maintained. These measures can	**NEGLIGIBLE** Section 10.8. In general, there are no resident sensitive receptors offshore and impacts will be negligible	2001 Offshore EIS, Section 10 Air Emissions

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
		be expected to be completely effective in eliminating any potential for release of gas from the pipeline and are used routinely worldwide.		
Water Quality	Section 9.5.1 Estimates of the volume of black and grey wastewaters, discharged from vessels during the remaining offshore and nearshore works, are provided in Table 9-2. Estimates have also been provided for galley wastes from the installation vessels.	Section 9.5.1 Such discharges will be quickly dispersed by wave and tide action, and discharges during future installation operations will not be "additive".	**NEGLIGIBLE** Section 9.5.1 Given the wide area and long period over which the discharges will be made, the magnitude of the impact is classified as negligible.	2010 Offshore Supplementary Update Report, Section 9 Water
Noise impact on cetaceans	Section 11.8.1 Relatively low noise levels will be generated by the installation vessels, these are likely to result in a negligible impact to cetaceans.	Section 11.7 In terms of mitigation against the noise generated by the marine construction vessels, a code of practice for dredging works was implemented in 2008 and 2009 (in agreement with the NPWS), and will be implemented during the next construction period. The code includes requirements such as a qualified and experienced Marine Mammal Observer (MMO) to be on board near shore construction vessels. The MMO is responsible for ensuring, through visual observations, that an exclusion zone of 1000m around the vessel is free of marine mammals for 30 minutes before operations commence.	**NEGLIGIBLE** Section 16 Negligible	2001 Offshore EIS, Section 11 Noise, 16 Assessment of Environmental Effects 2010 Offshore Supplementary Update Report, Section 11 Noise

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
Solid Waste	Section 15.2.8.3 Once the pipeline, umbilical and discharge pipe are operational, very little waste will be produced. It should be noted that small amounts of scale could be produced during maintenance operations. This waste will arise in the Terminal and therefore, is discussed in detail in the Terminal EIS. There will also be some solid waste generated by vessels carrying out survey or maintenance work along the pipeline route. This waste is held on board and there will no impact from this.	Section 16 .2 • inspection of pipeline integrity is routine, ensures that the pipeline functions correctly and removes scale build up; • scale is disposed of to licenced landfill site; and • subsea equipment is designed for project life. Replacement would not be a routine event. Written procedures would be followed.	**NEGLIGIBLE** Section 16	2001 Offshore EIS, Section 15 Material Assets, Section 16 Assessment of Environmental Effects
Post Construction Surveys (include Geophysical Surveys)[3]	Section 16.2 The length of the pipeline route from landfall to field will be surveyed • emissions to air from survey vessel; subsea noise; and • interference with other sea users.	Section 16.2 • survey will use low energy sonar, which has negligible effects on cetaceans; and • fishery liaison procedures will be employed.	**NEGLIGIBLE** Section 16.2 • emissions to air: refer to Chapters 10 and 13 • interaction with other sea users: refer to Chapter 15.	2001 Offshore EIS, Section 16 Assessment of Environmental Effects
Marine Ecology	Section 9.8.2 Leaching of trace metals from the sacrificial anodes is anticipated to have a negligible impact on the marine environment, as they will dissolve very slowly over the life of the pipeline. This will release small	Section 9.7.2 The sacrificial anodes used for cathodic protection will be designed to dissolve slowly, such that only low concentrations of metals are released over a long time period.	**NEGLIGIBLE** Section 9.10 There could be a slow breakdown of the sacrificial anodes if the pipe is left on the seabed, releasing metal ions into the water. This is expected to provide a negligible	2001 Offshore EIS, Section 9 Water

