Eastern Green Link 2 - Marine Scheme

Environmental Appraisal Report

Volume 3

Appendix 8.2 - Habitats Regulations Assessment Report

nationalgrid

Scottish & Southern Electricity Networks
TRANSMISSION

National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc

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Table of Contents

8.2 Habitat Regulations Assessment Report 1
8.2.1 Introduction 1
8.2.2 Legislative Framework 2
8.2.3 Assessment Methodology 3
8.2.4 Baseline Evidence Gathering 6
8.2.5 Test of Likely Significant Effects 28
8.2.6 Information to Inform Appropriate Assessment 43
8.2.7 In-combination Effects 45
8.2.8 Conclusions 57
8.2.9 References 58

Figures

Figure 1: Four Stage approach to Habitats Regulations Assessments of Projects. *Source: PINS Advice Note 10.* 5
Figure 2: Relevant European Sites 17

Tables

Table 1: Indicative Breeding Season Foraging Ranges for Qualifying Bird Species Designated for Their Breeding Population 7
Table 2: Presence and Seasonal Distribution of Seabirds Within the Study Area During Breeding Season 9
Table 3: Summary of the presence and distribution of ornithological receptors within the Study Area during the non-breeding season 13
Table 4: Summary of the European Sites traversed by or within the likely Zone of Influence of the Marine Scheme 18
Table 5: Likely impact pathways associated with the Installation and Operation and Maintenance Phases of the Marine Scheme 29
Table 6: Characteristics of underwater sound sources generated by the Marine Scheme Installation Phase 36
Table 7: Maximum estimated distance (m) from USBL and SBP at which the sound level will exceed the SPL_{peak} and SEL_{cum} PTS injury threshold 36
Table 8: Screening of project interactions for in-combination effects 47

8.2 Habitat Regulations Assessment Report

8.2.1 Introduction

8.2.1.1 Overview

This Habitats Regulations Assessment Report (HRA) has been prepared on behalf of National Grid Electricity Transmission (NGET) and Scottish Hydro Electric Transmission plc (SHE Transmission) (the Applicants). It forms part of the Environmental Appraisal Report (EAR) prepared to support the Marine Licence Applications (MLAs) to the Marine Scotland Licensing Operations Team (MS-LOT) and to the Marine Management Organisation (MMO).

The Applicants are applying for Marine Licences to undertake licensable activities sought under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009. The MLAs relate to the installation, operation and maintenance of a submarine High Voltage Direct Current (HVDC) link extending approximately 436 km from the Scottish landfall at Sandford Bay, Peterhead to the English landfall at Fraisthorpe Sands, Bridlington.

This HRA should be read in conjunction with the following EAR chapters:

- Chapter 2: Project Description;
- Chapter 8: Benthic Ecology (to which the report forms Appendix 8.2);
- Chapter 9: Fish and Shellfish;
- Chapter 10: Marine Mammals;
- Chapter 11: Ornithology; and
- Chapter 16: Cumulative and In-Combination Effects.

8.2.1.2 The Project

The Project comprises the components described below:

- **Scottish Onshore Scheme:** From the existing transmission system and an adjacent substation approximately 1 km of buried high voltage alternating current (HVAC) cable will connect to a proposed converter station. A further approximately 1 km of buried HVDC will extend from the proposed converter station to the landfall at Sandford Bay, Peterhead. The scope of the Scottish Onshore Scheme ends at Mean Low Water Springs (MLWS), and is covered by a separate consent application which was submitted in November 2021 to Aberdeenshire Council and permission granted in May 2022 (APP/2021/2681);
- **Marine Scheme:** Commencing at Mean High Water Springs (MHWS) within Sandford Bay, approximately 436 km of subsea HVDC cable, comprising 150 km in Scottish waters and 286 km in English waters, will extend to MHWS at Fraisthorpe Sands on the East Riding of Yorkshire coast. This comprises the subject of the MLAs to MS-LOT and the MMO, which this HRA Report supports; and
- **English Onshore Scheme:** From MLWS at Fraisthorpe Sands, approximately 67 km of underground buried HVDC will connect to a proposed converter station in Drax within the Selby District. The proposed converter station will then connect to an existing substation within the boundary of the Drax Power Station by approximately 100 m of HVAC cable. This is subject to a separate consent application which was submitted to East Riding of Yorkshire Council (Planning Portal Ref: PP-11285186v1BZD) and Selby District Council (Planning Portal Ref: PP-11291708v1GQS) in May 2022.

The details of the Marine Scheme are comprehensively described in Volume 2 Chapter 2: Project Description.

The Marine Scheme will provide 2 Giga Watts (GW) of transmission reinforcement between Scotland to England, by means of a submarine HVDC cable system. Two submarine HVDC cables and a separate Fibre Optic (FO) Cable (the cables) will be installed within a Marine Installation Corridor

approximately 436 km long and up to 500 m wide. The Marine Installation Corridor extends from MHWS at the Scottish landfall at Sandford Bay crossing Scottish territorial waters, Scottish offshore waters, English offshore waters and English territorial waters to MHWS at the English landfall at Fraisthorpe Sands.

The Scottish and English Onshore Schemes and Marine Schemes overlap in the intertidal zone between MHWS and MLWS, where the terrestrial and marine planning systems overlap.

This HRA report focuses on the Marine Scheme only. The Scottish Onshore Scheme and English Onshore Scheme are appraised in separate HRAs, which are cross-referred to in the main body of text where relevant.

8.2.2 Legislative Framework

Protection of sites of nature conservation importance at a European level originated when the UK was part of the European Union (EU) and was required to enact EU laws into its domestic laws. The EU legislation relevant to such sites were the European Directive 92/43/EEC on the 'Conservation of Natural Habitats and Wild Fauna and Flora', referred to as the 'Habitats Directive', and Council Directive 2009/147/EC (Birds Directive) the Conservation of Wild Birds (the codified version of Council Directive 79/409/EEC on the conservation of wild birds) referred to as the 'Wild Birds Directive'. Sites falling under the definitions provided in these Directives are referred to as European Sites and reflect the fact that these sites are of a European level of importance.

In Scotland, the Habitats Directive and the Birds Directive are transposed into law by The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), while in England, the same function is performed by The Conservation of Habitats and Species Regulations 2017, applying to Scottish and English territorial waters respectively. The Conservation of Offshore Marine Habitats and Species Regulations 2017 transpose the Habitats Directive into law for the offshore waters of both Scotland and England. The UK left the EU on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 ("the Withdrawal Act"). However, the most recent amendments to the Habitats Regulations –The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019 and The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 maintain the requirement for a HRA to be undertaken, as appropriate.

These regulations are collectively referred to as the 'Habitats Regulations'.

The Habitats Regulations enable the protection of sites that host habitats and species of European Importance. These sites are listed below and are collectively referred to as European Sites. They include Ramsar sites which are not formally covered by the Regulations but are included in the process as a result of guidance in the National Planning Policy Framework.

- Special Areas of Conservation (SAC);
- Special Protection Areas (SPA); and
- Ramsar Sites.

8.2.2.1 Statutory Requirements for Assessment of European Sites

The wording of the different Habitat Regulations governing the HRA process are very similar and have an identical intent and process. Regulation 48 of The Conservation (Natural Habitats, &c.) Regulations 1994 (applicable in Scotland), Regulation 63 of The Conservation of Habitats and Species Regulations 2017 (applicable in England) and Regulation 28 of The Conservation of Offshore Marine Habitats and Species Regulations 2017 (applicable in both Scotland and England) state that:

> *"A competent authority, before deciding to … give any consent for a plan or project which is likely to have a significant effect on a European site … must make an Appropriate Assessment of the implications for the plan or project in view of that site's conservation objectives… The competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site."*

Although Appropriate Assessment itself is undertaken by the competent authority, the Habitat Regulations also all require that:

> *"A person applying for any such consent, permission or other authorisation must provide such information as the competent authority may reasonably require for the purposes of the assessment or to enable it to determine whether an appropriate assessment is required."*

The first stage therefore requires an applicant to provide sufficient information to allow the competent authority to decide if Appropriate Assessment is necessary. It is this 'first stage' of assessment that has been conducted and reported in this document.

Should the first stage conclude that significant effects are likely, the applicant must provide sufficient assessment information to allow the competent authority to undertake an Appropriate Assessment.

Ordinarily, consent may only be given for the proposed scheme if, following Appropriate Assessment by the competent authority, it is established that it will not adversely affect the integrity of the European site as required by the Habitats Regulations:

> *"In the light of the conclusions of the assessment, and subject to [considerations of overriding public interest], the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site or the European offshore marine site (as the case may be)"*

If adverse effects on integrity are identified, alternatives must be considered to avoid those effects. However, where no alternatives exist, and so an adverse effect on integrity remains, a further assessment is made, under the Habitats Regulations, as to whether the scheme is required for imperative reasons of overriding public interest (IROPI). If the scheme meets that IROPI test, compensatory measures will be required to maintain the overall national site network.

The overall process set out in the Habitats Regulations is typically referred to as a 'Habitats Regulations Assessment' (HRA) or, in Scotland, a Habitats Regulations Appraisal. This has arisen to distinguish the overall process from the individual stage of "Appropriate Assessment", which is carried out by the competent authority. Throughout this Report the term HRA is used for the overall process and restricts the use of Appropriate Assessment to the specific stage of that name.

In Scottish waters, Marine Scotland Licencing Operations Team (MS-LOT) is the competent authority, whilst in English waters, this role is performed by the Marine Management Organisation (MMO). Due to the inherent similarities between the Scottish and English Habitats Regulations, this single HRA Report is provided covering European Sites in both Scottish and English territorial and offshore waters.

8.2.3 Assessment Methodology

8.2.3.1 Introduction

This HRA Report has been carried out with reference to the general EC guidance on HRA (European Commission, 2001), general guidance on HRA published by the UK Government in 2021 (Department for Environment, Food & Rural Affairs, Natural England, Welsh Government, and Natural Resources Wales, 2021). This assessment also considers guidance from the MMO[1]. Although the Marine Scheme is not subject to the Planning Act 2008 and will not be consented through a Development Consent Order the stages set out in the Planning Inspectorate (PINS) Advice Note 10 (The Planning Inspectorate, 2017) can be applied to any project. This is followed voluntarily to help inform the process but is by no means mandatory or statutory; in the absence of any other appropriate or similar guidance, it is considered appropriate to follow.

This assessment of Likely Significant Effects (LSEs) takes account of relevant EU case law (for instance, the Holohan and People over Wind cases, discussed below).

Figure 1 overleaf outlines the stages of HRA according to PINS Advice Note 10.

[1] https://www.gov.uk/guidance/marine-licensing-impact-assessments#habitats-regulations-assessment

Appropriate Assessment must be taken by the competent authority. In this case, MS-LOT will undertake a HRA and reach a decision as competent authority in Scotland. In England, the MMO will undertake a HRA and reach a decision as competent authority. As required by the Habitat Regulations, the information required to enable the competent authorities to undertake their HRAs and make their determinations must be provided by the Applicant. The information is required to enable the competent authorities to establish whether there are any LSEs from the Marine Scheme and this information is provided in this HRA Report.

The approach to this HRA was provided for review and feedback during non-statutory scoping which was submitted to both MS-LOT and the MMO on 06 July 2021.

8.2.3.2 HRA Stage 1 – Screening for LSEs

The objective of the LSE test is to 'screen out' those aspects of the Marine Scheme and / or the European Sites where it can, without any detailed appraisal, be reasonably concluded that significant adverse effects upon European Sites are unlikely, usually because there is no mechanism for an adverse interaction (i.e., a pathway) with European Sites. The remaining aspects are then taken forward to Appropriate Assessment. The assessment must consider the potential for effects 'in combination' with other plans and projects.

