

APPROPRIATE ASSESSMENT REPORT

FS007050 Greenlink Interconnector – Foreshore Licence Application

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1 INTRODUCTION

1.1 Project overview

Greenlink Interconnector Limited (GIL) is proposing to develop an electricity interconnector cable (Greenlink) linking the existing electricity grids in Ireland and Great Britain. The interconnector will have a nominal capacity of 500 MW. There will be one converter station near the existing National Grid substation at Pembroke in Pembrokeshire (Wales) and one converter station near the existing EirGrid substation at Great Island in County Wexford (Ireland). These will be connected by underground cables (onshore) and subsea cables (offshore).

Greenlink is designated as a European Union Project of Common Interest (PCI), project number 1.9.1, under the provisions of European Union Regulation No. 347/2013 on guidelines for Trans-European Network for Energy (TEN-E Regulations) and has successfully applied for funding under the Connecting Europe Facility.

The landfall points for the submarine cables are Baginbun Beach, County Wexford and Freshwater West, Pembrokeshire. The overall length of the interconnector is approximately 159km of submarine cabling and approximately 7km and 23km of onshore cable in Wales and Ireland respectively. The proposed development for the purposes of this Foreshore Licence Application covers the Irish marine components of Greenlink from mean high-water springs (MHWS) at the Irish landfall at Baginbun Beach, Co. Wexford to the 12nm limit. The Foreshore Licence Application also includes works at the Campile Estuary component of Greenlink (where the onshore cable route crosses the foreshore at the River Campile).

The proposed development is described fully in **Section 2.4** and comprises the following:

- Two high voltage direct current (HVDC) electricity power cables;
- A smaller fibre-optic cable for control and communication purposes;
- All associated works required to install, test, commission and complete the aforementioned cables; and
- All associated works required to operate, maintain, repair and decommission the aforementioned cables, including five repair events over the 40-year lifetime of Greenlink.

RPS has been commissioned by the Department of Housing, Local Government and Heritage (DHLGH) to provide Appropriate Assessment (AA) environmental consultancy services and to review the Natura Impact Statement (NIS) contained within the foreshore licence application for the proposed activities.

1.2 Methodology

The review comprises an assessment of the documentation and information submitted as part of the foreshore licence application, in particular the accompanying NIS, which should identify the potential impacts of the proposed activities on the qualifying interests of European sites.

The European Communities (Birds and Natural Habitats) Regulations 2011 (as amended), provides the following interpretation of what constitutes an NIS: “Natura Impact Statement” means a report comprising the scientific examination of a plan or project and the relevant European Site or European Sites, to identify and characterise any possible implications of the plan or project individually or in combination with other plans or projects in view of the conservation objectives of the site or sites, and any further information including, but not limited to, any plans, maps or drawings, scientific information or data required to enable the carrying out of an Appropriate Assessment.

This technical review has been undertaken with regard to the appropriate legislation, guidance and departmental circulars.

The NIS will be scrutinised to assess whether it includes the following:

- Robust scientific information and analysis including the reasoning and justifications for the conclusion. Other relevant documents submitted by the applicant may be cross-referenced and the findings integrated into the assessment, particularly where analysis of environmental factors is required to determine effects on the structure and function of the European sites;
- Compliance with the tests and standards of AA as presented in European and national guidance;

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- The assessment is carried out for the whole project, including all associated and ancillary elements;
- A robust scientific assessment and conclusions are reached relative to:
 - Conservation objectives of site(s), and
 - Integrity of site(s).
- Complete, precise and definitive findings and conclusions, capable of removing all reasonable scientific doubt as to the effects on the European sites.

The NIS and other reviewed documents are taken into account to allow DHLGH to arrive at a definitive determination under Article 6(3) of the Habitats Directive as to whether the project, on its own or in combination with other plans and projects, would adversely affect the integrity of a European site. In conducting the AA, case-law of the Court of Justice of the European Union (Case C-258/11) has established that the assessment carried out under Article 6(3) cannot have lacunae and must contain complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of a project on a European site.

In the European Communities (Birds and Natural Habitats) Regulations 2011, in carrying out an AA under paragraph (11) the public authority shall take into account each of the following matters:

- a. the Natura Impact Statement,
- b. any other plans or projects that may, in combination with the plan or project under consideration, adversely affect the integrity of a European Site,
- c. any supplemental information furnished in relation to any such report or statement,
- d. if appropriate, any additional information sought by the authority and furnished by the applicant in relation to a Natura Impact Statement,
- e. any information or advice obtained by the public authority,
- f. if appropriate, any written submissions or observations made to the public authority in relation to the application for consent for proposed plan or project, and
- g. any other relevant information.

1.3 Further Information Request

The initial RPS review of the 'Stage 1 – Appropriate Assessment Screening' (provided in the NIS, Chapter 4) and associated documents determined that insufficient information had been provided to assess, in view of best scientific knowledge and in view of the conservation objectives of the European sites, whether the proposed interconnector cable activities, individually or in combination with other plans or projects, is likely to have significant effects on a European site, and further information was required to inform the Screening for AA determination, and subsequently the AA.

A Request for Further Information (RFI), in accordance with Regulation 42(3) of the European Communities (Birds and Habitats) Regulations 2011, as amended, was issued by the DHLGH to the applicant. The following further information was requested:

- Inclusion of the Keeragh Islands SPA and Saltee Islands SPA in the assessment for likely significant effects.
- An assessment of likely significant effect related to the identified pressure 'hydrological changes (inshore/local)' as a result of placement of external cable protection.
- Provision of additional information to support the conclusion that there would be no likely significant effects to migratory fish species viability, populations, or stocks, as a result of UXO detonation, specifically how aggregations of migratory fish would be avoided. It was also noted that the applicant, in their response to IFI, provided additional project specific mitigation not included in the NIS.
- Clarification regarding the exclusion of transboundary effects, i.e. likely significant effects to marine mammals from UK SACs.

After receiving a further information response from the applicant, RPS completed a review of the Stage 1 Screening for AA documentation on behalf of DHLGH. That review found that likely significant effects on

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European sites could not be ruled out and therefore a Stage 2 Appropriate Assessment should be undertaken. An initial evaluation by RPS of the NIS and associated documents indicated that an adverse effect on integrity of Hook Head SAC could not be avoided due to the installation of external cable protection at the HDD exit point within the SAC. Following a meeting between RPS, DHLGH and the applicant, this element of the project was redesigned, removing the potential for requiring external cable protection within Hook Head SAC. As a result, this AA has been amended to account for this redesign and reflects the final project design. Additional information received from the applicant on impacts to migratory fish species and marine mammals and resulting mitigation measures has been incorporated into the AA. Removal of the requirement for external cable protection within Hook Head SAC removes the likelihood of hydrological changes (inshore/local) and therefore this potential effect has been screened out.

2 APPROPRIATE ASSESSMENT

2.1 Screening for Appropriate Assessment

An NIS was submitted as part of the foreshore licence application, to inform the AA to be completed by DHLGH. A Stage 1 Appropriate Assessment Screening was provided in Section 4 of the NIS, and concluded that it cannot be excluded beyond reasonable doubt, in view of best scientific knowledge on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans or projects would have a significant effect on the following sites:

- Hook Head SAC
- Saltee Islands SAC
- Slaney River Valley SAC.

RPS carried out a review of the Screening for AA (Stage 1 assessment) documentation on behalf of DHLGH and concluded that, in addition to the sites listed above, likely significant effects could not be excluded for the following sites:

- River Barrow and River Nore SAC
- Lower River Suir SAC
- Pembrokeshire Marine/Sir Benfro Forol SAC
- West Wales Marine/Gorllewin Cymru Forol SAC
- Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC
- North Anglesey Marine/Gogledd Môn Forol SAC
- North Channel SAC
- Llyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC
- Cardigan Bay/Bae Ceredigion SAC.

The elements of the proposed project alone or in combination with other projects or plans that are likely to give rise to significant effects on the above European sites are:

- Penetration and/or disturbance including abrasion; and
- Underwater noise changes – UXO detonation and geophysical survey

Therefore, the project is subject to an AA in accordance with Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora; the Planning and Development Act 2000 (as amended); and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011).

2.2 Structure of the Appropriate Assessment Report

A summary of the project description is provided in **Section 2.4** and the elements of the project alone and in combination with other projects or plans that are likely to give rise to significant effects on the European site are outlined in **Section 2.4.1**.

The conservation objectives for the European sites screened in for AA are provided in **Section 2.5**.

Assessments on how the project will affect the key species and key habitats, acknowledging any uncertainties and any gaps in information and on how the project will affect the integrity of the European sites are provided in **Section 3**.

A summary of the observations and submissions received on the application are provided in **Section 4**.

Proposed mitigation measures are provided in **Section 5**.

2.3 Appropriate Assessment Checklist

As per the EC Guidelines (2002) the checklist in **Table 2.1** outlines the information necessary to complete the AA.