[3] Geophysical surveys include side scan sonars

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
	amounts of metal ions into the water column which will be diluted by the natural water movements along the pipeline route. Any metals which leach from anodes which are covered by the sediment may take longer to disperse.		impact because of the slow rate of release and high dilution available	
Water Quality (Discharge pipe (outfall pipe) and Umbilical	Section 9.8.2 During operation, the discharge from the outfall location north of Erris Head will consist of treated surface water run-off from hard surfaces around the terminal, effectively treated rain water and therefore no impacts are predicted. The discharge on the seabed in the Corrib field will consist of produced water, which has been treated to reduce contaminant concentrations to those required by the existing IPPC licence. The concentrations specified in that licence were such that there would not be damage to marine organisms. No effects are therefore predicted.	Section 9.7 For all offshore aspects of the project other than the pipeline installation in Broadhaven Bay, and the discharge off Erris Head and in the Corrib Field, the mitigation measures as proposed in 2001 Offshore EIS remain valid. Section 7.5 The treated surface water run-off from hard surfaces around the terminal will be discharged through a pipeline that terminates around 12.5km from the landfall. The produced water will be subject to three stages of treatment before it is discharged via the umbilical to the Corrib Field. The contaminants likely to be present in the produced water discharge have been identified on the basis of the fluids analysed from well testing operations. These contaminants will be	**NEGLIGIBLE** Section 9.10 Based on the assessments made in the 2001 Offshore EIS and further consideration of the potential impacts carried out by the EPA in granting the IPPC licence, the reinstatement and residual impacts are still considered negligible	2010 Offshore Supplementary Update Report, Section 9 Water and 7 Flora and Fauna

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
		treated to their respective Environmental Quality Standards (EQS) (Water Framework Directive (2000/60/EC)).		
Rock Placement[4] **Offshore Geology**	Section 8.5 The rock placement in Broadhaven Bay will disturb an area of seabed equivalent to the design footprint of the rock berm. Seabed geology over the berm footprint will be entirely covered. An estimate assuming worst case scenario calculates the footprint to range from 15000m2 to 30,000m2 in addition to the existing project footprint associated with the offshore pipeline/umbilical and seabed infrastructure at the offshore gas field.	Section 8.7 All of the rock material that is to be deposited to protect the pipeline in the Bay will be inert hard rock that has been washed following quarrying and grading. As such, the potential for rock dust to be introduced into the water column is considered extremely low. The majority of the seabed of the Bay is sandy in nature, and as such the rock berm will introduce hard substrate for colonisation by epibenthic species. This introduced hard geology will be consistent with the exposed bedrock that necessitates the rock placement, as well as the subtidal cliffs at the peripheries of the Bay. Hard rock substrates are characterised by increased species richness compared with the sandy seabed.	**MINOR** Section 8.10 There will be a residual impact related to the presence on the seabed of the pipeline. This impact is considered to be minor, in that the area of seabed taken by the pipeline is very small and does not exhibit any geological features that are unique and which would be lost or damaged.	2010 Offshore Supplementary Update Report, Section 8.5/8.7 Geology 2001 Offshore EIS, Section 8.10 Geology and Sediment

[4] Impacts from concrete mattressing are as for from rock placement

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Offshore Gas Pipeline				
Rock Placement **Water Quality**	Section 9.8.1 Placement of rock over the pipeline section in Broadhaven Bay, and the burying of the umbilical using a subsea plough/jetting tool, will have a minor, short-term, localised impact (see Table 3-1 for installation period), creating increased turbidity. Given that the installation period has been extended, the impacts will be perceived over a longer time period, though they will effectively be negligible.	Section 9.7 For all offshore aspects of the project other than the pipeline installation in Broadhaven Bay, and the discharge off Erris Head and in the Corrib Field, the mitigation measures as proposed in 2001 Offshore EIS remain valid.	**NEGLIGIBLE** Section 9.10 The reinstatement and residual impacts are still considered negligible.	2010 Offshore Supplementary Update Report, Section 9 Water

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Onshore Gas Pipeline				
Human Beings	Section 6.4.2.3 The proposed onshore pipeline development, as part of the overall Corrib Gas Field Development, is likely to have the following impacts during its operation: • Create new jobs and demand for local services, benefiting the working community of the area.	Section 6.5.2 No remedial or reductive measures are considered necessary.	**POSITIVE** Section 6.6.2 The overall Corrib Gas Field Development will directly employ approximately 55 no. people during its operation at the Bellanaboy Bridge Gas Terminal, in a variety of occupations, both skilled and unskilled. Based on the classification of people by principal occupation and social class profile above, much of the population in the local vicinity of the subject site are likely to be qualified to benefit from the type of new employment which will be created. This is a significant positive impact for the local and wider community.	2010 Onshore EIS, Section 6 Community and Socio-Economics
Terrestrial Ecology	Section 12.4 Potential impacts on habitats and species are summarised in sections 12.4.2 and 12.4.3 while the predicted level of post construction impacts are outlined for the short term and long term in Section 12.7. Appendix P (NIS) Section 5.2 and Table P14.	Section 12.5 The following sections provide summary details on the mitigation measures proposed to ameliorate against those potential impacts outlined in Section 12.4. A full description of the proposed mitigation measures are provided in Appendix J(1). Appendix P (NIS) Section 6.	**No long term significant impacts** Section 12.6 Residual impacts are summarised in sections 12.7.1 – 12.7.4 and in Table 9 in Appendix J (1). The terminology for impact duration is in accordance with the EPA Guidelines (2003). Long term significant impacts are not expected because of the nature of pipeline construction and the fact that, with the exception of the landfall valve installation footprint, habitats can be reinstated.	2010 Onshore EIS, Section 12 Terrestrial Ecology Appendix J1, including Table 9, Summary of expected impacts on habitats and species Appendix P (NIS), including Table P14. 2010