This report has been prepared having regard to all relevant case law relating to the Habitat Regulations, the Habitats Directive and Birds Directive. This includes the ruling by the Court of Justice of the European Union (CJEU) in the case of People Over Wind, Peter Sweetman v Coillte Teoranta (C-323/17).

This case held that; "*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site*" (paragraph 40). This establishes that 'mitigation measures' cannot be taken into account at the screening stage, but they can be taken into account in an Appropriate Assessment. However, NatureScot have produced guidance clarifying that it is those measures specifically intended to avoid or reduce harmful effects to a European site which cannot be considered at the screening stage (NatureScot, 2018). This means there is scope to consider whether an aspect of a plan or project, or an undertaking by a proponent, may be an essential element of the plan or project and not simply concerned with avoiding impacts to European Sites, e.g., embedded mitigation as described in EAR Volume 2 Chapter 2: Project Description.

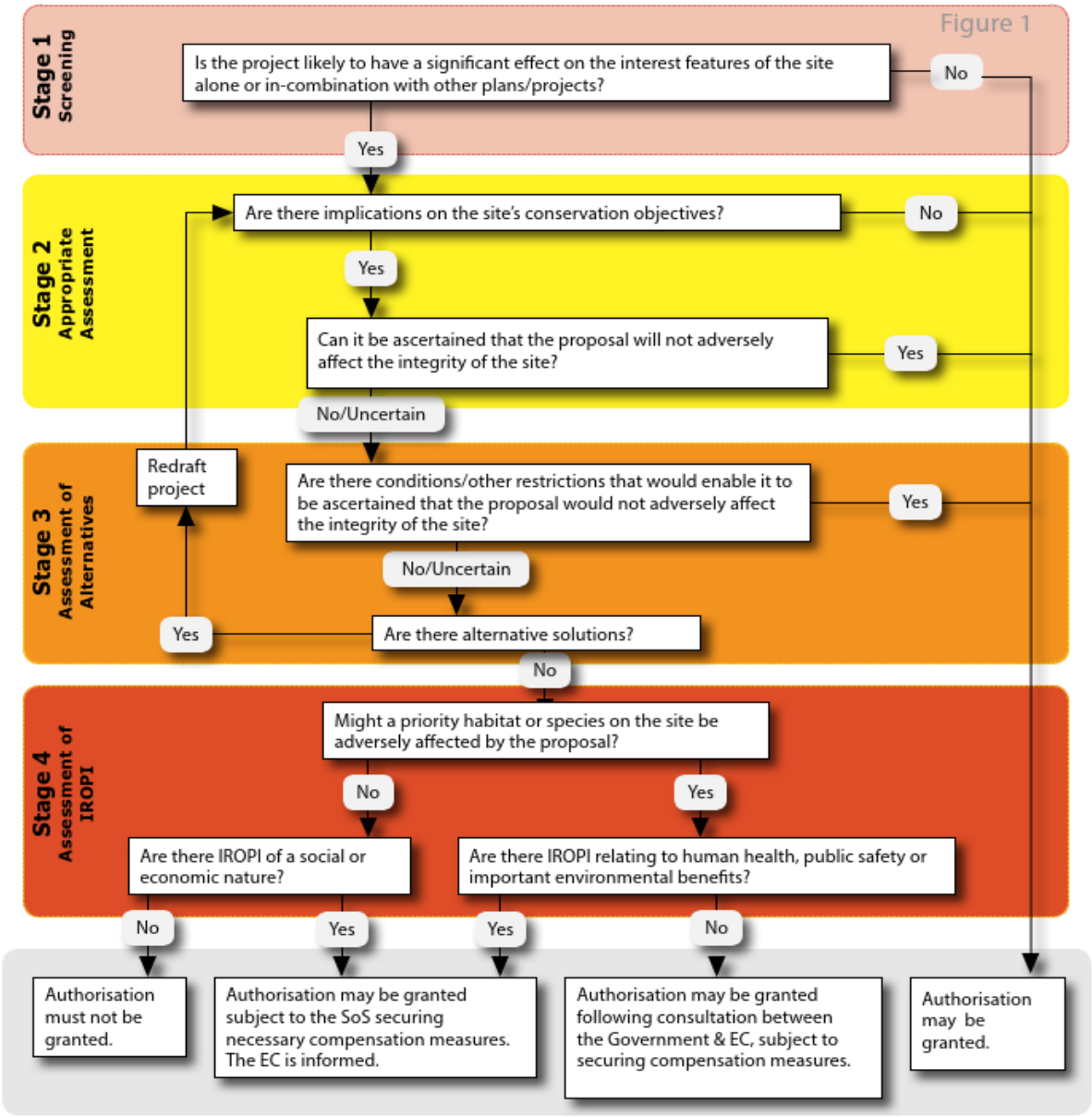


Figure 1: Four Stage approach to Habitats Regulations Assessments of Projects. ***Source: PINS Advice Note 10.***

8.2.3.3 HRA Stage 2 – Appropriate Assessment

Where it is determined that a conclusion of 'no LSE' cannot be drawn, the HRA proceeds to the next stage of HRA known as Appropriate Assessment. Case law has clarified that 'Appropriate Assessment' is not a technical term. In other words, there are no specific technical analyses, or level of detail, that are classified by law as belonging to Appropriate Assessment rather than the screening for LSE. The Appropriate Assessment constitutes whatever level of further assessment is required to determine whether an adverse effect on integrity would arise.

By virtue of the fact that it follows the screening process, there is an understanding that the analysis will be more detailed than that undertaken at the previous stage. One of the key considerations during Appropriate Assessment is whether there is available mitigation that would address the potential effect, allowing for a conclusion of no adverse effect on integrity of a site. In practice, the Appropriate Assessment takes any element of the Marine Scheme that could not be excluded as having LSEs following Stage 1 and assesses the potential for an effect in more detail, with a view to concluding whether there would be an adverse effect on site integrity. Adverse effects on site integrity include disruption of the coherent structure and function of the European site(s) and the ability of the site to achieve its conservation objectives.

In 2018, the Holohan ruling was handed down by the European Court of Justice. Among other provisions paragraph 39 of the ruling states that *'As regards other habitat types or species, which are present on the site, but for which that site has not been listed, and with respect to habitat types and species located outside that site, … typical habitats or species must be included in the Appropriate Assessment, if they are necessary to the conservation of the habitat types and species listed for the protected area'* [emphasis added]. This ruling has been considered in relation to the Marine Scheme and European Sites that are linked via an impact pathway.

8.2.3.4 The Rochdale Envelope

In July 2018, the Planning Inspectorate published Advice Note Nine: Rochdale Envelope (The Planning Inspectorate, 2018), explaining how the principles of the Rochdale Envelope should be used by planning applications for the Environmental Impact Assessment (EIA) process.

While the Marine Scheme is not a statutory EIA project, the Rochdale Envelope[2] is applicable where some of the details of a Marine Scheme cannot be confirmed when the application is submitted, and flexibility is needed to address uncertainty, as described in EAR Volume 2 Chapter 2: Project Description. Notwithstanding, all significant potential effects of the Marine Scheme must be properly addressed.

It encompasses three key principles:

- The assessment should use a cautious worst-case approach;
- The level of information assessed should be sufficient to enable the LSEs of the Marine Scheme to be assessed; and
- The allowance for flexibility should not be abused to provide inadequate descriptions of projects.

This HRA Report has given due consideration to the use of a Rochdale Envelope approach. The worst-case (i.e., the potentially most impactful) scenarios have been assessed in relation to their relevant impact pathways.

Throughout this HRA Report, Installation Phase and Decommissioning Phase impacts on European Sites are considered to be very similar in type, magnitude and effect. As such they are treated together.

8.2.4 Baseline Evidence Gathering

8.2.4.1 Scope of the HRA Report

There is no guidance that dictates the scope of an HRA in all circumstances and the study area for this HRA Report is largely dictated by the linkages between impact pathways and European site designations. Thus, the study area for this HRA extends to those European Sites that are included in the Test of LSEs. The scope of the assessment is primarily guided by the identified impact pathways (the source-pathway-receptor model) for the receptors assessed and detailed in the relevant EAR chapters. It should also be noted that the Marine Scheme was scoped in consultation with MS-LOT and the MMO with the submission of a non-statutory scoping report on 06 July 2021, and the feedback received has been fed into the assessment.

Impact pathways are routes by which the Installation, Operation and Maintenance and Decommissioning Phases of the Marine Scheme can lead to an effect upon a receptor, the receptor for HRA being a European site or its qualifying features. An example of an impact pathway is visual and noise disturbance arising during any phase of the project assessed from Installation Phase, through Operation and Maintenance, to the Decommissioning Phase. If there are ecological receptors sensitive to visual disturbance within a nearby European site (e.g., non-breeding overwintering birds), visual disturbance could alter their foraging and roosting behaviour, with potential to affect the integrity of the European site. In this example, the pathway is line of sight, and the potential zone of influence and magnitude of an impact can be considered on that basis. For other impact pathways (e.g., air pollution)

[2] The Rochdale Envelope arises from two cases: R. v Rochdale MBC ex parte Milne (No.1) and R. v Rochdale MBC ex parte Tew [1999], which are cases that dealt with outline planning applications for a proposed business park in Rochdale.

there may be guidance that sets out appropriate distance-based zones of influence for assessment. For other pathways of impact and receptors, a professional judgment must be made based on the best available evidence.

8.2.4.2 Relevant European Sites

Breeding Seabirds associated with European Sites

The Marine Scheme is located in waters that may be used by wide-ranging foraging seabirds from European Sites with numerous qualifying species. These seabird species have differing foraging ranges from their breeding colonies and therefore, different distributions at sea. To establish the potential presence of seabirds from any given designated site and hence determine potential connectivity with the Marine Scheme, it is therefore, necessary to review foraging ranges and distributions to identify likely presence within the Marine Installation Corridor.

These ranges and distributions are considered in this section and inform the screening of designated sites presented in Table 4. The mean maximum breeding season foraging ranges of seabirds that are qualifying features of these designated sites are presented in Table 1 (Woodward, et al., 2019).

Table 1: Indicative Breeding Season Foraging Ranges for Qualifying Bird Species Designated for Their Breeding Population

Qualifying Bird Species	**Mean Maximum Foraging Range (km ± SD)** (Woodward, Thaxter, Owen, & Cook, 2019)
Kittiwake	156.1 ±144.5
Guillemot	73.2 ± 80.5
Common tern	18.0 ± 8.9
Shag	13.2 ± 10.5
Herring gull	58.8 ± 26.8
[redacted]	[redacted]
Gannet	315.2 ± 194.2
Razorbill	88.7 ± 75.9
Sandwich tern	34.3 ± 23.2
Fulmar	542.3 ± 657.9

The standard advice from the JNCC is that to define functionally linked habitat for seabirds, the mean maximum foraging distance plus one standard deviation should be used e.g., 57.5 km for sandwich tern. It is recognised that seabirds from other SPA colonies may also occur in the footprint of the Marine Scheme, particularly those with extensive foraging ranges, e.g., Manx shearwater and gannet, or out with the breeding period. However, it is not possible to determine which designated sites these birds may originate from and evidence from studies suggest foraging densities of Manx shearwater to be low in the North Sea (Stone, Webb, & Tasker, 1994) and overall, foraging density of gannet declines with distance from the colony (Camphuysen C. J., 2011).