Table 2.1 Checklist for Appropriate Assessment

Are these known or available?	√ / x
Information about the project or plan.	
Full characteristics of the project or plan which may affect the site.	√: The characteristics of the proposed project are provided in the NIS Chapter 2.
The total range or area the plan or project will cover.	√: Total length of the cable is approximately 159 km, approximately 36 km of which occurs within Irish territorial waters, 50 km is within Irish offshore waters and the remainder within UK waters. Detail provided in the NIS, Section 2.1.
Size and other specifications of the project.	√: Details on size and other specifications of the project are provided in the NIS, Chapter 2.
The characteristics of existing, proposed or other approved projects or plans which may cause interactive or cumulative impacts with the project being assessed and which may affect the site.	√: Cumulative effects are considered in the NIS, Section 4.5 as part of the Stage 1 Screening for AA. Cumulative effects are further considered for each effect considered in Chapter 5 (the Stage 2 AA) and the RFI Response.
Planned or contemplated nature conservation initiatives likely to affect the status of the site in the future.	x: No nature conservation initiatives have been considered; however, it is unlikely that there are any in place.
The relationship (e.g. key distances etc.) between the project or plan and the Natura 2000 site.	√: European sites considered to be within the zone of influence, along with distances to the proposed development are provided in the NIS, Table 4-3, as part of the Stage 1 Screening for AA. Figures 4-1 and 4-2 in the NIS display the location these European sites in relation to the proposed development.
Information about the European sites	
The reasons for the designation of the Natura 2000 site.	√: Qualifying interests for each European site screened in for the Stage 1 assessment are provided in the NIS, Table 4-3.
The conservation objectives of the site and the factors that contribute to the conservation value of the site.	√: For the three sites originally taken forward to a Stage 2 assessment (Hook Head SAC, Slaney River Valley SAC and Saltee Islands SAC), conservation objectives and relevant details relating to the conservation value are provided in Chapter 5 of the NIS. For sites relating to migratory fish (River Barrow and River Nore SAC, Lower River Suir SAC and Slaney River Valley SAC) conservation objectives and other relevant information was provided in the applicant's RFI response. For the remaining sites taken through to AA by RPS, conservation objectives and related information was accessed on the relevant statutory body's website (e.g. NPWS, JNCC or NRW).
The conservation status of the site (favourable or otherwise).	√: As above, the conservation status for each relevant QI taken through for Stage 2 AA was provided in Chapter 5 of the NIS, in the RFI response or has been accessed on the relevant website.
The existing baseline condition of the site.	√: The baseline environment associated with each of the European sites is provided in the NIS, Chapter 3 and were relevant for this assessment has been accessed on the relevant statutory body's website.

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Are these known or available?	✓ / ✗
The key attributes of any Annex I habitats or Annex II species on the site.	✓: The Annex I habitats or Annex II species potentially affected by the project are described in detail in the NIS and detailed information on the European sites, their species and habitats is accessible through the relevant statutory body's website (NPWS, JNCC or NRW).
The physical and chemical composition of the site.	
The dynamics of the habitats, species and their ecology.	
Those aspects of the site that are sensitive to change.	
The key structural and functional relationships that create and maintain the site's integrity.	
The seasonal influences on the key Annex I habitats or Annex II species on the site.	
Other conservation issues relevant to the site, including likely future natural changes taking place.	✗: No other nature conservation initiatives or future natural changes have been taken into account, however, it is not known that any are planned.

2.4 Project Description

The proposed development is approximately 36km long and generally 500m wide, between Baginbun Beach, County Wexford and the 12nm limit. A small part of this width will be required for installation (of the order of 10-20m) once the final cable route within this corridor is agreed. It is proposed to finalise the precise position of the submarine cables within the corridor after permits are granted but before installation has commenced. This will allow for optimisation of the final laid submarine cables to minimise engineering and environmental challenges. Cables will be bundled together with no separation between the cables.

The project description includes route preparation in the form of a pre-grapnel run (a wire with a string of specially designed hooks) which is towed along the entire route to remove debris; the deposit and burial of the cables in the seabed; a horizontal direction drill (HDD) underneath the beach at Baginbun Beach; and the contingency for one unexploded ordnance (UXO) detonation. The original project design included a contingency for the deposit of two areas of external cable protection (each 20m x 5.2m by 0.7m high) at the HDD exit points within Hook Head SAC, however, following discussions between DHLGH and the applicant, this element of the project was re-designed, placing the HDD exit points within deeper sediments and removing the potential need for external cable protection.

The project description includes up to five discrete repairs of the submarine cables, including as a worst-case deposition of external cable protection, should it be required. The Project also includes a horizontal direction drill under the Campile Estuary associated with the Greenlink onshore cables.

The full programme of works is expected to take approximately 36 months from start to finish.

The project design also includes pre-installation geophysical surveys, expected to take place 3-6 months before cable installation begins. The objective of these surveys will be to ensure that no new obstructions have appeared on the seabed since the detailed engineering works. These surveys will involve a range of standard geophysical survey methods such as multi-beam echo sounder, side scan sonar, sub-bottom profiler and magnetometer.

A detailed project description of the proposed development is provided in Chapter 2 of the NIS.

2.4.1 Elements of the Project (Alone or in Combination with other Projects or Plans) that are Likely to Give Rise to Significant Effects on European Sites

The elements of the proposed development as identified in the Screening for AA, which accompanies this report, with the potential to give rise to adverse effects on European sites are:

- Penetration and/or disturbance including abrasion; and
- Underwater noise changes – UXO detonation and geophysical survey

These elements are related to the construction phase of the project only and are not expected to occur during operation or decommissioning phases. No elements of the project were considered likely to give rise to significant effects during operation or decommissioning phases.

In-combination, or cumulative, effects are discussed in the NIS Section 4.5 and considered for each potential adverse effect in Chapter 5 (the Stage 2 AA) and the RFI Response. In-combination effects are assessed here in **Section 3.4**.

2.5 European Site Descriptions, Qualifying Interests and Conservation Objectives

The following sub-sections provide a brief description of each of each European site and the qualifying interests (QI) of each site which are relevant to this AA and their conservation objectives. In total, 12 European sites were taken forward for consideration.

2.5.1 Hook Head SAC

Hook Head SAC is designated for three marine and coastal QIs:

- Reefs,
- Large shallow inlets and bays, and,
- Vegetated sea cliffs of the Atlantic and Baltic coasts.

The Screening for AA established that there was no pathway to impact between the proposed development and the sea cliffs QI, therefore, this QI was screened out of further assessment. As detailed in **Section 1.3** above, following a re-design of the HDD exit point in the nearshore environment within Hook Head SAC, the Screening for AA determined that there would be no likely significant effects on the large shallow inlets and bays QI. Therefore, the only QI at Hook Head SAC considered in this AA is reefs.

Extensive areas of reef occur with the SAC, occurring intertidally as vertical rock faces or inclined bedrock with large boulders (NPWS, 2011a). Subtidally, the reefs are aligned in a north-east/south-west orientation and are typically strewn with boulders, cobbles and patches of sand and gravel. There are also a number of isolated reefs that project from a sand plain (NPWS, 2014). Three community types/complexes can be distinguished for this habitat:

- Exposed to moderately exposed intertidal reef community complex – extends largely uninterrupted along the coastline from Doonoge Point (to the west of Hook Head) to Ingard Point to the East.
- Echinoderm and sponge dominated community complex – recorded in deeper waters. Species recorded within this community complex at Hook head include sponges, tunicates and echinoderms with a limited distribution in Ireland.
- *Laminaria* dominated community – recorded in the shallow waters around Hook Head.

A description of the reef habitats found within Hook Head SAC is provided in Section 3.1.2 of the NIS, which draws on the information available from NPWS and data gathered during the Greenlink cable route survey. Bedrock outcrops within the proposed development were identified during the geophysical survey. Attempts to ground truth these areas of reef were largely unsuccessful due to poor visibility. The NIS calculates the extent of Annex I reef habitat within the proposed development as 5.33 km², with 4.16 km² within Hook Head

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SAC. The conservation objectives of Hook Head SAC (NPWS, 2011b) are outlined in the Section 4.4.1 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.2** below.

Table 2.2 Relevant Qualifying Interests and conservation objectives of Hook Head SAC (IE000764)

Qualifying Interest	Conservation Objective	Attribute	Measure	Target
Reefs	To maintain the favourable conservation condition of Reefs in Hook Head SAC, which is defined by the following list of attributes and targets:	Distribution	Occurrence	The distribution of reefs should remain stable, subject to natural processes.
		Habitat area	Hectares	The permanent area is stable, subject to natural processes.
		Community structure	Biological composition	The following reef community complexes should be maintained in a natural condition: Exposed to moderately exposed intertidal reef community complex; and Echinoderm and sponge dominated community complex.
		Community extent	Hectares	The extent of <i>Laminaria</i> dominated community should be conserved, subject to natural processes.
		Community structure	Biological composition	The biology of <i>Laminaria</i> dominated community should be conserved, subject to natural processes.

2.5.2 Migratory fish SACs

Three SACs (River Barrow and River Nore SAC, Lower River Suir SAC and Slaney River Valley SAC) were taken forward to AA as likely significant effects to migratory fish species (twaite shad and Atlantic salmon) could not be ruled out. As the conservation objectives for these two QIs are identical for each SAC, in the interests of brevity, these have been provided once in **Table 2.3** below. **Sections 2.5.2.1 to 2.5.2.3** below briefly outline the migratory fish QIs within each SAC. It is noted that the conservation objectives for Atlantic salmon only apply to freshwater, however, as this species migrates to the marine environment, effects to salmon have been assessed.

Table 2.3 Relevant Qualifying Interests and conservation objectives of the River Barrow and River Nore SAC (IE002162), Lower River Suir SAC (IE002137) and the Slaney River Valley SAC (IE000781)

Qualifying Interest	Conservation Objective	Attribute	Measure	Target
Twaite shad <i>Alosa fallax</i>	To restore the favourable conservation condition of Twaite shad in the River Barrow and River	Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary

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Qualifying Interest	Conservation Objective	Attribute	Measure	Target
	Nore SAC, the Lower River Suir SAC and the Slaney River Valley SAC, which is defined by the following list of attributes and targets.	Population structure: age classes	Number of age classes	More than one age class present
		Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning habitats
		Water quality: oxygen levels	mg/l	No lower than 5 mg/l
		Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth
Atlantic salmon <i>Salmo salar</i>	To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets.	Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary
		Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded
		Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling
		Out-migrating smolt abundance	Number	No significant decline
		Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes
		Water quality	EPA Q value	At least Q4 at all sites sampled by EPA

2.5.2.1 River Barrow and River Nore SAC

The River Barrow and River Nore SAC passes through eight counties and extends from freshwater catchments in the Slieve Bloom Mountains to the estuary in Waterford. The Screening for AA established no pathways to impact between the proposed development and the majority of QIs designated within the River Barrow and River Nore SAC. The Screening for AA further determined that likely significant effects could be excluded for otter, sea lamprey and river lamprey, but could not be excluded for twaite shad and Atlantic salmon.