Aspect	Potential Impact	Mitigation Measures	Residual Impact	Extract Reference
Onshore Gas Pipeline				
				Onshore EIS, Section 12 Terrestrial Ecology
Traffic	Section 7.5.2 There will be very little traffic associated with the operation of the Corrib Onshore Pipeline. The traffic movements associated with the occasional safety checks and maintenance will be negligible and will not generate a potential traffic impact on the surrounding road network.	Section 7.6.1 The development of the pipeline will have minimal traffic associated with it during its operation apart for safety checks and maintenance purposes. This means no mitigation measures will be required for the operational stage of the pipeline.	**NEGLIGIBLE** Section 7.7 The results show that no operational difficulties are expected.	2010 Onshore EIS, Section 7 Traffic
Agriculture	Section 11.2.2 The extent of permanent exclusion from future development is defined by the area of the on-land permanent pipeline wayleave – in this case the width of the permanent wayleave is generally 14 metres (and 20m wide in peatland and forestry). Furthermore, potential development in close proximity to a gas pipeline must be controlled on the grounds of public safety, with exclusion areas normally calculated in reference to current pipeline design safety codes.	Section 11.4.1 1 Permanent landtake, permanent loss of areas for harvesting timber and temporary loss of areas for grazing or grass harvesting will be dealt with by compensation	**MINOR** Section 11.5.1 The proposed development will have a minor, long term residual impact on forestry production within the permanent wayleave. The residual impact on the remaining lands used for grazing and grass production will be short term and minor.	2010 Onshore EIS, Section 11 Material Assets

Aspect	Potential Impacts	Mitigation Measures	Residual Impact	Extract Reference
LVI				
Human Beings	Section 6.4.2.3 The proposed onshore pipeline development, as part of the overall Corrib Gas Field Development, is likely to have the following impacts during its operation: • Create new jobs and demand for local services, benefiting the working community of the area.	Section 6.5.2 No remedial or reductive measures are considered necessary.	**POSITIVE** Section 6.6.2 The overall Corrib Gas Field Development will directly employ approximately 55 no. people during its operation at the Bellanaboy Bridge Gas Terminal, in a variety of occupations, both skilled and unskilled. Based on the classification of people by principal occupation and social class profile above, much of the population in the local vicinity of the subject site are likely to be qualified to benefit from the type of new employment which will be created. This is a significant positive impact for the local and wider community.	2010 Onshore EIS, Section 6 Community and Socio-Economics
Traffic	Section 7.5.2 Once every 4-5 years the LVI will require a maintenance inspection, which will require the use of heavy machinery, but this will not involve a high number of traffic movements.	Section 7.6.1 The development of the pipeline will have minimal traffic associated with it during its operation apart for safety checks and maintenance purposes. This means no mitigation measures will be required for the operational stage of the pipeline.	**NEGLIGIBLE** Section 7.7 The results show that no operational difficulties are expected.	2010 Onshore EIS, Section 7 Traffic
Hydrogeology	Section 15.3.3.2 A perforated drainage pipe network will intercept both groundwater and surface water and divert elevated groundwater from the LVI site to a concealed outfall in the cliff face.	Section 15.3.3.2 No remedial or reductive measures are proposed.	**IMPERCEPTIBLE** Section 15.3.3.2 Only imperceptible impacts on local groundwater levels and groundwater flow in the area would be expected during the operational stage of the proposed project.	2010 Onshore EIS, Section 15 Hydrology and Hydrogeology