The breeding season for seabirds varies between species but broadly extends between April and August, with the core breeding period between May and July, during which time their distribution offshore is constrained by the requirement to return to their breeding sites. Following breeding, seabirds disperse away from their colonies to their wintering areas; for example, they may travel into the Atlantic or into the North Sea. Some species such as guillemot and razorbill disperse from the colonies during July and August. Adults become flightless during their post-breeding moult and the males are accompanied by flightless chicks. The highest numbers of flightless birds initially occur near the breeding colonies during July and early August.

A series of large-scale seabird tracking studies have been undertaken by the Royal Society for the Protection of Birds (RSPB) and partners between 2010 and 2015 across the UK during the late incubation / early chick rearing period of the breeding season. These data have been used to map the UK wide at sea distribution of four species: shag, kittiwake, guillemot and razorbill. These hotspot maps are presented in Cleasby, et al. (2018) and demonstrate the importance of the marine areas immediately offshore from the designated sites supporting breeding colonies, listed in Table 1. Of note, kittiwake hotspots were also identified to the south east of the Flamborough and Filey Coast SPA (see EAR Volume 2 Chapter 11: Ornithology for further details).

A summary of foraging seabirds with the potential to be associated with the Marine Installation Corridor are identified in Table 2.

Table 2: Presence and Seasonal Distribution of Seabirds Within the Study Area During Breeding Season

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Kittiwake	Qualifying feature of the Buchan Ness to Collieston Coast SPA and the Flamborough and Filey Coast SPA, with foraging hotspots from these SPAs along the north east coast of Scotland and to the south east of Flamborough Head (Cleasby, Owen, Wilson, & Bolton, 2018) and north of Flamborough Head (Waggitt, et al., 2020). Based on foraging ranges presented within Table 1 and tracking studies, kittiwake within the Marine Installation Corridor are likely to originate from these SPAs. However, other SPAs which might be a potential source include, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA and St Abb's Head to Fast Castle SPA. Kittiwake leave their breeding colonies in July/August and spend the winter at sea, often beyond the continental shelf. Their diet consists of mainly fish including capelin *Mallotus villosus*, herring *Clupea harengus*, sprat *Sprattus sprattus* and sand eel *Ammodytes tobianus* and they have been known to feed on small crustaceans such as shrimps. Highest numbers of kittiwake located along the north east coast of Scotland and south east and north of Flamborough Head were recorded in the spring and summer.	Kittiwake are likely to be present throughout the Marine Installation Corridor, particularly where the Marine Installation Corridor passes through the Buchan Ness to Collieston Coast SPA and near to the Flamborough and Filey Coast SPA. The core area of identified foraging hotspot south east of Flamborough Head (Cleasby, Owen, Wilson, & Bolton, 2018) does not overlap with the Marine Installation Corridor, but the high densities identified to the north of Flamborough Head in July (Waggitt, et al., 2020) does and therefore it is assumed that birds will pass through the Marine Installation Corridor to reach these favoured areas. Widely distributed throughout the study area all year, but particularly between May and August. Given, the foraging range for the species presented in Table 1, kittiwake from other east coast SPAs could also occur within the Marine Installation Corridor.
Guillemot	Qualifying feature of the Buchan Ness to Collieston Coast SPA and the Flamborough and Filey Coast SPA, with foraging hotspots from these SPAs along the north east coast of Scotland and offshore from the East Yorkshire coast between Flamborough Head and Filey (Cleasby, Owen, Wilson, & Bolton, 2018; Waggitt, et al., 2020). Based on foraging ranges presented within Table 1 and tracking studies, guillemot within the Marine Installation Corridor are likely to originate from these SPAs. However, other SPAs which might be a potential source include, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA and the Farne Islands SPA Nesting is confined to areas safe from mammalian predators such as sheer cliffs and offshore islands. They leave their breeding colonies from July and spend the winter at sea. Prey species predominantly consists of sandeel and clupeids *Clupeidae* spp. Highest numbers recorded in the spring and early summer. The highest number of guillemot along the Buchan Ness to Collieston Coast SPA and the Flamborough and Filey Coast SPA were recorded in summer.	Guillemot are likely to be present throughout the Marine Installation Corridor, particularly where the Marine Installation Corridor passes through the Buchan Ness to Collieston Coast SPA and near to the Flamborough and Filey Coast SPA. Whilst the highest numbers have been shown to be present close to nesting colonies, they are likely to be widely distributed throughout the Marine Installation Corridor, with numbers present from January and declining from July onwards as nest sites are abandoned. Given, the foraging range for the species presented in Table 1, Guillemot from other East Coast SPAs could also occur within the Marine Installation Corridor.

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Shag	Qualifying feature of the Buchan Ness to Collieston Coast SPA and the Flamborough and Filey Coast SPA, with foraging hotspots from these SPAs along the north east coast of Scotland and offshore from the East Yorkshire coast between Flamborough Head and Filey (Cleasby, Owen, Wilson, & Bolton, 2018; Waggitt, et al., 2020). Based on foraging ranges presented within Table 1 and tracking studies, shag within the Marine Installation Corridor are likely to originate from these SPAs. However, other SPAs which might be a potential source include, Forth Islands SPA and St Abb's Head to Fast Castle SPA. Shags are partially migratory, meaning that a proportion of individuals remain resident at the breeding colony throughout the year, while the remainder migrate to other locations in the non-breeding season. Shags are preponderantly benthic feeders (i.e., they find their prey on the sea bottom). They will eat a wide range of fish but their primary food source is sandeel.	Shag are likely to be present throughout the Marine Installation Corridor, particularly where the Marine Installation Corridor passes through the Buchan Ness to Collieston Coast SPA and near to the Flamborough and Filey Coast SPA. Whilst the highest numbers have been shown to be present close to nesting colonies, they are likely to be widely distributed throughout the Marine Installation Corridor, albeit in greatly reduced numbers with distance from land. Predominantly present between November and June, although recorded throughout the year.
Herring gull	Qualifying feature of Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA and St Abb's Head to Fast Castle SPA. Opportunistic feeder, taking fish, crustaceans, young birds and even garbage. Recorded throughout the year.	Present all year round, but likely to be present in higher numbers within the Marine Installation Corridor where it approaches nearshore areas, particularly at the Scottish landfall. The offshore areas of the Marine Installation Corridor are unlikely to support significant numbers of foraging herring gull.
Gannet	Qualifying feature of the Flamborough and Filey Coast SPA and the Forth Islands SPA. The nearest gannet colony is the Bempton Cliffs colony located approximately 10 km north of the Marine Scheme. This colony has shown a significant increase in numbers with a 240% increase in numbers since 2003 (3,940 individuals) to 2017 (13,392 individuals) (JNCC, Northern gannet (Morus bassanus), 2021d). Recent surveys carried out on this colony showed that gannets dispersed widely around the Bempton Cliffs, with high densities near the Bempton Cliffs and low densities over vast areas. Approximately 70% of foraging trips were within 50 km of Bempton Cliffs. They revealed that the maximum foraging range was 404 km from the colony (Langston, Teuten, & Butler, 2013). The tracking studies confirmed that the entire range (i.e., 404 km foraging range) and beyond is used by breeding gannets from the Bempton Cliffs. Gannets are pelagic feeders, foraging primarily on lipid-rich pelagic fish up to 30 cm in length such as mackerel *Scomber scombrus*, herring and sandeel.	High numbers likely to be present throughout the Marine Installation Corridor between April and September with highest numbers between June and August and only sporadic presence between October and March.

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Razorbill	A qualifying feature of the Flamborough and Filey Coast SPA with highest densities north of Flamborough Head (Waggitt, et al., 2020). Based on foraging ranges presented within Table 1 and tracking studies, razorbill within the Marine Installation Corridor are likely to originate from these SPAs. However, other SPAs which might be a potential source include, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA and St Abb's Head to Fast Castle SPA. They nest on small ledges or in cracks of rocky cliffs and in associated screes. Breeding begins in late April with a peak in mid-May. Prey species predominantly consists of sandeel. Highest numbers recorded in the spring and early summer. They feed mainly on small fish (e.g., sandeel, herring, sprat, cod *Gadus morhua*)	Highest numbers present close to nesting colonies, but likely to be widely distributed throughout the Marine Installation Corridor, with numbers declining from July onwards as nest sites are abandoned.
Fulmar	Qualifying feature of Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA and Fowlsheugh SPA. They typically nest on top of cliffs but will also nest on more sloping ground and in puffin burrows on Islands. They are 'opportunistic feeders' feeding at sea on a variety of foods ranging from zooplankton and small fish to offal and discards produced by commercial fishing.	Present all year round, but likely to be present in higher numbers within the Marine Installation Corridor nearest their breeding colonies from April to August, particularly at the Scottish landfall.
[redacted]	[redacted]	[redacted]

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Common tern	The foraging area for common tern within the Greater Wash SPA was determined by boat based visual tracking surveys for foraging birds carried out between 2006 and 2008 (Natural England & JNCC, 2016). The results of these surveys combined with information on the habitat characteristics of the locations relative to other areas available, was to construct habitat association models of tern usage. These models were used to predict species-specific tern usage patterns and determine their foraging areas around breeding colony SPAs. For this, the nearest breeding colony was located within the North Norfolk Coast SPA (which overlaps with the Greater Wash SPA). Common tern was tracked from Blakeney Point during 2008. The results show that in every case, the predicted foraging usage for common tern was greatest in the vicinity of the colony, with very little or no usage distant from the shore. These colonies are located outside the study area and more than 130 km from the Marine Installation Corridor.	The Marine Installation Corridor is not identified as a core foraging area for common tern.
Sandwich tern	The foraging areas for sandwich tern within the Greater Wash SPA and for breeding populations at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA / Ythan Estuary and Meikle Loch Ramsar was modelled to predict species-specific tern usage patterns and determine their foraging areas around breeding colony SPAs (Natural England & JNCC, 2016 and Scottish Natural Heritage, 2016). For the Greater Wash SPA populations, the nearest breeding colony for both species was located within the North Norfolk Coast SPA (which overlaps with the Greater Wash SPA). Sandwich tern was tracked from both Scolt Head and Blakeney Point over three survey seasons from 2006 to 2008, while common tern was tracked from Blakeney Point during 2008. The results show that in every case, the predicted foraging usage for common tern and sandwich tern was greatest in the vicinity of the colony, with very little or no usage distant from the shore. These colonies are located outside the study area and more than 130 km from the Marine Installation Corridor. For the Sands of Forvie colony, modelling to inform a proposed marine extension predicted maximum foraging usage alongshore 12 km to the north and 19 km to the south, but just 4 km east out to sea.	The Marine Installation Corridor is not identified as a core foraging area for sandwich tern.

Non-breeding seabirds and waterbirds associated with European Sites

The Marine Scheme is located in waters that may be used by other wide-ranging foraging seabirds and waterbirds during the non-breeding seasons. These species have differing non-breeding foraging distributions, with many important coastal and marine areas designated for the protection of these species' key foraging areas. This section considers the likelihood of non-breeding seabirds and waterbirds associated with European Sites occurring within the Marine Installation Corridor. Important concentrations of non-breeding seabirds and waterbirds are most likely to be encountered in the areas which have been designated as such.

For example, the Greater Wash SPA (located approximately 3.1 km to the south of the Marine Installation Corridor) and Outer Firth of Forth and St Andrews Bay Complex SPA (located approximately 39 km to the west of the Marine Installation Corridor), both of which qualify for non-breeding populations of red-throated diver, little gull and common scoter. These species may be present within the Marine Installation Corridor or within the Marine Scheme Zone of Influence (ZoI) (refer to Table 5). However, the Ythan Estuary, Sands of Forvie and Meikle Loch SPA (located approximately 8 km to the south of the Marine Installation Corridor) has been excluded from further consideration because the qualifying species are not anticipated to occur within the Marine Installation Corridor nor the Marine Scheme's ZoI.