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The site is one of only three known spawning grounds in Ireland for twaite shad and the freshwater stretch of the River Nore main channel is a designated Salmonid Water under the EU Freshwater Fish Directive. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for salmon spawning (NPWS, 2016).

The conservation objectives of the River Barrow and River Nore SAC (NPWS, 2011c) are outlined in Section 4.4.3 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.3** above.

2.5.2.2 Lower River Suir SAC

The River Suir and its tributaries flow through Tipperary, Kilkenny and Waterford. The Lower River Suir SAC consists of the freshwater stretches of the River Suir immediately south of Thurles, Co. Tipperary, the tidal stretches as far as the confluence with the rivers Barrow/Nore immediately east of Cheekpoint in Co. Waterford. The Screening for AA established no pathways to impact between the proposed development and the majority of QIs designated within Lower River Suir SAC. The Screening for AA further determined that likely significant effects could be excluded for sea lamprey and river lamprey but could not be excluded for twaite shad and Atlantic salmon.

The site is one of only three known spawning grounds in Ireland for twaite shad. The Aherlow River, a tributary of the Suir, is a designated Salmonid Water under the EU Freshwater Fish Directive (NPWS, 2013a).

The conservation objectives of the Lower River Suir SAC (NPWS, 2017) are outlined in the Section 4.4.3 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.3** above.

2.5.2.3 Slaney River Valley SAC

The Slaney River Valley SAC comprises the freshwater stretches of the River Slaney as far as the Wicklow Mountains, a number of tributaries, the estuary at Ferrycarrig and Wexford Harbour. The SAC flows through Counties Wicklow, Wexford and Carlow (NPWS, 2015). The Screening for AA established no pathways to impact between the proposed development and the majority of QIs designated within the Slaney River Valley SAC. The Screening for AA further determined that likely significant effects could be excluded for sea lamprey and river lamprey but could not be excluded for twaite shad and Atlantic salmon. Additionally, likely significant effects to harbour seal could not be excluded. See **Section 2.5.3.1** below for the conservation objectives relating to the harbour seal QI of the Slaney River Valley SAC.

The site supports populations of twaite shad in its tidal stretches. The upper Slaney and tributary headwaters are very important for salmon spawning (NPWS, 2015).

The conservation objectives of the Slaney River Valley SAC (NPWS, 2011d) are outlined in the Section 4.4.3 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.3** above.

2.5.3 Marine mammal SACs – Ireland

Two SACs within Irish waters (Saltee Islands SAC and River Slaney Valley SAC) were brought forward to AA as likely significant effects to marine mammal species could not be ruled out. **Sections 2.5.3.1 to 2.5.3.2** below briefly describe the marine mammal QIs at each site and outlines their conservation objectives.

2.5.3.1 Slaney River SAC

As described in **Section 2.5.2.3** above, the Slaney River Valley extends from the Wicklow Mountains to Wexford Harbour. Wexford Harbour is an extensive, shallow estuary which dries out at low tide exposing large expanses of mudflats and sandflats. The site supports regionally significant numbers of harbour seal (NPWS, 2015). The species occurs year-round in Wexford Harbour, using sandbanks for breeding (approximately May-July), moulting (approximately August – September) and non-breeding resting activity. The species also utilise aquatic habitat for foraging, and all suitable aquatic habitat is considered relevant to the species range and ecological requirements and is therefore of potential use by harbour seal (NPWS, 2011e). Outside of the breeding and moulting season (i.e. from October – April), the location and composition of haul-out groups may be different and information on these is comparatively limited (NPWS, 2011d). At least 27 harbour seal regularly use the site (NPWS, 2015).

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The conservation objectives of harbour seal at Slaney River Valley SAC (NPWS, 2011d) are outlined in the Section 4.4.5.2 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.4** below.

Table 2.4 Relevant Qualifying Interests of the Slaney River Valley SAC (IE000781)

Qualifying Interest	Conservation Objective	Attribute	Measure	Target
Harbour seal <i>Phoca vitulina</i>	To maintain the favourable conservation condition of Harbour Seal in the Slaney River Valley SAC, which is defined by the following list of attributes and targets	Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.
		Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition
		Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition
		Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition
		Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site.

2.5.3.2 Saltee Islands SAC

The Saltee Islands SAC comprises the Great Saltee and Little Saltee and a constellation of islets and rocks off the south coast of Co. Wexford and a large area of the surrounding seas. The islands are situated between 4 and 5 km off the coast. The site is designated for a range of marine and coastal habitats and grey seal (NPWS, 2013b). The Screening for AA established no pathways to impact between the proposed development and the habitat QIs designated at the Saltee Islands SAC but could not exclude the possibility of likely significant effects to grey seal.

The Saltee Islands constitute a broken reef that protrudes from a seabed of sand and shell. Both islands have exposed rocky cliffs on the south and east sides. The northern and western sides of both islands are fringed with shingle and boulder shores, with small areas of intertidal sandflats. Great Saltee has a breeding population of grey seal, one of very few in eastern Ireland. The breeding population was estimated at 571-734 individuals in 2005. A one-off moult count in 2007 gave a figure of 246 individuals (NPWS, 2011f). Grey seal occupies both aquatic and terrestrial habitats within the Saltee Islands SAC, including intertidal shorelines that become exposed during the tidal cycle and outlying rocky skerries when these are not inundated by wave action. The species is present at the site throughout the year during all aspects of its annual life cycle; breeding from approximately August – December, moulting from approximately December – April and non-breeding foraging and resting phases. All suitable aquatic habitat is considered relevant to the species range and ecological requirements at the site and is therefore of potential use by grey seal (NPWS, 2011f).

The conservation objectives of grey seal at the Saltee Islands SAC (NPWS, 2011g) are outlined in the Section 4.4.5.1 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.5** below.

Table 2.5 Relevant Qualifying Interests of the Saltee Islands SAC (IE000707)

Qualifying Interest	Conservation Objective	Attribute	Measure	Target
Grey seal <i>Halichoerus grypus</i>	To maintain the favourable conservation condition of Grey Seal in the Saltee Islands SAC, which is defined by the following list of attributes and targets	Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.
		Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition
		Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition
		Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition
		Population composition	Number of cohorts	The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually
		Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the grey seal population

2.5.4 Harbour porpoise SACs – UK

The following four SACs have been designated for harbour porpoise in the Irish and Celtic Seas and identical conservation objectives have been set by the JNCC for all four sites. As a result, this AA will consider these sites as a suite of SACs.

- West Wales Marine/Gorllewin Cymru Forol SAC (UK0030397)
- Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC (UK0030396)
- North Anglesey Marine/Gogledd Môn Forol SAC (UK0030398)
- North Channel SAC (UK0030399)

As the proposed development crosses Welsh waters, a Habitats Regulation Assessment has been carried out as part of the Welsh Marine Licence application and includes the above sites, however, as a precautionary measure, these sites have also been assessed in this AA review. For all four of the above-listed SACs in UK waters, the Screening for AA could not exclude the possibility of likely significant effects to harbour porpoise on the basis that individuals may be transiting through the proposed development. No other qualifying features are designated at these SACs.

The conservation objectives for harbour porpoise at the four harbour porpoise SACs (JNCC, 2019a - d) are outlined in the Section 4.4.5.4 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in **Table 2.6** below.

Table 2.6 Relevant Qualifying Interests of all harbour porpoise SACs in UK waters

Qualifying Interest	Conservation Objective
Harbour porpoise <i>Phocoena phocoena</i>	<p>To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status for harbour porpoise in UK waters.</p> <p>In the context of natural change, this will be achieved by ensuring that:</p> <ol style="list-style-type: none"> 1. Harbour porpoise is a viable component of the site; 2. There is no significant disturbance of the species; and 3. The condition of supporting habitats and processes, and the availability of prey is maintained.

2.5.5 Other marine mammal SACs – UK

A further three SACs in UK waters have been taken through to AA. The Screening for AA could not exclude the possibility of likely significant effects to grey seal and bottlenose dolphin from these sites on the basis that these species may be transiting through the proposed development. No other qualifying features at these sites were considered to interact with the proposed development. Note that the applicant screened out impacts to grey seal from these sites, this assessment has taken them through to AA on a precautionary basis, as there is a chance that grey seal from these sites may transit through the proposed development.

Sections 2.5.5.1 to 2.5.5.3 below briefly describe the marine mammal QIs at each site and outline their conservation objectives.

2.5.5.1 Pembrokeshire Marine / Sir Benfro Forol SAC

Pembrokeshire Marine SAC has been designated for the presence of eight marine habitat types and seven Annex II species. The only qualifying feature of the site which is considered in this AA is grey seal due to the potential for this mobile species to transit through/forage within the proposed development. While most of the important pupping beaches, caves and haul-out sites for the site occur in Pembrokeshire, grey seals are known to travel widely and range throughout the Irish and Celtic Seas (NRW, 2018a).

The conservation objectives for grey seal at Pembrokeshire Marine SAC (NRW, 2018a) are outlined in the Section 4.4.5.3 of the NIS as part of the Assessment of Likely Significant Effects, and are provided in Table 2.7 below.

Table 2.7 Relevant Qualifying Interests of the Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)

Qualifying Interest	Conservation Objective
Grey seal <i>Halichoerus grypus</i>	<p>To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status:</p> <hr/> <p>Population</p> <p>The population is maintaining itself on a long-term basis as a stable component of its natural habitat. Important elements include:</p> <ul style="list-style-type: none"> • Population size • Structure, production • Condition of the species within the site. • Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression <hr/> <p>Range</p>

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Qualifying Interest	Conservation Objective
	<p>The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future</p> <ul style="list-style-type: none"> • Grey seal range within the SAC and adjacent inter-connected areas is not constrained or hindered • There are appropriate and sufficient food resources within the SAC and beyond • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing
	<p>Supporting habitats and species</p> <p>The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and population dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include:</p> <ul style="list-style-type: none"> • Distribution • Extent • Structure • Function and quality of habitat • Prey availability and quality

2.5.5.2 Llyn Peninsula and the Sarnau / Pen Llŷn a'r Sarnau SAC

The Llyn Peninsula and the Sarnau SAC has been designated for the presence of nine marine and coastal habitat types and three Annex II species. The qualifying features of the site considered in this AA are grey seal and bottle nose dolphin due to the potential for these mobile species to transit through/forage within the proposed development. Bottlenose dolphin do not form a discrete population within the Llyn Peninsula SAC, but instead should be seen as part of a wider population that ranges across waters of the Irish Sea and includes Cardigan Bay SAC. Similarly, grey seal present within the Llyn Peninsula do not form a discrete population but are centred (in terms of abundance) on Cardigan Bay and are considered part of the SW England and Wales management unit. Tracking data show that seal moved from haul out sites in the SAC to the east coast of Ireland (NRW, 2018b).