Aspect	Potential Impacts	Mitigation Measures	Residual Impact	Extract Reference
LVI				
Noise	Section 9.4.5 There will be no continuous operational noise generated by the proposed development.	Section 9.5.6 Residents of the nearest receptors will be notified well in advance prior to any major maintenance works at the LVI, or if the LVI pipeline restart system needs to be operated.	**NEGLIGIBLE** Section 9.6 The only noise to be generated by the development during operations will be from weekly visits to the LVI, and any maintenance works. The additional traffic generated by this activity will be negligible in comparison to the existing traffic flows.	2010 Onshore EIS, Section 9 Noise and Vibration
Landscape	Section 10.4.1.1. The LVI will become a new but non-prominent feature of this landscape.	Section 10.4.1.1. It is located approximately 50m from the landfall in (Glengad) and has been set down in a 'dished' area approximately 3m below existing ground level. The careful siting of the installation at reduced ground levels results in low levels of change in landscape resource.	**MODERATE** Section 10.6 The LVI will not be a prominent feature in the landscape at the headland at (Glengad) due it is low-lying nature and design mitigation measures. No significant visual impacts are predicted for properties with a potential view across the location of the restored LVI.	2010 Onshore EIS, Section 10 Landscape and Visual Impact Assessment
Terrestrial Ecology	Section 12.4.4.2 There will be a small permanent loss of habitat at the footprint of the landfall valve installation (approximately 20m x 22m) and along the access road. This will be located in an area of improved agricultural grassland of low ecological value. Impacts are expected to be long term, localised, direct, and moderate. Normal operation of the LVI will not have any impact upon wildlife using the area, including the occasional	Section 12.5.4.2 Following construction this topsoil will then be used on the slopes of the facility, which will then be left to revegetate naturally. It is proposed therefore that no seed or topsoil will be imported into the cSAC in order to prevent the introduction of non-native genotypes which could result in the genetic pollution of the local plant populations, also to protect against the introduction of pest species.	**SLIGHT/MODERATE** Section 12.6.4 In the short term impact level is expected to be moderate for the footprint of the LVI, but imperceptible to slight for other areas associated with the LVI. Long term impacts are expected to be slight to moderate (LVI footprint) and imperceptible to slight for reinstated areas. Although there will be slight loss of foraging habitat for birds and small mammals, it is	2010 Onshore EIS, Section 12 Terrestrial Ecology and Appendix J1, Table 9, Summary of expected impacts on habitats and species Appendix P (NIS), including

Aspect	Potential Impacts	Mitigation Measures	Residual Impact	Extract Reference
LVI				
	otter holt and the Sand Martin colony close by. The facility will not require illumination during night-time. Regular monitoring checks at the LVI will involve one or two individuals with a small vehicle or jeep and are not expected to impact on species using the site any more than current agricultural activities impact on the area. If works or servicing is required at the LVI at any stage, then this may temporarily disturb faunal species for the duration of the work, but no lasting impact is expected.	To aid topsoil stability and grass growth, a geotextile membrane will be laid on the slopes of the facility. Appendix P (NIS) Section 6.	expected that in the long term - with likely further agricultural improvement in the locality - the residual impact will be slight. In addition, the provision for naturally regenerated grassland areas on the slopes of the facility and on level areas will compensate to some extent, for the loss of the pre-existing grassland. The residual impact in vegetation and faunal terms and also in the context of the present function of this area as a buffer zone within the cSAC, is expected to be slight.	Table P14
Agriculture	11.3.2.1 Approximately 0.5 hectares of farmland will be required for the LVI (and permanent access road) at Glengad. This land is in the ownership of SEPIL.	Section 11.4.1.1 Permanent landtake, permanent loss of areas for harvesting timber and temporary loss of areas for grazing or grass harvesting will be dealt with by compensation.	**MINOR** Section 11.5.1 The proposed development will have a minor, long term residual impact at the LVI due to loss of land for production.	2010 Onshore EIS, Section 11 Material Assets

3 CONCLUSION

The tables in this document outlines where consideration has been made of the potential and residual impacts and mitigation measures associated with the operation of both the onshore and offshore elements of the Corrib Pipeline.