The presence of non-breeding seabirds and waterbirds associated with European Sites within the Marine Installation Corridor or the Marine Scheme's ZoI is summarised in Table 3.

Table 3: Summary of the presence and distribution of ornithological receptors within the Study Area during the non-breeding season

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Red-throated diver	Within the Greater Wash SPA, this species is recorded in relatively high densities in the northern section of the SPA, approximately 3.1 km south of the Marine Installation Corridor (NE & JNCC, 2016). There is no evidence to suggest that the Scottish landfall or anywhere else along the Marine Installation Corridor provides suitable habitat to support significant concentrations of red-throated diver, with further populations occurring within the Outer Firth of Forth and St Andrews Bay Complex SPA, approximately, 39.7 km to the west of the Marine Installation Corridor.	The Marine Installation Corridor does not represent key foraging areas for overwintering red-throated diver, although relatively high densities occur within the northern section of the Greater Wash SPA. Based on modelling undertaken for Hornsea Four offshore windfarm, very low densities of red-throated diver, i.e., between two and three individuals may be present within the Marine Installation Corridor and surrounding ZoI. Red-throated diver are not noted in significant numbers elsewhere along the Marine Installation Corridor.
Common scoter	Within the Greater Wash SPA, the species is concentrated in the central and southern sections, predominantly off the North Norfolk coast. (NE & JNCC, 2016). There is no evidence to suggest that the Scottish landfall or anywhere else along the Marine Installation Corridor provides suitable habitat to support significant concentrations of common scoter, with further populations occurring within the Outer Firth of Forth and St Andrews Bay Complex SPA, approximately, 39.7 km to the west of the Marine Installation Corridor.	The Marine Installation Corridor does not represent key foraging areas for overwintering common scoter, with the species favouring the coastal waters of the North Norfolk coast. Common scoter are not noted in significant numbers elsewhere along the Marine Installation Corridor.

Receptor	Summary of Data Relevant to the Study Area	Presence in the Study Area
Little gull	Within the Greater Wash SPA, the species is concentrated in the central and southern regions of the site. (NE & JNCC, 2016). There is no evidence to suggest that the Scottish landfall or anywhere else along the Marine Installation Corridor provides suitable habitat to support significant concentrations of little gull, with further populations occurring within the Outer Firth of Forth and St Andrews Bay Complex SPA, approximately, 39.7 km to the west of the Marine Installation Corridor.	The Marine Installation Corridor does not represent key foraging areas for overwintering little gull, with the species favouring the central and southern sections off the Greater Wash SPA. Little gull are not noted in significant numbers elsewhere along the Marine Installation Corridor.
Other non-breeding seabirds, including auks, gulls and seaducks, associated with SPAs on the Scottish and English North Sea coast	Widely distributed and transitory throughout the marine installation corridor, with no evidence to suggest significant concentrations within the study area.	The Marine Installation Corridor is unlikely to represent key foraging areas for the non-breeding seabirds, with low numbers likely to be encountered infrequently across the Marine Installation Corridor.

The Marine Installation Corridor or the Marine Scheme's ZoI is also likely to support a variety of other non-breeding seabird and waterbird species, however, none of these species are anticipated to occur in significant concentrations within the Marine Installation Corridor, with only infrequent present of transitory individuals, therefore they are not considered further.

Species associated with the Greater Wash SPA are considered in detail below, because they may occur within the Marine Installation Corridor or the Marine Scheme's ZoI.

Red-throated diver feed on a wide variety of fish, which they catch by diving from the surface and pursuing their prey underwater. Little gull feed by picking up food off the water surface, by plunging into the water to catch their prey and/or wading in the shallow water. The fish species taken by these bird species will be influenced by what is locally most readily available, but the diet of these species can include haddock *Melanogrammus aeglefinus*, cod, herring, sprat and gurnard *Eutrigla gurnardus* along with smaller species such as sandeels, pipefish *Syngathidae*, gobies Gobiidae, flatfish *Pleuronectidae* and butterfish *Pholis gunnellus*. Common scoter feed almost exclusively on molluscs and small crustaceans, diving from the surface to pluck their prey from the seabed with an average foraging dive depth being shallower than 15 m.

Red-throated diver arrive in UK coastal waters in September and with numbers beginning to decline from February, as birds start to depart for their breeding grounds. The main period of occurrence in coastal offshore waters is from October to March (Natural England, 2016). Red-throated diver and common scoter, are associated with inshore waters, occurring in sandy bays, firths, and sea lochs, as well as open coastline and shallow offshore areas, i.e., sandbanks. Little gull is a passage migrant, non-breeding summer and winter visitor which is often thinly distributed both in inshore and offshore waters (Natural England & JNCC, 2016).

Aerial surveys used to assess non-breeding populations of waterbirds and seabirds in association with the designation of the Greater Wash SPA were carried out over five winter seasons (2003 to 2008). These data showed that the highest densities of red-throated diver off the east coast of England were concentrated throughout, what is now designated as the Greater Wash SPA boundary, with densities reducing further offshore. Red-throated diver were recorded in relatively high densities (0.2 individuals/km^2 to 0.67 individuals/km^2) in the northern section of the Greater Wash SPA located approximately 3.1 km south of the Marine Installation Corridor during the non-breeding season (September to April) (see EAR Volume 2 Chapter 11: Ornithology for further details).

Whilst, the Marine Installation Corridor does not overlap with areas identified as important for red-throated diver, i.e., designated as part of the Greater Wash SPA, it is likely that individuals may occasionally occur within the Marine Installation Corridor and surrounding waters. Hornsea Four Offshore Windfarm modelled the potential abundance and density of red-throated diver in relation to their export cable, which runs parallel to the Marine Installation between KP425 and KP431. This modelling estimated that red-throated divers occur in very low densities of between 0.004 birds per km^2 and 0.005 birds per km^2 and that based on these densities, between two and three red-throated divers would be present within a 2 km buffer of the export cable (Ørsted, 2022).

Common scoter was recorded in relatively low numbers for most of the surveys within the Greater Wash SPA. However, for three of the surveys (2003, 2005 and 2007) they were recorded in large numbers. The highest density of common scoter (31.06 individuals per km^2 to 56.58 individuals per km^2) was recorded in the central and southern end of the Greater Wash SPA, located north west of the Scolt Head (see EAR Volume 2 Chapter 11: Ornithology for further details). Common scoter is likely to only be an infrequent visitor within the Marine Installation Corridor, given, that the highest densities of this species are within the Wash and off the North Norfolk coast (Lawson et al. 2016).

Little gull is a predominately marine species, using inshore and offshore areas and is thinly distributed across the Greater Wash SPA. Survey data for little gull in the Greater Wash SPA was collected over fiver winter seasons between2003 and 2008) however, the spatial coverage for two of these years (2007 and 2008) was insufficient to provide a representative distribution of this species within the Greater Wash SPA and the resulting data was therefore displayed as raw count data. The raw count data shows a majority of the individuals were recorded in the central and southern end of the Greater Wash SPA, near the Wash and extended seaward beyond the Greater Wash SPA boundary. Four individuals were recorded adjacent and outside of the Greater Wash SPA boundary in the northern section located within the study area, but outside the Marine Installation Corridor (see EAR Volume 2 Chapter 11: Ornithology for further details).

Screening of European Sites

It is noted that the Project will comprise three key components, including the onshore works at Peterhead (Scotland), the marine works in Scottish and English waters (the ‘Marine Scheme’) and the onshore works between Fraisthorpe Sands and Drax (England).

Given these cross-habitat scheme components, there may be clear linkages and overlaps of impact pathways between different elements of the scheme. Since any HRA must be ‘in-combination’ with other plans and projects, the HRA for the Project will need to consider both marine/coastal and fully inland European Sites.

The main inland European Sites of potential relevance to the Scottish Onshore Scheme and the Marine Scheme are the River Dee SAC, the River South Esk SAC, the River Tay SAC, the River Teith SAC and the River Tweed SAC, due to their designation for migratory fish species. A number of Scottish SPAs and SACs have also been considered (Loch of Strathbeg SPA, Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Montrose Basin SPA, Buchan Ness to Collieston Coast SAC, Sands of Forvie SAC, Garron Point SAC, Firth of Tay & Eden Estuary SAC) but no impact pathways have been identified to Marine Scheme and therefore they are not considered further.

There are relatively few inland sites within probable zones of influence (ZoIs) of the English Onshore Scheme, which potentially require consideration as part of this Marine Scheme HRA Report. The main inland European Sites of potential relevance to the English Onshore Scheme are the Humber Estuary SAC, SPA and Ramsar site and the River Derwent SAC, due to their designation for migratory fish species and the fact the onshore scheme will cross the River Ouse which connects the Humber Estuary to the River Derwent. Consideration has been given to the Derwent Valley SAC, SPA and Ramsar site, Thorne Moor SAC, Thorne & Hatfield Moors SAC, North York Moors SAC, and Skipwith Common SAC (all within 10 km of the onshore scheme in England) but no impact pathways have been identified to either the English Onshore or Marine Scheme and therefore they have not been considered further.

Projects that cross European Sites may pose disproportionately strong threats to the Conservation Objectives of these sites, given their proximity to ecological interest features. The Marine Scheme passes through the marine area associated with the SPA and not the sea cliff habitat which host the breeding birds of one European site for 2.3 km as it leaves its Scottish landfall.