The conservation objectives for bottlenose dolphin at the Llyn Peninsula and the Sarnau SAC (NRW, 2018b) are outlined in Section 4.4.5.5 of the NIS as part of the Assessment of Likely Significant Effects. As the conservation objectives for these two QIs are identical for the Llyn Peninsula and the Sarnau SAC and Cardigan Bay SAC, in the interests of brevity, these have been provided once in **Table 2.8** below. **Sections 2.5.5.3** below briefly outlines grey seal and bottlenose dolphin within Cardigan Bay SAC.

Table 2.8 Relevant Qualifying Interests of the Llyn Peninsula and the Sarnau/Pen Llŷn a'r Sarnau SAC (UK0013117) and Cardigan Bay / Bae Ceredigion SAC (UK0012712)

Qualifying Interest	Conservation Objective
<p>Bottlenose dolphin <i>Tursiops truncatus</i></p> <p>Grey seal <i>Halichoerus grypus</i></p>	<p>To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status:</p> <p>Population</p> <p>The population is maintaining itself on a long-term basis as a stable component of its natural habitat. Important elements include:</p> <ul style="list-style-type: none"> • Population size • Structure, production • Condition of the species within the site. • Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression

Qualifying Interest	Conservation Objective
	<ul style="list-style-type: none"> For grey seal, populations should not be reduced as a consequence of human activity
	<p>Range</p> <p>The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future</p> <ul style="list-style-type: none"> Their range within the SAC and adjacent inter-connected areas is not constrained or hindered There are appropriate and sufficient food resources within the SAC and beyond The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing
	<p>Supporting habitats and species</p> <p>The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and population dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include:</p> <ul style="list-style-type: none"> Distribution Extent Structure Function and quality of habitat Prey availability and quality
	<p>Restoration and recovery</p> <p>For bottlenose dolphin, populations should be increasing.</p>

2.5.5.3 Cardigan Bay / Bae Ceredigion SAC

Cardigan Bay SAC has been designated for the presence of three marine and coastal habitat types and four Annex II species. The qualifying features of the site considered in this AA are grey seal and bottle nose dolphin due to the potential for these mobile species to transit through/forage within the proposed development. Cardigan Bay is one of two coastal areas in the UK where bottlenose dolphins have been most frequently recorded and are seen year-round. The dolphins of Cardigan bay are highly mobile, and the resident population is estimated at between 100 – 300 bottlenose dolphins in Cardigan Bay (NRW, 2018c). Grey seal present within Cardigan Bay do not form a discrete population but are centred (in terms of abundance) on Cardigan Bay and are considered part of the SW England and Wales management unit. Tracking data show that individuals transit to France, the west coast of Scotland and Ireland (NRW, 2018c).

The conservation objectives for bottlenose dolphin at Cardigan Bay SAC are outlined in Section 4.4.5.5 of the NIS as part of the Assessment of Likely Significant Effects. As the conservation objectives for bottlenose dolphin and grey seal are identical for the Llyn Peninsula and the Sarnau SAC and Cardigan Bay SAC, in the interests of brevity, these have been provided once in **Table 2.8** above.

3 ASSESSMENT OF IMPACTS

As outlined in the previous section, twelve SACs have been taken forward for assessment in the AA and have been broadly categorised above according to the receptors considered (i.e. reefs, migratory fish, marine mammals). The following assessment will focus on these broad receptor groups and effects on the integrity of European sites will be assessed in **Table 3.1**.

3.1 Hook Head SAC

3.1.1 Assessment of Adverse Impacts on Reefs

The Screening for AA carried concluded that there is potential for a likely significant effect on the reefs QI from penetration and/or disturbance including abrasion. Note that the applicant identified a potential for likely significant effect from physical change (to another seabed type), however, as no external cable protection will be deposited within the SAC as part of the amended project design, the Screening for AA concluded that there are no likely significant effects to reefs from this pressure.

Cable trenching across reef habitat has the potential to reduce the habitat area and affect the community structure of the QI. In designing the route of the cable INFOMAR bathymetry data and NPWS habitat maps were used to identify a cable route through Hook Head SAC that avoided reef habitat. The cable route survey carried out by the applicant further identified areas of bedrock reef habitat within the proposed development. The final project design is an installation corridor that avoids crossing Annex I bedrock reef by allowing installation in sandy sediments which will recover relatively rapidly from penetration impacts.

Although the proposed development will avoid the bedrock reef through routing, there is still a very small risk that during installation, activities that penetrate and/or disturb the habitat could be undertaken. This is highly unlikely as crossing hard substrate would involve (in terms of engineering) cutting and external cable protection, both of which are costly.

3.1.2 Mitigation

A contract condition is proposed to remove the risk of installation in bedrock occurring. In addition, exclusion zones will be established around the bedrock reef habitat within the proposed development. No intrusive works will be permitted within these zones.

3.1.3 Conclusion

The implementation of exclusion zones, in addition to route design, results in the pressure pathway to reef habitat being removed. It can therefore be concluded that the proposed development will not have an adverse effect on the integrity of Hook Head SAC, alone or in-combination with other plans or projects.

3.2 Migratory fish SACs

The Screening for AA concluded that there is potential for likely significant effects to the Atlantic salmon and twaite shad QIs of three SACs (River Barrow and River Nore SAC, Lower River Suir SAC and Slaney River Valley SAC) as a result of underwater noise changes from UXO detonation and geophysical survey (for twaite shad only). The applicant's original Assessment of Likely Significant Effects (Section 4.4 of the NIS document) concluded that there was no potential for likely significant effects, however, further information was requested from the applicant to support this conclusion. In addition, project-specific mitigation in the form of a seasonal restriction to avoid impacts to migratory fish species was described in the applicant's response to the observations of Inland Fisheries Ireland. Case law has established that mitigation measures cannot be taken into account when undertaking an assessment of likely significant effects, therefore, the applicant was requested to provide information to enable a Stage 2 AA of underwater noise changes to migratory fish. This supplementary Stage 2/NIS information was provided by the applicant in subsequent documents including 'Greenlink Information to Inform 2nd Public Consultation'.

3.2.1 Assessment of Adverse Impacts on Migratory Fish

3.2.1.1 Geophysical survey

The applicant's AA Screening concluded that there were no likely significant effects to all fish species from underwater noise associated with the geophysical survey. The Screening for AA review carried out by RPS concluded that the frequencies of the proposed surveys will be outside of the audible range of lamprey and Atlantic salmon, however, for hearing specialist species such as twaite shad, the noise assessment carried out by the applicant found zones of influence for recoverable injury and temporary injury of 630m and 2.2km, respectively. On a precautionary basis, in the absence of mitigation, it could not be excluded that injury and disturbance could occur to twaite shad, although, it is acknowledged that the zones of injury calculated in the noise assessment are themselves conservative and do not take into account environmental conditions which are likely to further reduce the propagation of sound and therefore reduce zones of influence. It is also acknowledged that for geophysical works, the potential zone of influence will be transient and temporary as the geophysical vessel moves slowly in a constant direction along the survey line.

3.2.1.2 UXO detonation

It is not expected that UXO detonation will be required within the proposed development and is being included in the foreshore licence application as a contingency measure. If UXO detonation is required, the large and sudden pressure change could cause permanent injury to Atlantic salmon if individuals are present within the zone of influence of the detonation (estimated to be 6.2 km radial distance). It is not possible to estimate with certainty how many salmon could be within the water and zone of influence at the time of a UXO detonation.

Spring may be more sensitive for juvenile salmon (smolt) as they are migrating from Irish rivers. In November adult individuals return to spawn in the River Barrow, River Nore, Lower River Suir and Slaney River and could be present within the proposed development. The sensitive time for twaite shad is between April and May as they enter the estuaries of rivers prior to spawning. Both species lay their eggs in the upper reaches of rivers and therefore UXO detonation (if required) in open coastal waters will not affect eggs. It is possible that juveniles of both species could be within coastal water during migration and therefore be affected.

Underwater noise activities will not displace migratory fish. The UXO detonation (if required) will be a brief one-off event and any individuals disturbed by the sudden but brief underwater noise change will be able to return to the area rapidly. The change in underwater noise will not affect the habitat of either species. No UXO detonation will occur within the SACs, therefore spawning habitats will be unaffected.

If required, the UXO detonation will be a brief one-off event (the detonation will be instantaneous as will the effect). While the SACs are located outside the 6.2 km zone of influence for injury, these species could swim into the zone of influence during their migration. There is limited publicly available information on the migration patterns of Atlantic salmon and twaite shad from the SACs in question and it is unknown whether the proposed development crosses important migration pathways. In the absence of data, it must be assumed that fish densities in the water could be high. If enough individuals were injured there could be a long-term effect on the population. It is not possible to determine how quickly the population will recover, given that exact numbers affected cannot be predicted.

In the absence of mitigation, due to a lack of data, it cannot be excluded that noise generated from UXO detonation will not lead to an adverse effect on the conservation objectives of the sites.

3.2.2 Mitigation

Mitigation measures specific to migratory fish are detailed here and summarised in **Section 5**.