APPENDIX 2

Table A2 – Table 3.1 (EACS, 2015) Summary of planned and previously approved pipeline operational activities

Location	Activity	Frequency	Scope	Reference Document(s) /Assessments	Note
Offshore / nearshore pipeline	Annual/Biennial post start-up offshore pipeline and umbilical surveys	At least every two years	Geophysical survey to assess the integrity of the pipeline. Inshore and offshore elements.	• Offshore EIS (RSK, 2001) • Offshore Supplementary Update Report (RSK, 2010) • Corrib Ocean Bottom Cable Seismic Survey Natura Impact Statement (to support the AA Process for the proposed West Connacht Coast SAC) February 2013† • Corrib Offshore Pipeline Inspection Survey 2014 – Screening for AA • Corrib Offshore Protection Works - Geophysical Survey 2014 Screening for AA • Corrib Nearshore Protection Works Surveys – 2015 Screening for AA	† *West Connacht Coast SAC was first notified in 2012.*
	Cathodic protection survey	Every two years	Resistivity survey along the length of the pipeline undertaken by small inshore vessel and an ROV further offshore	• Offshore EIS (RSK, 2001) • Plan of Development 2001 • Offshore Supplementary Update Report (RSK, 2010)	
	Intelligent Pipeline Integrity Gauge (PIG) run	Once at initial operation, and as required thereafter dependent on initial results [2]			*The PIG will be launched from the subsea manifold at the field and contained within the pipeline, so this activity has no potential to impact on any European site.*
	Rock placement	Currently estimated to be every two years	Placement of rock material[3] to protect seabed assets. Mitigation against scouring, free-spanning, pipeline exposure etc.	• Offshore EIS (RSK, 2001) • Plan of Development 2001 • Offshore Supplementary Update Report (RSK, 2010) • Corrib Water Outfall Line Remedial Works Screening for Appropriate Assessment (2015)	*Also assessed separately prior to rock placement in 2009 in relation to Broadhaven Bay SAC, and marine mammals (See 5.3.1.3).*
Onshore					
Landfall Valve Installation (LVI)	Regular inspection and routine corrective maintenance	Minimum weekly visits	One work vehicle accessing the site, with two personnel	• Corrib Onshore Pipeline EIS (RPS, 2010)	
	Maintenance of safety shutdown valves	Once every 5 years	45 tonne crane, if deemed necessary, and up to six truck movements and personnel cars		
	Emergency shutdown of the LVI system	Unknown	Potentially 2 vehicles and 4 personnel		
Onshore pipeline wayleave	Geotechnical inspection	Annual	Two personnel - on foot	Corrib Onshore Pipeline EIS (RPS, 2010)	*Geotechnical instrumentation is installed along the wayleave that is monitored from the terminal so frequent access not required.*
Onshore pipeline wayleave	Pipeline inspection	Monthly	Two personnel - on foot	Landowner Liaison Strategy and Plan (Condition No 42,, Section40)	*As a base case, SEPIL in line with I.S. 328 intend to perform monthly walk downs /ground patrols of the complete onshore pipeline route*

[2] Estimated to be no more frequent than once every 5 years

[3] Impacts from concrete mattressing are as for rock placement.

Table A2 – Table 5.2 (EACS, 2015) Consented offshore surveys / activities - NIS/ Screening reports

NIS/Screening Report		Report Date	Consenting Body	Date of approval
i	Corrib Ocean Bottom Cable Seismic Survey Natura Impact Statement (to support the Appropriate Assessment Process for the proposed West Connacht Coast SAC)	February 2013	*DCENR*	04 March 2013
ii	Corrib Field Rig Site Survey and Well Intervention Works Screening for Appropriate Assessment	February 2014	DCENR	28 February 2014
iii	Corrib Offshore Pipeline Inspection Survey 2014 Screening for Appropriate Assessment	June 2014	DCENR	30 July 2014
iv	Corrib Offshore Protection Works - Geophysical Survey 2014 Screening for Appropriate Assessment	July 2014	DCENR	30 July 2014
v	Corrib Water Outfall Line Remedial Works Screening for Appropriate Assessment *(Note: this included an assessment of acoustic and visual surveys)*	April 2015	DCENR	• Surveys:15 April 2015 • Protection Works Method Statement: 04 June 2015 • Remedial Works: 04 June 2015 • Protection Works Method Statement Addendum: 09 July 2015
vi	Corrib Nearshore Protection Works Surveys – 2015 Screening for Appropriate Assessment	July 2015	DCENR	• 22 July 2015