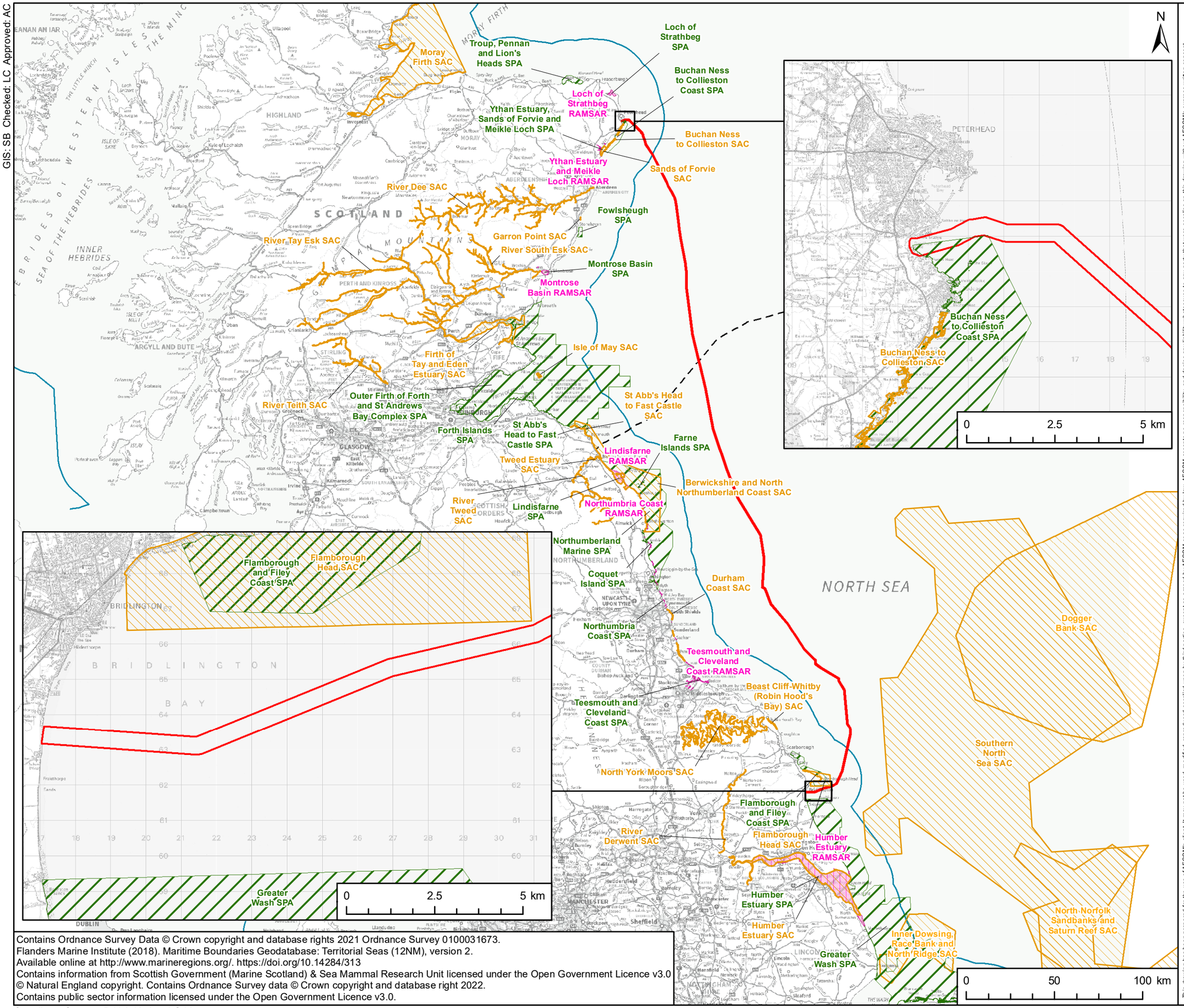
- **Buchan Ness to Collieston Coast SPA**: This site is on the coast of Aberdeenshire in north east Scotland. The SPA consists of a 15 km stretch of south east facing cliff formed of granite, quartzite and other rocks. The total area of the SPA is 54.05 km^2. The site is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the site in the nearby waters, as well as travelling further afield. The Marine Installation Corridor runs through this SPA for approximately 2.3 km as it leaves its Scottish landfall.

Various other European Sites (Table 4) lie outside the anticipated Marine Scheme footprint but may nonetheless be impacted by the activities within the Marine Installation Corridor. For example, this could be because these sites harbour mobile bird, fish or mammal species for which European Sites are designated and which potentially frequent the Marine Installation Corridor, or due to impact pathways extending some distance beyond the Marine Installation Corridor.

The list of sites included in this assessment was agreed with stakeholders during the EAR Scoping stage (See EAR Volume 2 Chapter 6: Consultation and Stakeholder Engagement).

A map of relevant European sies is presented in Figure 2.

GIS: SB Checked: LC Approved: AC



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Flanders Marine Institute (2018). Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 2.
Available online at http://www.marineregions.org/. https://doi.org/10.14284/313
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Coordinate System: British National Grid

Scale @ A3 1:2,000,000 / 1:100,000

nationalgrid
Scottish & Southern Electricity Networks

PROJECT
Eastern Green Link 2

KEY
- Marine Installation Corridor
- UK Territorial Sea Limit
- Scottish/English Water Border
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- RAMSAR

TITLE
Figure 2
Relevant European Sites

REFERENCE
SEGL2_M_EAR_4-1_v3_20220615

SHEET NUMBER
1 of 1

DATE
15/06/2022

Table 4: Summary of the European Sites traversed by or within the likely Zone of Influence of the Marine Scheme