3.2.2.1 Geophysical survey

Although the applicant does not outline specific mitigation measures for impacts to migratory fish from underwater noise, it is considered that the measures to be implemented to reduce impacts to marine mammals (soft-start/ramp up procedures) will also reduce potential impacts to migratory fish by allowing fish to leave the zone of injury before full power output.

3.2.2.2 UXO detonation

The applicant intends to take all feasible measures to avoid detonation of UXO, and therefore avoid all associated effects. A UXO survey will be undertaken by the installation contractor along the proposed centreline of the cable to identify UXO. The survey will typically cover an area of seabed 50m either side of the centreline and will identify magnetic anomalies which will be categorised depending on their attributes as likely or potential UXO. If anomalies cannot be avoided by routing, a visual inspection of the anomaly will be made by diver or ROV using a qualified survey contractor and Explosives Ordnance Detonation expert. For each confirmed UXO a disposal strategy will be agreed. The following decision-making process will be followed for any identified UXO:

- Avoid by micro-routing the marine cables within the permitted corridor.
- If it cannot be avoided, visual inspection confirms a UXO, and it is safe to do so, remove the UXO.
- If it cannot be moved, detonate on site in accordance with best practice.

Due to the width of the proposed development, the applicant is confident that any identified UXO will be avoided due to micro-routing. UXO detonation is a last resort and will only be undertaken if the UXO cannot be avoided or it is not safe to move. The following mitigation measures are proposed by the applicant, should a UXO be identified:

1. Avoid the need for detonation (as described above).
2. Use of deflagration (low order detonation) on any UXO charge size that requires disposal. Deflagration reduces the source levels and reduces the potential zone of effect for injury. Underwater noise modelling undertaken for the Welsh Greenlink Marine Licence determination showed that deflagration reduces the zone of influence for fish from 6.2 km to between 0.4 km and 1.8 km.
3. The applicant has committed to not undertaking UXO detonation between April and May (inclusive) between KP145 and KP159.27 to avoid the sensitive spawning period for twaite shad.
4. The applicant has committed to the use of a big bubble curtain (BBC), a noise abatement technique designed to change the physical condition of the water and the outward propagation of the acoustic/shock waves. The use of BBC aims to reduce the sound energy emitted into the environment, thereby reducing the distance over which auditory injury may occur. Note that the deployment and efficacy of BBCs is more challenging with increasing water depths. The applicant therefore commits to use of a BBC for deflagration in water depths equal to or less than 40 m, i.e. between landfall and KP160. If a UXO is identified in water depths of 40 – 70 m, advice will be sought as to practicalities and cost of deploying a BBC at the specific location.
5. Soft start: A sequence of small to large charges would be implemented to allow additional time for fish to leave the zone of potential effect. Typically, charges of 50g, 100g, 150g and 200g would be deployed, sequenced to commence at 5-minute intervals, with a further 5-minute interval before the deflagration of the UXO. An additional 250 g charge may be added to the sequence if the UXO requiring deflagration is greater than 250 kg.

If deflagration of a UXO is required, any individuals within close proximity may experience permanent injury, however, the charge size will be significantly reduced from 794 kg to 1.54 kg, resulting in a significantly smaller zone of influence for permanent injury. It is not possible to estimate with certainty how many Atlantic salmon or twaite shad could be within the zone of influence, however, considering the significant reduction in that zone, the number of individuals affected will be significantly less with the implementation of mitigation. With a seasonal restriction in place, UXO deflagration will not take place during the sensitive spawning period of twaite shad. Atlantic salmon may be impacted by UXO deflagration during sensitive periods; however, the zone of influence will be significantly reduced.

3.2.3 Conclusion

It can be concluded that the mitigation proposed by the applicant represents all reasonable measures currently available to avoid and reduce effects from underwater noise changes to Atlantic salmon and twaite shad.

3.3 Marine mammal SACs

The Screening for AA concluded that there is potential for likely significant effects to the following marine mammal QI species at their respective SACs as a result of both UXO detonation and geophysical survey. Impacts to each species will be assessed in the following sections, with assessment against the conservation objectives specific to each group of sites (i.e. Irish marine mammal SACs, UK harbour porpoise SACs, other marine mammal SACs – UK) provided in **Table 3.1**.

Harbour seal

- Slaney River Valley SAC

Grey seal

- Saltee Islands SAC
- Pembrokeshire Marine / Sir Benfro Forol SAC
- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC
- Cardigan Bay / Bae Ceredigion SAC

Harbour porpoise

- West Wales Marine/Gorllewin Cymru Forol SAC
- Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC
- North Anglesey Marine/Gogledd Môn Forol SAC
- North Channel SAC

Bottlenose dolphin

- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC
- Cardigan Bay / Bae Ceredigion SAC

3.3.1 Assessment of Adverse Impacts on Marine Mammals

As outlined previously, it is not expected that UXO detonation will be required within the proposed development and this element is included in the foreshore licence application as a contingency measure.

3.3.1.1 Harbour seal and grey seal

For the purposes of assessment from underwater noise impact, both harbour and grey seal have similar hearing frequencies and are therefore considered here together.

3.3.1.1.1 Geophysical survey

Underwater noise modelling (Greenlink EIAR – Ireland Appendix C) carried out by the applicant found that seals in water would be vulnerable to continuous noise emitted as a result of geophysical surveys. Continuous noise sources include multi-beam echosounder and side scan sonar, with permanent injury potentially occurring within 15m and temporary injury 40m of the multi-beam echosounder. It is noted that these calculations are conservative, without consideration of environmental factors which may reduce sound propagation.

The geophysical survey will be transient and temporary, and the sound levels generated will not act as an artificial barrier preventing access to important habitats. Given the distances from the proposed development and the seal SACs (6.1 km from the closest site – Saltee Islands SAC) breeding, resting and moulting behaviour and habitats will not be affected.

In the absence of mitigation, injury and disturbance effects to seals cannot be ruled out.

3.3.1.1.2 UXO detonation

If UXO detonation is required, it would not affect breeding, moulting or resting behaviour or sites of both harbour seal and grey seal, nor would it act as an artificial barrier restricting access to suitable habitat or reducing their range. It is unlikely that UXO detonation would have an adverse effect on prey availability or quality, given the one-off and temporary nature of the impact.

The underwater noise modelling (Greenlink EIAR – Ireland Appendix C) indicated that, without any mitigation in place and considering a worst-case scenario of 794kg detonation, seals would be at risk of permanent injury within 13 km of the sound source, and at risk of temporary injury within 17 km of the source. Seals within 54 km could be disturbed. Without mitigation in place, if a number of adults and juveniles from an SAC are within the zone of influence at the time of detonation, they could be killed or injured, disrupting the ratio of adults and juveniles and adversely affecting seal populations within the relevant SACs. It is noted that these calculations are highly conservative, due to the high explosive weight used to estimate the sound levels, and do not take account of environmental factors which may reduce sound propagation.

3.3.1.2 Harbour porpoise

3.3.1.2.1 Geophysical survey

Underwater noise modelling (Greenlink EIAR – Ireland Appendix C) carried out by the applicant found that harbour porpoise would be vulnerable to continuous noise emitted as a result of geophysical surveys. Noise sources comprise multi-beam echosounder, side scan sonar and sub-bottom profiler, with multibeam echosounder having the largest zone of influence. Permanent injury could potentially occur within 110m and temporary injury within 180m of the multi-beam echosounder. It is noted that these calculations are conservative, without consideration of environmental factors which may reduce sound propagation.

The geophysical survey will be transient and temporary, and the sound levels generated will not act as an artificial barrier preventing access to important habitats, however, in the absence of mitigation, injury and disturbance effects to harbour porpoise cannot be ruled out.

3.3.1.2.2 UXO detonation

Harbour porpoise from UK SACs may be foraging or transiting through the proposed development area at the time of UXO detonation. If UXO detonation is required, it would not affect the condition of supporting habitats and processes or the availability of prey for harbour porpoise at these sites.

The underwater noise modelling (Greenlink EIAR – Ireland Appendix C) indicated that, without any mitigation in place and considering a worst-case scenario of 794kg detonation, harbour porpoise would be at risk of permanent injury within 23 km of the source, at risk of temporary injury within 27 km of the source and at risk of disturbance within 54 km. Without mitigation in place, if harbour porpoise individuals within the zone of influence at the time of detonation, they could be killed, injured or disturbed. It is noted that these calculations are highly conservative, due to the high explosive weight used to estimate the sound levels, and do not take account of environmental factors which may reduce sound propagation.

3.3.1.3 Bottlenose dolphin

3.3.1.3.1 Geophysical survey

Underwater noise modelling (Greenlink EIAR – Ireland Appendix C) carried out by the applicant found that bottlenose dolphin would be vulnerable to continuous noise emitted as a result of geophysical surveys, namely from the multi-beam echosounder. Permanent injury could potentially occur within 2.6m and temporary injury within 7m of the multi-beam echosounder. It is noted that these calculations are conservative, without consideration of environmental factors which may reduce sound propagation.

The geophysical survey will be transient and temporary, and the sound levels generated will not act as an artificial barrier preventing access to important habitats, however, in the absence of mitigation, injury and disturbance effects to bottlenose dolphin cannot be ruled out.

3.3.1.3.2 UXO detonation

Bottlenose dolphin from UK SACs may be foraging or transiting through the proposed development at the time of UXO detonation. If UXO detonation is required, it would not restrict access to suitable habitat, change the extent or structure of habitats or reduce bottlenose dolphin range. It is highly unlikely that UXO detonation would have an adverse effect on prey availability or quality, given the one-off and temporary nature of the impact.

The underwater noise modelling (Greenlink EIAR – Ireland Appendix C) indicated that, without any mitigation in place and considering a worst-case scenario of 794kg detonation, bottlenose dolphin would be at risk of permanent injury within 5.8 km of the source, at risk of temporary injury within 8.6 km of the source and at risk of disturbance within 54 km. Without mitigation in place, if bottlenose dolphin individuals are within the zone of influence at the time of detonation, they could be killed, injured or disturbed. It is noted that these calculations are highly conservative, due to the high explosive weight used to estimate the sound levels, and do not take account of environmental factors which may reduce sound propagation.