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Moray Firth SAC (Scotland)	92.51 km to the north west	• Bottlenose dolphin *Tursiops truncatus* • Sandbanks which are slightly covered by sea water all the time	• Physical disturbance; • Invasive species; • Water quality; • Fisheries; • Other fishing; • Underwater noise; • Coastal development; • Cables and pipelines; and • Commercial shipping, ferries, personal leisure craft, wildlife tour boats and tidal turbines (death or injury by collision).	Yes (species) – bottlenose dolphin present within the SAC, likely also using marine waters around the Marine Installation Corridor. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for bottlenose dolphin only.
Buchan Ness to Collieston Coast SPA (Scotland)	Marine Installation Corridor partially overlaps the SPA for approximately 2.30 km	• Northern fulmar *Fulmarus glacialis* • Black-legged kittiwake *Rissa tridactyla* • Common guillemot *Uria aalge* • European shag *Phalacrocorax aristotelis* • Herring gull *Larus argentatus* • Seabird assemblage	• Fishing and harvesting aquatic resources; • Outdoor sports and leisure activities, recreational activities; • Marine water pollution; • Invasive non-native species; • Other ecosystem modifications; • Interspecific faunal relations; • Inundation (natural processes); and • Changes in biotic conditions.	Yes (all species) – mobile bird species present throughout the year, likely foraging, preening or loafing in marine waters around the Marine Installation Corridor.	Included for all species.
Troup, Pennan and Lion's Heads SPA (Scotland)	30.93 km to the north west	• Razorbill *Alca torda* • Northern fulmar *Fulmarus glacialis* • Black-legged kittiwake *Rissa tridactyla* • Common guillemot *Uria aalge* • Herring gull *Larus argentatus* • Seabird assemblage	• Marine water pollution; • Interspecific faunal relations; • Invasive non-native species; • Other ecosystem modifications; • Fishing and harvesting aquatic resources; and • Changes in biotic conditions.	Yes (all species) – some of the qualifying bird species (present throughout the year) forage in the marine water column; some seabirds will utilise marine waters far from the SPA. With reference to Table 1, seabirds can travel very long distances to forage from their colonies. For example, kittiwake can routinely travel over 100 km to forage, while fulmar routinely forage over 500 km from their nest sites.	Included for all species.
Loch of Strathbeg SPA / Ramsar (Scotland)	14.30 km to the north	• Whooper swan *Cygnus Cygnus* • Barnacle goose *Branta leucopsis* • Pink-footed goose *Anser brachyrhynchus* • Waterfowl assemblage of international importance • Dune slack pool	• Tourism; • Recreation; • Fishing recreation/ sport; • Agriculture; • Sewage treatment/ disposal; and • Hunting recreational/ sport.	No (all species) – waterfowl and waders for which the SPA is designated do not forage out to sea. Therefore, given that species will not forage within the Marine Installation Corridor, this site can be excluded from the test of LSE	Excluded for all species.
Buchan Ness to Collieston Coast SAC (Scotland)	1.72 km to the south	• Vegetated sea cliffs of the Atlantic and Baltic Coasts	• Recreational pressure; and • Air quality.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
Ythan Estuary, Sands of Forvie and Meikle Loch SPA (Scotland)	8.04 km to the south	• [redacted] • Common tern *Sterna hirundo* • Pink-footed goose *Anser brachyrhynchus* • Sandwich tern *Sterna sandvicensis* • Waterfowl assemblage	• Fishing and harvesting aquatic resources; • Outdoor sports and leisure activities, recreational activities; • Invasive non-native species; • Interspecific floral relations; • Changes in abiotic conditions; and • Changes in biotic conditions.	No (species) – whilst the Marine Installation Corridor is within the potential foraging range for sandwich tern and common tern (Woodward et al. 2019), the Marine Installation Corridor is not within the core foraging area for either species (Scottish Natural Heritage, 2016). All other waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that the Marine Installation Corridor is either outside of foraging range for the majority of species or outside of the core foraging area for sandwich tern and common tern, this site can be excluded from the test of LSE.	Excluded for all species.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Ythan Estuary and Meikle Loch Ramsar (Scotland)	15.62 km to the south	• [redacted] • Common tern *Sterna hirundo* • Pink-footed goose *Anser brachyrhynchus* • Sandwich tern *Sterna sandvicensis* • Eider *Somateria mollissima* • Redshank *Tringa totanus* • Lapwing *Vanellus vanellus* Waterfowl assemblage	• Fishing and harvesting aquatic resources; • Outdoor sports and leisure activities, recreational activities; • Invasive non-native species; • Interspecific floral relations; • Changes in abiotic conditions; and • Changes in biotic conditions.	No (species) – whilst, the Marine Installation Corridor is within the potential foraging range for sandwich tern and common tern (Woodward et al. 2019), the Marine Installation Corridor is not within the core foraging area for either species (Scottish Natural Heritage, 2016). All other waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that the Marine Installation Corridor is either outside of foraging range for the majority of species or outside of the core foraging area for sandwich tern and common tern, this site can be excluded from the test of LSE.	Excluded for all species.
Sands of Forvie SAC (Scotland)	17.09 km to the south	• Embryonic shifting dunes • Shifting dunes along the shoreline with Ammophila arenaria • Decalcified fixed dunes • Humid dune slacks	• Air quality; • Excessive trampling; • Invasive non-native species; • Changes in abiotic conditions; and • Changes in biotic conditions.	No – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
River Dee SAC (Scotland)	37.75 km to the west	• Freshwater pearl mussel *Margaritifera margaritifera* • Atlantic salmon *Salmo salar* • Otter *Lutra lutra*	• Sediment displacement and increased turbidity; • Water pollution; • Changes in species distributions; and • Fisheries: Commercial marine and estuarine.	Yes (migratory species) – migratory salmon present within the SAC, likely also using marine waters on migration. Freshwater pearl mussel is dependent on salmon migration for part of its lifecycle. No (other species) - unlikely for otter to have an impact pathway to the Marine Scheme.	Included for Atlantic salmon and freshwater pearl mussel only.
Garron Point SAC (Scotland)	52.19 km to the west	• Narrow-mouthed whorl snail *Vertigo angustior*	• Water quality; and • Water levels.	No (species)– no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
River South Esk SAC (Scotland)	81.14 km to the west	• Atlantic salmon *Salmo salar* • Freshwater pearl mussel *Margaritifera margaritifera*	• Sediment displacement and increased turbidity; • Water pollution; • Changes in species distributions; and • Fisheries: Commercial marine and estuarine.	Yes (migratory species) – migratory salmon present within the SAC, likely also using marine waters on migration. Freshwater pearl mussel is dependent on salmon migration for part of its lifecycle.	Included for all species.
Montrose Basin SPA / Ramsar (Scotland)	76.64 km to the west	• Dunlin *Calidris alpina alpina* • Eider *Somateria mollissima* • Greylag goose *Anser anser* • Knot *Calidris canutus* • Oystercatcher *Haematopus ostralegus* • Pink-footed goose *Anser brachyrhynchus* • Redshank *Tringa tetanus* • Shelduck *Tadorna tadorna* • Waterfowl assemblage • Wigeon *Anas penelope*	• Fishing and harvesting aquatic resources; • Pollution; • Changes in abiotic conditions; and • Changes in biotic conditions.	No (all species) - All waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that species will not forage within the Marine Installation Corridor, this site can be excluded from the test of LSE.	Excluded for all species.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
River Tay SAC (Scotland)	>100 km to the west	• Atlantic salmon *Salmo salar* • Brook lamprey *Lampetra planeri* • Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels • Otter *Lutra lutra* • River lamprey *Lampetra fluviatilis* • Sea lamprey *Petromyzon marinus*	• Sediment displacement and increased turbidity; • Water pollution; • Invasive non-native species; • Changes in species distributions; and • Fisheries: Commercial marine and estuarine.	Yes (migratory species)- River lamprey, sea lamprey and Atlantic salmon are all sea-going species at some stage in their lifecycle. These species are mobile and migratory marine species that may pass through the area within the which the Marine Installation Corridor falls. No (non-migratory species) - Brook lamprey is a freshwater species, and not sea-going. No (other species) - unlikely impact pathway for otter to the Marine Scheme. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for migratory species only.
River Teith SAC (Scotland)	>100 km to the west	• Atlantic salmon *Salmo salar* • Brook lamprey *Lampetra planeri* • River lamprey *Lampetra fluviatilis* • Sea lamprey *Petromyzon marinus*	• Sediment displacement and increased turbidity; • Water pollution; • Invasive non-native species; • Changes in species distributions; and • Fisheries: Commercial marine and estuarine.	Yes (migratory species)- River lamprey, Sea lamprey and Atlantic salmon are all sea-going species at some stage in their lifecycle. These species are mobile and migratory marine species that may pass through the area within the which the Marine Installation Corridor falls. No (non-migratory species) - Brook lamprey is a freshwater species, and not sea-going.	Included for migratory species only.
Fowlsheugh SPA (Scotland)	53.54 km to the west	• Razorbill *Alca torda* • Northern fulmar *Fulmarus glacialis* • Black-legged kittiwake *Rissa tridactyla* • Common guillemot *Uria aalge* • Herring gull *Larus argentatus* • Seabird assemblage	• Interspecific faunal relations; • Invasive non-native species; • Marine water pollution; • Fishing and harvesting aquatic resources; and • Changes in biotic conditions.	Yes (all species) – some of the qualifying bird species (present throughout the year) forage in the marine water column; some seabirds will utilise marine waters far from the SPA. With reference to Table 1, seabirds can travel very long distances to forage from their colonies. For example, Kittiwake can routinely travel over 100 km to forage, while fulmar routinely forage over 500 km from their nest sites.	Included for all species.
Firth of Tay & Eden Estuary SAC (Scotland)	92.78 km to the west	• Estuaries • Subtidal sandbanks • Intertidal mudflats and sandflats • Harbour seal *Phoca vitulina*	• Recreational disturbance; • Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	No (species and habitats) – For harbour seals, a screening distance of 50 km is considered appropriate as this species forages close to their haul-out sites (Thompson, et al., 1998). Therefore, given the distance from the Marine Installation Corridor, this site can be excluded from the test of LSE.	Excluded for all species and habitats.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Outer Firth of Forth and St Andrews Bay Complex SPA (Scotland)	39.70 km to the west	• Red-throated diver *Gavia stellata* • Slavonian grebe *Podiceps auratus* • Common eider *Somateria mollissima* • Long-tailed duck *Clangula hyemalis* • Common scoter *Melanitta nigra* • Velvet scoter *Melanitta fusca* • Common goldeneye *Bucephala clangula* • Red-breasted merganser *Mergus serrator* • Waterfowl assemblage • Common tern *Sterna hirundo* • Arctic tern *Sterna paradisaea* • European shag *Phalacrocorax aristotelis* • Northern gannet *Morus bassanus* • Atlantic puffin *Fratercula arctica* • Black-legged kittiwake *Rissa tridactyla* • Manx shearwater *Puffinus puffinus* • Common guillemot *Uria aalge* • Razorbill *Alca torda* • Herring gull *Larus argentatus* • Little gull *Larus minutus* • Black-headed gull *Chroicocephalus ridibundus* • Common gull *Larus canus* • Seabird assemblage	• Recreational disturbance; • Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	No (all species) - The SPA is designated, in part, to protect the marine foraging areas of the seabird colonies associated with the Forth Islands SPA, as well as non-breeding assemblages of seabirds and waterbirds. The Marine Installation Corridor is a sufficient distance that there are no pathways to species occurring within marine foraging areas of the SPA. Breeding seabirds with extensive foraging ranges from their colonies are considered in the screening for the Forth Islands SPA. All waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, this site can be excluded from the test of LSE.	Excluded for all species.
Forth Islands SPA (Scotland)	86.29 km to the west	• Arctic tern *Sterna paradisaea* • Common tern *Sterna hirundo* • Cormorant *Phalacrocorax carbo* • Gannet *Morus bassanus* • Guillemot *Uria aalge* • Herring gull *Larus argentatus* • Kittiwake *Rissa tridactyla* • Lesser black-backed gull *Larus fuscus* • Puffin *Fratercula arctica* • Razorbill *Alca torda* • [redacted] • Sandwich tern *Sterna sandvicensis* • Seabird assemblage • Shag *Phalacrocorax aristotelis*	• Invasive non-native species; • Water pollution; • Outdoor sports and leisure activities, recreational activities; • Interspecific faunal relations; • Other ecosystem modifications; • Fisheries: Commercial marine and estuarine; • Changes in abiotic conditions; and • Changes in biotic conditions.	Yes (gannet, guillemot, herring gull, lesser black-backed gull, kittiwake, puffin, razorbill, shag) - these qualifying bird species (present throughout the year) forage in the marine water column; some seabirds will utilise marine waters far from the SPA. With reference to Table 1, seabirds can travel very long distances to forage from their colonies. For example, gannet, puffin and kittiwake can routinely travel 200 km to 500 km to forage depending on species. No (Arctic tern, common tern, cormorant, [redacted], sandwich tern) – the Marine Installation Corridor is beyond the maximum breeding season foraging distance for these species.	Included for gannet, guillemot, herring gull, lesser black-backed gull, kittiwake, puffin, razorbill, shag only.
Isle of May SAC (Scotland)	88.38 km to the west	• Reefs • Grey seal *Halichoerus grypus*	• Recreational disturbance; • Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	Yes (grey seal) – the seas around the scheme could constitute functionally-linked habitat for the grey seal feature of this SAC. No (reefs) - no impact pathway for reefs to the Marine Scheme.	Included for grey seal only.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
St Abb's Head to Fast Castle SPA (including its marine extension; Scotland)	69.55 km to the west	• Razorbill *Alca torda* • Common guillemot *Uria aalge* • Black-legged kittiwake *Rissa tridactyla* • Herring gull *Larus argentatus* • European shag *Phalacrocorax aristotelis* • Seabird assemblage	• Recreational disturbance; • Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	Yes (razorbill, guillemot, kittiwake, herring gull)– mobile bird species present throughout the year, likely foraging, preening or loafing in marine waters around the indicative alignment. With reference to Table 1, seabirds can travel very long distances to forage from their colonies. For example, Kittiwake can routinely travel over 100 km from their colonies to forage. No (shag) - the Marine Installation Corridor is beyond the maximum breeding season foraging distance for this species.	Included for razorbill, guillemot, kittiwake, herring gull only.
St Abb's Head to Fast Castle SAC (Scotland)	70.87 km to the south west	• Vegetated sea cliffs of the Atlantic & Baltic coasts	• Trampling damage; and • Air quality.	No (habitats) – no connection the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
Berwickshire and North Northumberland Coast SAC (Scotland / England)	36.43 km to the west	• Mudflats and sandflats not covered by seawater at low tide • Large shallow inlets and bays • Reefs • Submerged or partially submerged sea caves • Grey seal *Halichoerus grypus*	• Abrasion to reefs and other SAC habitats; • Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine.	Yes (species) – grey seal are mobile marine mammals that may use the marine waters around the Marine Scheme for foraging. JNCC advises that underwater noise can cause significant effects up to 50 km distant. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for grey seal only.
River Tweed SAC (Scotland / England)	67.13 km to the west	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • Atlantic salmon *Salmo salar* • Sea lamprey *Petromyzon marinus* • River lamprey *Lampetra fluviatilis* • Brook lamprey *Lampetra planeri* • Otter *Lutra lutra*	• Sediment displacement and increased turbidity; • Water pollution; • Changes in species distributions; and • Fisheries: Commercial marine and estuarine.	Yes (migratory species)- River lamprey, Sea lamprey and Atlantic salmon are all sea-going species at some stage in their lifecycle. These species are mobile and migratory marine species that may pass through the area within the which the Marine Installation Corridor falls. No (non-migratory species) - Brook lamprey is a freshwater species, and not sea-going. No (otter) - unlikely impact pathway for otter to the Marine Scheme. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for migratory species only.
Tweed Estuary SAC (England)	65.04 km to the west	• Estuaries • Mudflats and sandflats not covered by seawater at low tide • Sea lamprey *Petromyzon marinus* • River lamprey *Lampetra fluviatilis*	• Abrasion to reefs and other SAC habitats; • Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine	Yes (species) – lamprey are mobile and migratory marine species that may pass through the area within the which the Marine Installation Corridor falls. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for migratory species only.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Northumberland Marine SPA (England)	35.33 km to the west	• Arctic tern *Sterna paradisaea* • Common tern *Sterna hirundo* • Guillemot *Uria aalge* • [redacted] • Atlantic puffin *Fratercula arctica* • [redacted] • Sandwich tern *Sterna sandvicensis* • Seabird assemblage	• Recreational disturbance; • Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	No (all species) – The Northumberland Marine SPA protects the waters surrounding important breeding seabird colonies. The Marine Installation Corridor is a sufficient distance that there are no pathways to species occurring within marine foraging areas of the SPA. Breeding seabirds with extensive foraging ranges from their colonies are considered in the screening for the relevant SPAs supporting the host breeding colonies. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
Lindisfarne SPA / Ramsar (England)	55.26 km to the west	• Whooper swan *Cygnus cygnus* • Greylag goose *Anser anser* • Light-bellied brent goose *Branta bernicla hrota* • Common shelduck *Tadorna tadorna* • Eurasian wigeon *Anas penelope* • Common eider *Somateria mollissima* • Long-tailed duck *Clangula hyemalis* • Common scoter *Melanitta nigra* • Red-breasted merganser *Mergus serrator* • Ringed plover *Charadrius hiaticula* • Golden plover *Pluvialis apricaria* • Grey plover *Pluvialis squatarola* • Sanderling *Calidris alba* • Dunlin *Calidris alpina alpina* • Bar-tailed godwit *Limosa lapponica* • Common redshank *Tringa totanus* • [redacted] [redacted]	• Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine.	No (all species) – distance [redacted] All other waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
Northumbria Coast SPA / Ramsar (England)	50.41 km to the west	• Arctic tern *Sterna paradisaea* • [redacted] • Purple sandpiper *Calidris maritima* • Turnstone *Arenaria interpres*	• Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine.	No (all species) –Scheme.. (Arctic tern [redacted] the Marine Installation Corridor is beyond the maximum breeding season foraging distance for these species. All other waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
Durham Coast SAC (England)	52.76 km to the west	• Vegetated sea cliffs	• Air quality; and • Recreational trampling.	No (all habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Farne Islands SPA (England)	46.01 km to the west	• Arctic tern *Sterna paradisaea* • Common tern *Sterna hirundo* • Guillemot *Uria aalge* • [redacted] • Sandwich tern *Sterna sandvicensis* • Seabird assemblage	• Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine.	Yes (guillemot) - mobile bird species present throughout the year, forage in the marine water column; will utilise marine waters far from the SPA. Guillemot can travel very long distances to forage from their colonies (see Table 1). No (other species) - whilst the Marine Installation Corridor is within the potential foraging range for sandwich tern (Woodward et al. 2019), the Marine Installation Corridor is not within the core foraging area for the species, which was used to inform the boundaries of the Northumberland Marine SPA (Natural England, 2015). The Marine Installation Corridor is beyond the maximum breeding season foraging distance for all other species.	Included for guillemot only.
Coquet Island SPA (England)	54.49 km to the west	• Arctic tern *Sterna paradisaea* • Common tern *Sterna hirundo* • [redacted] • Sandwich tern *Sterna sandvicensis*	• Sediment displacement and increased turbidity; • Public access / disturbance; • Water pollution; • Changes in species distributions; • Coastal squeeze; • Transportation and service corridors; • Air pollution: Risk of atmospheric nitrogen deposition; and • Fisheries: Commercial marine and estuarine.	No (all species) - whilst the Marine Installation Corridor is within the potential foraging range for sandwich tern (Woodward et al. 2019), the Marine Installation Corridor is not within the core foraging area for the species, which was used to inform the boundaries of the Northumberland Marine SPA (Natural England, 2015). The Marine Installation Corridor is beyond the maximum breeding season foraging distance for all other species. Therefore, given that the Marine Installation Corridor is either outside of foraging range for the majority of species or outside of the core foraging area for sandwich tern, this site can be excluded from the test of LSE.	Excluded for all species.
Teesmouth and Cleveland Coast SPA/ Ramsar (England)	52.57 km to the west	• Pied avocet *Recurvirostra avosetta* • Red knot *Calidris canutus* • Ruff *Calidris pugnax* • Common redshank *Tringa totanus* • Sandwich tern *Sterna sandvicensis* • Common tern *Sterna hirundo* • [redacted] • Waterbird assemblage	• Physical modification; • Public; • Access/Disturbance; • Direct land take from development; • Fisheries: Commercial marine and estuarine; • Fisheries: Recreational marine and estuarine; and • Coastal squeeze.	No (all species) –Scheme. (Sandwich tern, common tern [redacted] the Marine Installation Corridor is beyond the maximum breeding season foraging distance for these species. All other waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
Southern North Sea SAC (England)	18.78 km to the east	• Harbour porpoise *Phocoena phocoena*	• Visual and noise disturbance; • Marine consents and permits; • Fisheries: Commercial marine and estuarine; and • Water pollution.	Yes – harbour porpoise are mobile cetaceans that may use the marine waters around the Marine Scheme.	Included for harbour porpoise.
Dogger Bank SAC (England)	68.92 km to the east	• Sandbanks which are slightly covered by sea water all the time	• Abrasion to sandbanks; • Sediment displacement and increased turbidity; and • Transportation and service corridors.	No – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
Beast Cliff Whitby SAC (England)	38.76 km to the west	• Vegetated sea cliffs	• Air pollution: Risk of atmospheric nitrogen deposition; and • Recreational trampling.	No – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Flamborough and Filey Coast SPA (England)	1.99 km to the north west	• Northern gannet *Morus bassanus* • Common guillemot *Uria aalge* • Black-legged kittiwake *Rissa tridactyla* • Razorbill *Alca torda* • Seabird assemblage	• Shipping lanes, ports, marine constructions; • Other human intrusions and disturbances; • Modification of cultivation practices; • Outdoor sports and leisure activities, recreational activities; • Invasive non-native species; • Discharges; • Structures, buildings in the landscape; • Collapse of terrain, landslide; • Cultivation; • Improved access to site; • Fishing and harvesting aquatic resources; and • Reduced fecundity/ genetic depression.	Yes (all species) – some of the qualifying bird species (present throughout the year) forage in the marine water column; some seabirds will utilise marine waters far from the SPA. For example, the identified core foraging area (hotspot) for the kittiwake population of this SPA extends up to 160 km from the SPA boundary at its greatest extent.	Included for all species.
Flamborough Head SAC (England)	0.12 km to the north west	• Reefs • Vegetated sea cliffs of the Atlantic and Baltic Coasts • Submerged or partially submerged sea caves	• Fishing and [redacted]arvesting aquatic resources; • Outdoor sports and leisure activities, recreational activities; • Invasive non-native species; and • Changes in biotic conditions.	Yes (reefs)– this SAC lies within the ZoI of potential impact to benthic habitats (specifically the reef habitats). No (vegetated cliffs and sea caves) - Unlikely pathway for vegetated sea cliffs of the Atlantic and Baltic Coasts or Submerged or partially submerged sea caves to the Marine Scheme.	Included for reefs only.
Greater Wash SPA (England)	3.42 km to the south	• Red-throated diver *Gavia stellata* • Little gull *Hydrocoloeus minutus* • Common scoter *Melanitta nigra* • Sandwich tern *Sterna sandvicensis* • [redacted] • Common tern *Sterna hirundo*	• Outdoor sports and leisure activities, recreational activities; • Shipping lanes, ports, marine constructions; • Fishing and harvesting aquatic resources; • Renewable abiotic energy use; and • Marine water pollution.	Yes (red-throated diver) – small numbers may occur within the Marine Installation Corridor. No (little gull, common scoter, sandwich tern, [redacted] common tern) - The Marine Installation Corridor does not represent key foraging areas for overwintering common scoter and little gull, and breeding sandwich tern, [redacted] common tern.	Included for red-throated diver only.
Thorne Moor SAC (England)	62.32 km from the marine installation corridor	• Degraded raised bogs still capable of natural regeneration	• Invasive non-native species; • Human induced changes in hydraulic conditions; • Other human intrusions and disturbances; • Air pollution, air-borne pollutants; and • Biocenotic evolution, succession.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
Thorne & Hatfield Moors SPA (England)	62.20 km from the marine installation corridor	• Nightjar *Caprimulgus europaeus*	• Other urbanisation, industrial and similar activities; and • Outdoor sports and leisure activities, recreational activities.	No (species) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
North York Moors SAC	37.57 km from the marine installation corridor	• Northern Atlantic wet heaths with *Erica tetralix* • European dry heaths • Blanket bogs	• Invasive non-native species; • Interspecific floral relations; • Air pollution, air-borne pollutants; • Fire and fire suppression; and • Changes in abiotic conditions.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
Humber Estuary SPA / Ramsar (England)	34.69 km to the south of the Marine Scheme	• Pied avocet *Recurvirostra avosetta* • Bittern *Botaurus stellaris* • Hen harrier *Circus cyaneus* • Golden plover *Pluvialis apricaria* • Bar-tailed godwit *Limosa lapponica* • Ruff *Philomachus pugnax* • Marsh harrier *Circus aeruginosus* • [redacted] • Shelduck *Tadorna tadorna* • Red knot *Calidris canutus* • Dunlin *Calidris alpina* • Black-tailed godwit *Limosa limosa* • Common redshank *Tringa totanus*	• Problematic native species; • Changes in abiotic conditions; • Changes in biotic conditions; • Abiotic (slow) natural processes; and • Outdoor sports and leisure activities, recreational activities.	No (all species) – it is unlikely the interest features will be affected given the distance from the Marine Scheme. All waterbirds for which the SPA is designated do not forage out to sea, at a distance where there would interact with the Marine Installation Corridor. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.
Humber Estuary SAC (England)	36.69 km to the south of the Marine Scheme	• Estuaries • Mudflats and sandflats not covered by seawater at low tide • Sandbanks which are slightly covered by sea water all the time • Coastal lagoons • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Embryonic shifting dunes • Shifting dunes along the shoreline with *Ammophila arenaria* • Fixed coastal dunes with herbaceous vegetation • Dunes with *Hippopha rhamnoides* • Sea lamprey *Petromyzon marinus* • River lamprey *Lampetra fluviatilis* • Grey seal *Halichoerus grypus*	• Water pollution; • Coastal squeeze; • Changes in species distributions; • Invasive species; • Natural changes to site conditions; • Public Pressure Access/Disturbance; • Fisheries: Fish stocking; • Fisheries: Commercial Pressure marine and estuarine; and • Direct land take from development.	Yes (all species)– this SAC is partly designated for mobile species (sea lamprey and grey seal) and the Marine Installation Corridor is in the same marine mammal Management Unit. No (habitats) – unlikely to be affected due to the distance to the Marine Installation Corridor.	Included for all species only.
Skipwith Common SAC	55.85 km from the marine installation corridor	• Northern Atlantic wet heaths with Erica tetralix • European dry heaths	• Air pollution, air-borne pollutants; • Human induced changes in hydraulic conditions; • Outdoor sports and leisure activities, recreational activities; and • Biocenotic evolution, succession.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
Inner Dowsing, Race Bank and North Ridge SAC (England)	84.57 km to the south	• Reefs • Sandbanks which are slightly covered by sea water all the time	• Exploration and extraction of oil or gas; • Renewable abiotic energy use; • Shipping lanes, ports, marine constructions; • Pollution to surface waters (limnic & terrestrial, marine & brackish); • Marine water pollution; • Fishing and harvesting aquatic resources; and • Mining and quarrying.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.