3.3.2 Mitigation

Mitigation measures specific to marine mammals are detailed here and summarised in **Section 5**.

3.3.2.1 Geophysical survey

The geophysical survey contractor will follow DAHG (2014) 'Guidance to Manage the Risk to Marine Mammals from Man-made sound sources in Irish Waters'. Adherence to the guidelines include the implementation of pre-start watches, whereby operations are delayed if marine mammals are sighted within the 'mitigation zone' (500m of the sound source) and only started when the animal is outside of the zone. The guidelines also include the use of soft-start/ramp up procedures, whereby the sound energy emitted from the source is sequentially increased over a period of time to allow marine mammals to leave the zone of potential effect.

3.3.2.2 UXO detonation

As outlined in **Section 3.2.2** for migratory fish, the applicant intends to take all feasible measures to avoid detonation of UXO, and therefore avoid all associated effects to marine mammals. Due to the width of the proposed development, the applicant is confident that any identified UXO will be avoided due to micro-routing. UXO detonation is a last resort and will only be undertaken if the UXO cannot be avoided or it is not safe to move. The following mitigation measures for marine mammals are proposed by the applicant, should a UXO be identified:

1. Avoid the need for detonation (as described above).
2. Use of deflagration (low order detonation) as described in **Section 3.2.2**. Underwater noise modelling undertaken for the Welsh Greenlink Marine Licence determination showed that deflagration reduces the zone of influence for injury to harbour porpoise (the most sensitive species to underwater sound changes) from 10.6km to a range between 7.3 km and 8.3 km. Temporary auditory effects were reduced from 14 km to between 8.3 km and 10km. Although these figures relate to the Welsh application, they demonstrate the usefulness of this method in reducing the potential zones of influence.
3. Spatial-temporal restrictions: a 1km radial mitigation zones will be established around the UXO location. Two dedicated marine mammal observers (MMOs) will undertake a 60-minute pre-detonation search of the mitigation zone in good visibility using both visual and acoustic methods. If a marine mammal is observed during the 60-minute search, detonation will be delayed until 20 minutes after the mammal has passed out of the mitigation zone.
4. Use of BBC: as outlined in **Section 3.2.2**.
5. Use of Acoustic Deterrent Device (ADD): ADDS are used to exclude animals from a mitigation zones and are used in conjunction with visual and/or acoustic monitoring and should normally be used for as short a period as necessary to minimise the introduction of additional noise. ADDs emit medium to high frequency sounds that deter animals from injury zones and have been widely used during

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pile-driving operations and UXO detonations. The ADD will be activated 50 minutes prior to UXO deflagration dependant on the UXO charge size.

6. Use of Passive Acoustic Monitoring (PAM) to support visual observations: PAM is a software system that utilises hydrophones to detect vocalisations of marine mammals. It is useful during periods of darkness, poor visibility or sea state and would be used to detect marine mammals present within the proposed development.
7. Soft start: as outlined in **Section 3.2.2**.

If deflagration of a UXO is required, marine mammal individuals within close proximity may experience mortality or injury, however, the charge size will be reduced from a worst-case scenario of 794 kg to 1.54 kg, resulting in a significantly smaller zone of influence for permanent injury. A range of mitigation measures will be implemented: a timing restriction to ensure that deflagration occurs when species densities are at their lowest, the sue of noise abatement (the BBC) and acoustic deterrents.

3.3.3 Conclusion

These mitigation measures listed above are industry standard and represent all reasonable currently available measure to avoid and reduce adverse effects from underwater noise changes to marine mammals.

3.4 Assessment of In-Combination Impacts

The applicant's Stage 1 screening identified 14 projects, plans or activities within 10 km of the proposed development. These projects were then considered for the likelihood of in-combination effects with the proposed development. Twelve projects were screened out on the grounds that there was either no common pressure-receptor pathway or that the pressure-receptor pathways are not expected to overlap spatially with the proposed development. The two projects taken forward were the Celtic Sea Array site investigation survey and Kilmore Quay Disposal site.

A further check of the DHLGH website for new foreshore licence applications in Co. Wexford and Co. Waterford was undertaken in December 2020. This identified two further projects (Enniscorthy Flood Defence Scheme and Cheekpoint Boat Owners Association Pontoon and Gangway). Both projects are further than 10 km from the proposed development and inland and were therefore screened out of any further cumulative impact assessment.

3.4.1 Hook Head SAC

No common pressure-receptor pathways exist between the proposed development and other projects, and there is no spatial overlap with other projects. Celtic Sea Array site investigations and the Kilmore Quay dredge disposal were considered to have likely significant effects in-combination with the proposed development, however, as there is no spatial overlap with these projects, there is no pathway to cumulative effects on reef habitat.

3.4.2 Migratory Fish SACs

Kilmore Quay Disposal site was screened out as the disposal works are anticipated to have finished before the proposed development begins.

Screening concluded that there is potential for cumulative effects to marine mammals between the Celtic Sea Array survey and the proposed development if geophysical survey activities were carried out simultaneously. However, it is unlikely that they will occur simultaneously as given the close proximity, the geophysical signals would interfere with each other. In addition, both projects are committing to the application of DAHG (2014) guidelines which ensures the use of mitigation such as soft start/ramp up procedures which will allow time for fish to leave the zone of injury.

Celtic Sea Array is not planning any UXO detonation. The UXO deflagration for the proposed development, if required, will be a one-off event. The noise charge from the deflagration will be significant but brief. It will act independently of any noise changes emitted by the Celtic Sea Array surveys and will be the more significant of the two sound sources. As a UXO deflagration will be the more significant of the two events, any potential cumulative effect on migratory fish will not be significant.

3.4.3 Marine Mammal SACs

Kilmore Quay Disposal site was screened out as the disposal works are anticipated to have finished before the proposed development begins. Screening concluded that there is potential for cumulative effects to marine mammals between the Celtic Sea Array survey and the proposed development if geophysical survey activities were carried out simultaneously. However, it is unlikely that they will occur simultaneously as given the close proximity, the geophysical signals would interfere with each other. In addition, both projects are committing to the application of DAHG (2014) guidelines which will avoid adverse effects on marine mammals.

Celtic Sea Array is not planning any UXO detonation. The UXO deflagration for the proposed development, if required, will be a one-off event. The noise charge from the deflagration will be significant but brief. It will act independently of any noise changes emitted by the Celtic Sea Array surveys and will be the more significant of the two sound sources. As a UXO deflagration will be the more significant of the two events, any potential cumulative effect will not be significant.

3.5 Assessment of Impacts on the Integrity of European Sites

From the Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2002), the meaning of integrity is described as follows;

'The integrity of a site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives' (MN2000, paragraph 4.6(3)).

Site specific conservation objectives have been prepared for each European site, where available, and are summarised in **Table 2.2 to Table 2.8** above.

From the information gathered and the predictions made about the changes that are likely to result from the construction and operation stages of the project, the integrity of site checklist is completed for the European sites screened in for AA in **Table 3.1** below.

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Table 3.1 Integrity of European Sites Checklist

Does the project have the potential to:	European Sites				
	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
Cause delays in progress towards achieving the conservation objectives of the site?	No. Site is currently in favourable condition for reefs and the potential for effects will be removed by implementation of exclusion zones around all reef habitat.	No. Atlantic salmon and twaite shad are in unfavourable condition in all three SACs, however, recent Article 17 reporting (NPWS, 2019) does not list underwater noise changes as one of the main pressures or threats facing these species, nor is management of underwater noise proposed as a conservation measure to achieve favourable condition. For Atlantic salmon, the only attributes of the conservation objectives the project has the potential to impact are 'adult spawning fish' and 'salmon fry abundance'. For twaite shad, the only attribute of the conservation objectives the project has the potential to impact is 'population structure: age classes'. For both species, with mitigation in place, the zone of injury of UXO deflagration will be significantly reduced and it is highly unlikely that mortality	No. Sites are currently in favourable condition for harbour and grey seal and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to changes in population composition (for grey seal at Saltee Islands SAC) or adverse levels of disturbance for both species at Saltee Islands SAC and Slaney River Valley SAC.	No. These harbour porpoise sites are currently in favourable condition and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to significant disturbance or cause any changes in the condition of supporting habitats and processes or the availability of prey. Harbour porpoise will remain a viable component of each site.	No. Grey seal at Pembrokeshire Marine SAC and bottlenose dolphin and grey seal at Lleyn Peninsula and the Sarnau SAC and Cardigan Bay SAC are all in favourable conservation condition. With mitigation measures in place, geophysical survey and UXO deflagration will not lead to reduction or changes to population elements (size, structure, production, condition of species or contaminant burden). The ranges of these species will not be hindered, prey availability will not be reduced and supporting habitat will not be reduced or constrained.