European site (Country)	Approx. distance from Marine Installation Corridor	Qualifying species/habitats	Threats and pressures to site integrity	Likely connection to impact pathways from Eastern Link Green 2	Included or Excluded for assessment (test of LSEs)
North Norfolk Sandbanks and Saturn Reef SAC (England)	>100 km to the south east	• Reefs • Sandbanks which are slightly covered by sea water all the time	• Fishing and harvesting aquatic resources; • Mining and quarrying; • Marine water pollution; • Shipping lanes, ports, marine constructions; and • Exploration and extraction of oil or gas.	No (habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all habitats.
River Derwent SAC (England)	400 m from the English Onshore Scheme 36.03 km from Marine Scheme	• Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation • River lamprey *Lampetra fluviatilis* • Sea lamprey *Petromyzon marinus* • Bullhead *Cottus gobio* • Otter *Lutra lutra*	• Physical modification; • Water pollution; • Invasive species; • Change in land management; and • Water abstraction.	Yes (sea lamprey) – the land route crosses the River Ouse which could disrupt movement of migratory sea lamprey. No (other species and habitats) - no connection to the Marine Scheme.	Included for sea lamprey only.
Lower Derwent Valley SAC (England)	54.50 km	• Lowland hay meadows *Alopecurus pratensis*, *Sanguisorba officinalis* • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*); Alder woodland on floodplains • Otter *Lutra lutra*	• Air pollution, air-borne pollutants; • Biocenotic evolution, succession; • Grazing; • Invasive non-native species; and • Outdoor sports and leisure activities, recreational activities	No (species and habitats) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species and habitats.
Lower Derwent Valley SPA / Ramsar (England)	44.87 km	• Bewick's swan *Cygnus columbianus bewickii* (Non-breeding) • Eurasian wigeon *Anas penelope* (Non-breeding) • Eurasian teal *Anas crecca* (Non-breeding) • Northern shoveler *Anas clypeata* (Breeding) • European golden plover *Pluvialis apricaria* (Non-breeding) • Ruff *Philomachus pugnax* (Non-breeding) • Waterbird assemblage	• Water diversion for irrigation / domestic / industrial use; and • Reservoir / barrage / dam impact: flooding	No (all species) – no connection to the Marine Scheme. Therefore, given that there is no connection to the Marine Scheme, this site can be excluded from the test of LSE.	Excluded for all species.

8.2.4.3 In-combination Scope

It is a requirement of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended), Regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and Regulation 28 of The Conservation of Offshore Marine Habitats and Species Regulations 2017, to not only assess the impacts of a development project alone, but also to investigate whether there might be 'in-combination' effects with other projects or plans. In practice, such an 'in-combination' assessment is of greatest relevance when an impact pathway relating to a project would otherwise be screened out because it is considered not to result in LSEs.

EAR Volume 2 Chapter 16: Cumulative and In-combination Effects identified the following projects to have potential in-combination effects with the Marine Scheme:

- Green Volt Floating Offshore Wind Farm Export Cable;
- ScotWind Proposed Site Area / Option Agreement 6;
- ScotWind Proposed Site Area / Option Agreement 1;
- Seagreen 1A (Bravo) Offshore Wind Farm;
- Berwick Bank Offshore Wind Farm;
- Dogger Bank C / Sofia Export Cables;
- Northern Endurance Carbon Dioxide Pipelines (Teesside and Humber); and
- Hornsea Project Four (HOW04) Offshore Wind Site Export Cable.