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European Sites					
Does the project have the potential to:	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
		of entire age classes will occur.			
Interrupt progress towards achieving the conservation objectives of the site?	No. Site is currently in favourable condition for reefs and the potential for effects will be removed by implementation of exclusion zones around all reef habitat.	No. Atlantic salmon and twaite shad are in unfavourable condition in all three SACs, however, recent Article 17 reporting (NPWS, 2019) does not list underwater noise changes as one of the main pressures or threats facing these species, nor is management of underwater noise proposed as a conservation measure to achieve favourable condition. As outlined above, with implementation of mitigation, it is highly unlikely that the project will lead to significant effects, therefore, it is not considered that the project will interrupt progress towards achieving the conservation objectives of the site.	No. Sites are currently in favourable condition for harbour and grey seal and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to changes in population composition (for grey seal at Saltee Islands SAC) or adverse levels of disturbance for both species at Saltee Islands SAC and Slaney River Valley SAC.	No. These harbour porpoise sites are currently in favourable condition and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to significant disturbance or cause any changes in the condition of supporting habitats and processes or the availability of prey. Harbour porpoise will remain a viable component of each site.	No. Grey seal at Pembrokeshire Marine SAC and bottlenose dolphin and grey seal at Lleyn Peninsula and the Sarnau SAC and Cardigan Bay SAC are all in favourable conservation condition. With mitigation measures in place, geophysical survey and UXO deflagration will not lead to reduction or changes to population elements (size, structure, production, condition of species or contaminant burden). The ranges of these species will not be hindered, prey availability will not be reduced and supporting habitat will not be reduced or constrained.
Disrupt those factors that help to maintain the favourable conditions of the site?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. Attributes which maintain the	N/A. Atlantic salmon and twaite shad are in unfavourable condition in all three SACs and conservation objectives for these species are to restore the favourable condition.	No. Sites are currently in favourable condition for harbour and grey seal and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to changes in population composition (for grey seal at	No. These harbour porpoise sites are currently in favourable condition and with mitigation measures in place, geophysical survey and UXO deflagration will not lead to significant disturbance or cause any changes in the	No. Grey seal at Pembrokeshire Marine SAC and bottlenose dolphin and grey seal at Lleyn Peninsula and the Sarnau SAC and Cardigan Bay SAC are all in favourable conservation condition. With mitigation

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European Sites					
Does the project have the potential to:	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
	favourable condition of the site will not be impacted.		Saltee Islands SAC) or adverse levels of disturbance for both species at Saltee Islands SAC and Slaney River Valley SAC.	condition of supporting habitats and processes or the availability of prey. Harbour porpoise will remain a viable component of each site.	measures in place, geophysical survey and UXO deflagration will not lead to reduction or changes to population elements (size, structure, production, condition of species or contaminant burden). The ranges of these species will not be hindered, prey availability will not be reduced and supporting habitat will not be reduced or constrained.
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No interaction with key species indicators will occur.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, sensitive spawning period for twaite shad will be avoided and measures will be implemented to reduce noise propagation and encourage fish to leave the area prior to deflagration. As a result, it is considered unlikely that there will be interference with the balance, distribution or density of either Atlantic salmon or twaite shad.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be interference with the balance, distribution or density of either harbour or grey seal.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect harbour porpoise, and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be interference with the balance, distribution, or density of harbour porpoise.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and dolphins, and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be interference with the balance, distribution, or density of either grey seal or bottlenose dolphin.

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	European Sites				
Does the project have the potential to:	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)

Other Indicators:

Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No interaction with aspects of site functioning will occur.	No. There will be no impacts to the function of habitats of the sites.	No. There will be no impacts to the function of habitats of the sites.	No. There will be no impacts to the function of habitats of the sites.	No. There will be no impacts to the function of habitats of the sites.
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No interaction with relationship dynamics will occur.	No. There will be no impacts capable of changing relationships that define the structure or function of the sites.	No. There will be no impacts capable of changing relationships that define the structure or function of the sites.	No. There will be no impacts capable of changing relationships that define the structure or function of the sites.	No. There will be no impacts capable of changing relationships that define the structure or function of the sites.
Interfere with predicted or expected natural changes to the site (such as water dynamics or	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No	No. There will be no impacts that interfere with predicted or expected natural changes at the sites.	No. There will be no impacts that interfere with predicted or expected natural changes at the sites.	No. There will be no impacts that interfere with predicted or expected natural changes at the sites.	No. There will be no impacts that interfere with predicted or expected natural changes at the sites.

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Does the project have the potential to:	European Sites				
	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
chemical composition)?	interference with natural changes will occur.				
Reduce the area of key habitats?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No spatial overlap will occur.	No. There will be no interaction with key habitats within the three SACs.	No. There will be no interaction with key habitats within these SACs.	No. There will be no interaction with key habitats within these SACs.	No. There will be no interaction with key habitats within these SACs.
Reduce the population of key species?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No spatial overlap of key reef species or communities will occur.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, sensitive spawning period for twaite shad will be avoided and measures will be implemented to reduce noise propagation and encourage fish to leave the area prior to deflagration. As a result, it is considered unlikely that there will be population-level impacts to either Atlantic salmon or twaite shad.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be population-level impacts to either harbour or grey seal.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect harbour porpoise, and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be population-level impacts to harbour porpoise.	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and dolphins, and encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be population-level impacts to either grey seal or bottlenose dolphin.

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Does the project have the potential to:	European Sites				
	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
Change the balance between key species?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No spatial overlap of key reef species or communities will occur.	No. There will be no change in the balance between key species.	No. There will be no change in the balance between key species.	No. There will be no change in the balance between key species.	No. There will be no change in the balance between key species.
Reduce diversity of the site?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No spatial overlap of key reef species or communities will occur.	No. Due to the marine nature of the project, there will be no interaction with the majority of the QIs of the three sites and no pathway has been identified capable of reducing diversity.	No. Due to the marine nature of the project and distance from these SACs, there will be no interaction with the majority of the QIs of the sites and no pathway has been identified capable of reducing diversity.	No. There are no other QIs at these harbour porpoise SACs, and due to the considerable distance between the project and these SACs, there is no pathway capable of reducing diversity.	No. Due to the marine nature of the project and distance from these SACs, there will be no interaction with the majority of the QIs of the sites and no pathway has been identified capable of reducing diversity.
Result in disturbance that could affect population size or density or the balance between key species?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No spatial overlap or disturbance	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, sensitive spawning period for twaite shad will be avoided and measures will be implemented	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and encourage	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect harbour porpoise and	No. As outlined above, with implementation of mitigation, the zone of injury of UXO deflagration will be significantly reduced, and measures will be implemented to reduce noise propagation, detect seals and dolphins and encourage them

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Does the project have the potential to:	European Sites				
	Hook Head SAC	Migratory Fish SACs (River Barrow and River Nore SAC, Lower River Suir, Slaney River Valley)	Marine mammal SACs – Ireland (Saltee Islands SAC, Slaney River Valley SAC)	Harbour porpoise SACs – UK (West Wales Marine SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, North Channel SAC)	Other marine mammal SACs – UK (Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC, Cardigan Bay SAC)
	of key reef species or communities will occur.	to reduce noise propagation and encourage fish to leave the area prior to deflagration. As a result, it is considered unlikely that there will be disturbance capable of affecting population size, density or balance between species at these sites.	them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be disturbance capable of affecting population size, density or balance between species at these sites.	encourage them to leave the area prior to deflagration. As a result, it is considered unlikely that there will be disturbance capable of affecting population size, density or balance between species at these sites.	to leave the area prior to deflagration. As a result, it is considered unlikely that there will be disturbance capable of affecting population size, density or balance between species at these sites.
Result in fragmentation?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No fragmentation of reef habitat will occur.	No. Fragmentation of habitats will not occur due to the distance between the project and the sites. Fragmentation of species is not expected, and as outlined above, population level impacts are not expected.	No. Fragmentation of habitats will not occur due to the distance between the project and the sites. Fragmentation of species is not expected, and as outlined above, population level impacts are not expected.	No. Fragmentation of habitats will not occur due to the distance between the project and the sites. Fragmentation of species is not expected, and as outlined above, population level impacts are not expected.	No. Fragmentation of habitats will not occur due to the distance between the project and the sites. Fragmentation of species is not expected, and as outlined above, population level impacts are not expected.
Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding, etc.)?	No. The potential for effects will be removed by implementation of exclusion zones around all reef habitat. No loss of habitat or key features will occur.	No. There is no interaction between the project and key features of the three sites.	No. There is no interaction between the project and key features of these sites.	No. There is no interaction between the project and key features of these sites.	No. There is no interaction between the project and key features of these sites.

4 OBSERVATIONS AND SUBMISSIONS

DHLGH held a period of statutory consultation following the submission of the Foreshore Licence Application from 12th November 2019 to the 8th January 2020 (extend until 22nd January 2020 for some stakeholders). Following the RFI and subsequent further information submitted by GIL in support of their application, a second period of statutory consultation was held in April 2021. Observations received from the prescribed bodies and public submissions and the applicant's responses to these are available to view on the [DHLGH website](#).

Observations from the prescribed bodies are described in detail in Section 2.3 of the accompanying **EIAR Technical Review**, carried out by RPS on behalf of DHLGH. Of relevance for European sites and therefore this AA report, are the observations from Inland Fisheries Ireland (IFI), which are summarised below.

4.1.1 Inland Fisheries Ireland

Inland Fisheries Ireland (IFI) raised two main observations on 5th March 2020.

IFI raised concerns regarding additional geophysical survey work 3-6 months ahead of installation, due to the potential for impacts to fish species due to impacts from underwater noise. IFI initially requested that further geophysical surveying not be undertaken, and that route clearance as indicated by the applicant (pre-lay grapnel) be used to ensure no issues impeding the cable route. The applicant responded to IFI outlining that the pre-construction geophysical route survey will be limited in extent, centring on the cable centreline and that the survey is required for additional reasons, including identifying any unexploded ordnance, confirming the seabed level and to inform micro-routing of the cable around mobile bedforms and sensitive habitats. Due to the time period between the previous geophysical survey and cable laying (3 years) there is the potential for sensitive habitat areas to have increased or appeared. For these reasons the applicant strongly requested that IFI's request does not become a condition of the foreshore licence. IFI confirmed that they were satisfied that additional surveys are required and requested that all mitigation measures outlined by the applicant in their response be implemented.

In their initial observations, IFI highlighted the importance of the area of the proposed development for twaite shad, which is an Annex II species under the Habitats Directive and protected by Special Areas of Conservation nearby. IFI recommended that the timing of the works should take into consideration the relevant life cycle elements of the species, i.e. that directional drilling under the River Campile and all marine works of route clearing, rock armour placement and cable laying be undertaken outside the period April- May inclusive, in order to reduce any adverse impacts on the twaite shad.

The applicant responded, outlining why underwater sound pressures from horizontal directional drilling (HDD) under the Campile Estuary are unlikely to result in any disturbance to fish. The applicant recognised that UXO detonation has the potential to injure twaite shad and agree that as a precaution, UXO detonation between April and May (inclusive) should be avoided. The applicant proposed that the following Project Specific Mitigation be added to the Schedule of Mitigation of the EIAR:

PS19 – UXO detonation will not be undertaken between April and May (inclusive) between KP145 and KP159.27.

IFI agreed to the proposed mitigation measure.

In their response to the second public consultation, IFI reiterated their position regarding UXO detonation, acknowledging the mitigation measures to be implemented if a detonation is necessary. IFI further requested that the local Environment Officer is notified once the cable laying method is agreed and in the event that UXO detonation is required. In their response, the applicant agreed to these requests and reiterated the mitigation measures proposed.

5 MITIGATION MEASURES

5.1 Summary of Mitigation Measures

The applicant has provided a number of mitigation measures in the NIS Chapter 5 'Stage 2 – Appropriate Assessment Natura Impact Statement' and in the document 'Greenlink Information to Inform 2nd Public Consultation'. A full updated 'Schedule of Mitigation' is provided in the latter and includes both embedded mitigation (i.e. elements of the project design) and project-specific (PS) mitigation. This AA focuses solely on those measures provided to ensure that the proposed works do not prevent or obstruct any of the QIs or SCI species from reaching or maintaining favourable conservation status.

Table 5.1 below provides a mitigation measures assessment matrix as a means of summarising and assessing the mitigation measures provided in the NIS which are relevant to this AA.

Table 5.1 Mitigation Measures Matrix

List measures to be introduced	Summary of measure	Explain how the measures will avoid the adverse effects on the integrity of the site.	Explain how the measures will reduce the adverse effects on the integrity of the site.	Provide evidence of how they will be implemented and by whom.
<p>EM 19: DAHG (2014) mitigation procedures for geophysical survey and UXO detonation followed by suitable qualified Marine Mammal Observer (MMO)</p>	<p><u>Geophysical survey</u></p> <p>A 30-minute watch for marine mammals will be conducted prior to the start of operations. If a marine mammal is sighted within 500 m of the vessel, start-up will be delayed until the animal is outside the 500m zone.</p> <p>Following the pre-start watch, the ramp-up/soft start procedure outlined in Section 4.3.4 (ii) of DAHG (2014) will be followed.</p> <p>The above procedure will be repeated if there is a break in sound output for longer than 30 minutes.</p> <p><u>UXO detonation (deflagration)</u></p> <p>Procedure will be followed as above, however, a mitigation zone of 1 km will be applied for the pre-start watch. The ramp-up procedure outlined in Section 4.3.5 of DAHG (2014) will be followed. See mitigation measure PS 11 for further detail.</p>	<p>The MMO will ensure that no marine mammals are within the mitigation zone prior to geophysical operations commencing.</p> <p>The ramp-up procedure will allow fish and marine mammals to leave the potential zone of injury before full power output.</p> <p>The MMO will ensure that no marine mammals are within the mitigation zone prior to UXO deflagration commencing.</p>	<p>N/A</p>	<p>Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.</p>
<p>PS 2: Exclusion zones around Annex I bedrock reef features</p>	<p>Exclusion zones have been established around Annex I bedrock reef features within Hook Head SAC.</p>	<p>This measure will ensure that no intrusive works will be undertaken within areas of bedrock reef.</p>	<p>N/A</p>	<p>GIL will ensure that the Installation Contractor adheres to these exclusions.</p>
<p>PS 9: Passive acoustic monitoring (PAM)</p>	<p>If UXO detonation is required, PAM will be used during periods of darkness and poor visibility when marine mammal observer (MMO) watches may be reduced in their effectiveness and in order to permit 24-hour monitoring. It will be operated by a suitably trained and experienced MMO.</p>	<p>PAM will support visual observations in ensuring that marine mammals do not enter the mitigation zone prior to UXO detonation.</p>	<p>N/A</p>	<p>PAM will be operated by a suitably trained and experienced MMO.</p>
<p>PS 10: Acoustic deterrent device (ADD)</p>	<p>Activation of an ADD (Lofitech AS seal scarer, or similar) for 50 minutes prior to UXO detonation dependant on UXO charge size. The ADD will be used for as short a</p>	<p>ADD will emit medium to high frequency sounds that deter marine</p>	<p>N/A</p>	<p>Detail not provided, although based on experience, assume that ADD will be deployed</p>

List measures to be introduced	Summary of measure	Explain how the measures will <u>avoid</u> the adverse effects on the integrity of the site.	Explain how the measures will <u>reduce</u> the adverse effects on the integrity of the site.	Provide evidence of how they will be implemented and by whom.
	period as necessary to minimise the introduction of additional noise.	mammals from the injury zone.		from the vessel by the MMO.
PS 11: Softstart procedure (UXO-specific)	If the UXO identified is greater than 10kg, then a soft-start procedure will be used in combination with the ADD. In this scenario, the MMO would conduct a pre-start search, the ADD would be activated and then a sequence of small to large charges would be implemented to allow additional time for marine mammals [and fish] to leave the area of potential effect. Typically, charges of 50g, 100g, 150g and 200g would be deployed 5 minutes after the deactivation of the ADD and would be sequenced to commence at 5 minute intervals, with the a further 5 minute interval before the detonation of the UXO. An additional 250g charge may be added to the sequence if the UXO requiring detonation is greater than 250kg.	The soft-start/ramp-up procedure will allow fish and marine mammals to leave the potential zone of injury before full power output.		Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.
PS 19: Deflagration	Deflagration (low order detonation) will be undertaken on all UXO charge sizes.		Deflagration would significantly reduce the source levels and the potential zone of effect for injury, therefore reducing the potential for injurious effects to fish and marine mammals.	Will be conditioned as part of Foreshore Licence.
PS 20: Seasonal restriction	UXO detonation will not be undertaken between April and May (inclusive) between KP145 and KP159.27 to avoid the sensitive spawning period for twaite shad.	This restriction will avoid the sensitive spawning period for twaite shad.		Will be conditioned as part of Foreshore Licence.
PS 21: Big bubble curtain (BBC) <40m deep	A big bubble curtain (BBC) will be used for deflagration in water depths equal to or less than 40m i.e. in Irish waters from KP160 to landfall.		Where conditions are appropriate, a BBC will attenuate noise to further reduce the source levels and the potential zone of effects therefore reducing the potential for injurious effects to fish and marine mammals.	Will be conditioned as part of Foreshore Licence.

List measures to be introduced

Summary of measure

Explain how the measures will avoid the adverse effects on the integrity of the site.

Explain how the measures will reduce the adverse effects on the integrity of the site.

Provide evidence of how they will be implemented and by whom.

PS 22: BBC waters 40-70m deep

If a UXO is identified in water depths of 40-70m, advice would be sought as to practicalities and cost of deploying a BBC in winter at the specific location. A BBC will be used if the contractor concludes it will be effective.

As above.

Will be conditioned as part of Foreshore Licence.

5.1.1 Conclusion of Assessment of Mitigation Measures

Industry standard mitigation measures have been proposed for the avoidance of impacts to European sites. With this suite of procedures in place, it is highly unlikely that sound emitted as a result of the geophysical surveys and UXO detonation to induce auditory injury to any Annex II migratory fish or marine mammal. There may be some low-level disturbance to marine mammals, e.g. behavioural disturbance including avoidance and changes in behaviour. Any potential disturbance effects will be temporary and short term and will not restrict access to suitable habitats or lead to the permanent exclusion of marine mammals from part of their range within the site, or permanently prevent access for the species to suitable habitat.

The implementation of exclusion zones around Annex I reef habitat within Hook Head SAC will remove the potential for adverse effects to this habitat.

It can therefore be concluded beyond reasonable scientific doubt that with the proper implementation of the proposed mitigation measures, the proposed Greenlink Interconnector Cable, individually or in combination with other plans or projects would not have adverse effects on the integrity the European sites.

6 DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

6.1 Discussion

The NIS identified and described the likely significant effects of the proposed project on the existing environments of the following European sites:

- Hook Head SAC
- Saltee Islands SAC
- Slaney River Valley SAC.

This AA assessed likely significant effects on the above sites and the following additional sites:

- River Barrow and River Nore SAC
- Lower River Suir SAC
- Pembrokeshire Marine/Sir Benfro Forol SAC
- West Wales Marine/Gorllewin Cymru Forol SAC
- Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC
- North Anglesey Marine/Gogledd Môn Forol SAC
- North Channel SAC
- Llyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC
- Cardigan Bay/Bae Ceredigion SAC.

The impact of the proposed project on the conservation objectives of the above sites alone and in combination with other plans or projects was also assessed. The NIS sets out specific mitigation measures, considered to be industry best practise, which will avoid and reduce the potential impacts.

6.2 Recommendations

6.2.1 Recommended Licence Conditions

Based on this assessment and the conditions proposed by statutory consultees, RPS considers that the following conditions should be attached to any decision by the DHLGH to consent the proposed project. The purpose of these conditions is to avoid, reduce and offset any significant effects on European sites as a result of the proposed project. Conditions which do not relate specifically to European sites are recommended in the Environmental Impact Assessment Report Technical Review carried out by RPS, which accompanies this report to DHLGH.

1. All mitigation measures proposed in the NIS should be implemented as conditions to the Foreshore Licence. It is recommended that requirements for evidence of implementation of these mitigation measures are included in these conditions.

6.3 Conclusion

It can be concluded beyond reasonable scientific doubt that the proposed Greenlink Interconnector Cable, individually or in combination with other plans or projects would not have adverse effects on the integrity of the following European sites:

- Hook Head SAC
- Saltee Islands SAC
- Slaney River Valley SAC.
- River Barrow and River Nore SAC

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- Lower River Suir SAC
 - Pembrokeshire Marine/Sir Benfro Forol SAC
 - West Wales Marine/Gorllewin Cymru Forol SAC
 - Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC
 - North Anglesey Marine/Gogledd Môn Forol SAC
 - North Channel SAC
 - Llyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC
 - Cardigan Bay/Bae Ceredigion SAC.

It is noted that the Minister for the DHLGH's formal determination shall not be prejudiced by this review.

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