The appraisal of in-combination effects resulting from the Marine Scheme and those projects identified in EAR Volume 2 Chapter 16: Cumulative and In-Combination Effects, all ranged from Negligible to Minor effects, which are not significant.

This HRA Report assess the in-combination effects within the context of potential for significant effects on European Sites.

8.2.5 Test of Likely Significant Effects

8.2.5.1 Introduction

This first stage of the HRA is essentially a high-level risk assessment to decide whether an Appropriate Assessment is required. It provides an overview of the potential impacts and effects, that may occur during Marine Scheme project phases, and associated ZoIs. The essential question is:

> *Is the project, either alone or in combination with other relevant projects and plans, likely to result in a significant effect upon any European site?*

European designated sites considered within this section are those with qualifying features that fall within or utilise the area within (i.e., foraging ranges/ migration) the ZoI of Project related activities, for which LSE could not be ruled out.

8.2.5.2 Impact Pathways

Table 5 provides an overview of the most likely impact pathways associated with the Installation and Operation and Maintenance Phases of the Marine Scheme. The HRA Report has been informed by other recent development and consenting data, as required, as well as published academic research articles (e.g., see Taormina et al., 2018 for a thorough review of the ecological effects of submarine power cables[3]). A Test of LSEs by impact pathway for each European site will be discussed further in the sections below.

[3] Taormina B., Bald J., Want A., Thouzeau G., Lejart M., Desroy N. & Carlier A. (2018). A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. *Renewable and Sustainable Energy Reviews* 96: 380-391.

Table 5: Likely impact pathways associated with the Installation and Operation and Maintenance Phases of the Marine Scheme

Stage of Development	Impact Pathways	Details	Zone of Influence (ZoI)	Potentially Affected European Sites
Installation	Temporary disturbance of seabed habitats.	There will be direct temporary habitat loss along the 436 km of the Marine Installation Corridor, although this effect will not occur along the entire stretch of the cable length at the same time, the actual disturbance will be localised. Full details are presented in EAR Volume 2 Chapter 2: Project Description.	106.0 km of boulder clearance plough (25 m swathe) and 340.0 km of mechanical trenching (15 m swathe). This gives a total footprint of 7.6 km^2 per cable, which is 15.2 km^2 for separate lay.	Buchan Ness to Collieston Coast SPA – Indirect impact in relation to temporary disturbance or potential loss of habitat for ornithological prey species
	Vessel presence and visual disturbance to birds	Regardless of the installation method used, airborne sound and visual disturbance will occur within Buchan Ness to Collieston Coast SPA and others that are functionally linked to noise (see final column).	For most seabirds, airborne sound and visual disturbance can displace birds at up to 2 km from the development; divers and seaducks are more sensitive, with displacement at up to 4 km (See EAR Volume 2 Chapter 11: Ornithology).	Buchan Ness to Collieston Coast SPA Troup, Pennan and Lion's Heads SPA Fowlsheugh SPA Forth Islands SPA St Abb's Head to Fast Castle SPA Farne Islands SPA Flamborough and Filey Coast SPA Greater Wash SPA
	Disturbance to marine mammals and fish from underwater sound	Sound disturbance from submarine cable installations is significantly lower than from other anthropogenic sources (impact piling or explosions). Notwithstanding this, any noise impacts will require detailed consideration.	Maximum effective deterrence (disturbance) range of 5 km for marine mammals. Disturbance to fish from sound sources generated by project activities to a maximum estimated distance of 1 km (based on Popper et al., 2014 thresholds). Project based calculations identify the distance at which the injury and behavioural disturbance threshold is met is 46 m and 54 m respectively. See EAR Volume 2 Chapter 9: Fish and Shellfish Ecology and Chapter 10: Marine Mammals for further details.	Moray Firth SAC River Dee SAC River South Esk SAC River Tay SAC River Teith SAC Firth of Tay & Eden Estuary SAC Isle of May SAC Berwickshire and North Northumberland Coast SAC River Tweed SAC Tweed Estuary SAC Southern North Sea SAC Humber Estuary SAC River Derwent SAC

Stage of Development	Impact Pathways	Details	Zone of Influence (ZoI)	Potentially Affected European Sites
	Vessel Presence (including collision risk and disturbance)	The installation of the Marine Scheme will involve the deployment of a number of vessels including survey vessels, cable laying vessels, guard vessels, rock placement vessel, and additional specialised support vessels such as a jack up barge and dive support vessels for the works at the HDD breakout point in the nearshore. See EAR Volume 2 Chapter 2: Project Description. Larger marine mammals, such as whales, are typically considered most at risk of vessel collision, but a recent review indicated that many other species, including smaller mammals like dolphins, porpoises, and seals may also be at risk.	Whilst the ZoI is expected to be <1 m for collisions, marine mammals are mobile qualifying features and may be present in the vicinity of the installation corridor and hence within the ZoI.	Southern North Sea (England) Berwickshire and North Northumberland Coast (Scotland and England) Humber Estuary Isle of May (Scotland) Moray Firth (Scotland)
	Increased SSC and sediment deposition	Depending on the nature of the seabed, sediment disturbance through ploughing and/or jet trenching can lead to sediment plumes, which persist between several hours to days. While this effect may impede predators that hunt visually (e.g., seabirds and marine mammals), such effects are likely to be localised and transient.	1.5 km is expected to be the maximum distance at which increased SSC are likely to have a LSE. Coarse sand is likely to travel no more than 200 m. Fine sands and silts will however, likely to be transported beyond the Marine Installation Corridor with any fine sand settling on the seabed up to 1.5 km from the point where it is mobilised. Full details are presented in EAR Volume 2 Chapter 7: Physical Environment.	Flamborough Head SAC

Stage of Development	Impact Pathways	Details	Zone of Influence (ZoI)	Potentially Affected European Sites
	Water quality	During construction there is a risk of resuspension of contaminants (e.g., heavy metals, hydrocarbons) into the surrounding water column. HDD uses drilling fluid to suspend rock cuttings and carry them out of the borehole. The drilling fluid used will be biologically inert and selected from the Centre for Environment, Fisheries, and Aquaculture Science (Cefas) approved list of drilling fluids to ensure no harmful effect on the surrounding environment. Furthermore, there is a potential for ships and hydraulic equipment to result in accidental oil leakages / spillages during cable laying.	Footprint of the proposed works plus 1.5 km buffer for all sediment and contaminant resuspension; based on professional judgement and consideration of worst-case for fine particulates (Chapter 7: Physical Environment). Any accidental spillages will also be limited in extent and therefore the ZoI is considered sufficiently applicable. Noting that many seabirds have large breeding season foraging ranges (refer to Table 1), individuals from more distance designated sites may occur in the ZoI.	Buchan Ness to Collieston Coast SPA Troup, Pennan and Lion's Heads SPA Fowlsheugh SPA Forth Islands SPA St Abb's Head to Fast Castle SPA Farne Islands SPA Flamborough and Filey Coast SPA Greater Wash SPA Flamborough Head SAC Southern North Sea SAC Berwickshire and North Northumberland Coast SAC Humber Estuary SAC Isle of May SAC Moray Firth SAC
	Changes in prey availability	With reference to Chapter 2: Project Description and Chapter 11: Ornithology, various activities associated with the Installation Phase of the Marine Scheme may result in disturbance and displacement of prey items such as disturbance to seabed and/or water quality resulting in changes in prey availability for ornithological receptors in offshore waters.	Footprint of the proposed works plus 1.5 km buffer for all sediment and contaminant resuspension. Disturbance to fish species from underwater noise will not be greater than this. Noting that many seabirds have large breeding season foraging ranges (refer to Table 1), individuals from more distance designated sites may occur in the ZoI.	Buchan Ness to Collieston Coast SPA Troup, Pennan and Lion's Heads SPA Fowlsheugh SPA Forth Islands SPA St Abb's Head to Fast Castle SPA Farne Islands SPA Flamborough and Filey Coast SPA Greater Wash SPA

Stage of Development	Impact Pathways	Details	Zone of Influence (ZoI)	Potentially Affected European Sites
Operation and Maintenance	Permanent loss of seabed habitats.	Permanent loss of benthic habitat as a result of rock placement, which will be required in locations where the minimum depth of lowering cannot be achieved and at cable crossings and at the landfalls in the form of breakout protection. Full details are presented in EAR Volume 2 Chapter 2: Project Description.	Remedial and planned rock berm up to 138 km totalling approximately 1 km^2 per cable or 2 km^2 for separate lay. Crossings: 6 x pipeline crossings with an approximate footprint of 4,750 m^2 each 18 x cable crossings with an approximate footprint of at 4,100 m^2 each Totalling approximately 0.1 km^2 per cable or 0.2 km^2 if separate lay. Rock protection at landfalls: 0.01 km^2 per landfall, 0.02 km^2 total (same for separate lay/bundled cables).	Buchan Ness to Collieston Coast SPA – Indirect impact in relation to potential loss of habitat for ornithological prey species
	Electromagnetic field (EMF) impacts	EMF effects are of potential concern regarding diadromous fish. For example, magnetic fields have been observed to reduce swimming speed in European eel *Anguilla anguilla* in some circumstances (Orpwood, Fryer, Rycroft, & Armstrong, 2015).	For the separated cables, the magnetic field resulted in a combined field slightly above the background level at 20 m from the cable.	River Dee SAC River South Esk SAC River Tay SAC River Teith SAC River Tweed SAC Tweed Estuary SAC Humber Estuary SAC
	Inspection/repair activities	Surveys will be undertaken to monitor the condition of the cables - methods are anticipated to include ROV and geophysical survey techniques. Surveys may identify the need for preventative maintenance to increase the external protection. Repairs to submarine cables that have been designed, manufactured, installed, and protected correctly are not common.	As per impact pathways for Installation Phase.	

8.2.5.3 Installation Phase

Temporary Habitat Disturbance

There are Installation Phase activities that will temporarily disturb seabed habitats, resulting in short term physical disturbance to, and/or loss of seabed habitats, and in some instances physical damage. These activities include cable route clearance, burial trenching trials, and cable installation.

The dominant habitat types along the Marine Installation Corridor are muddy sand, coarse sediment, rippled sand, and mixed sediments influenced by changes in water depth (see EAR Volume 2 Chapter 8: Benthic Ecology). Areas of low to medium resemblance stony reef were identified at the nearshore Scottish landfall (KP0.5 to KP1.4), within Buchan Ness to Collieston Coast SPA, but it should be noted that this is not a qualifying feature of the site.

Communities associated with sandy sediment, particularly in shallow waters where there may be disturbance of the seabed from waves and tides, are expected to be relatively tolerant of disturbance. As sediments are displaced there may be some direct mortality for the larger and less mobile benthic species but for many animals, displacement will be temporary, and fauna will be able to redistribute within the sediment as needed once the cable lay vessels have moved away. Recovery is expected to be relatively rapid.

The Buchan Ness to Collieston Coast SPA is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the site in the nearby waters, as well as travelling further afield. The Marine Installation Corridor runs through this SPA for approximately 2.3 km and accounts for an area that is equivalent to 2.1% of the total SPA. This site has no benthic qualifying features, and such there are no direct effects on the conservation of the site. However, it is acknowledged that this SPA is designated in part for its importance as a foraging ground for the seabirds breeding within the SPA, hence habitat disturbance has the potential to indirectly affect the qualifying bird features of the site through changes in prey species availability.

As per EAR Volume 2 Chapter 8: Benthic Ecology and Chapter 9: Fish and Shellfish of the EAR, it has been concluded that the impact to benthic ecology and fish from disturbance of subtidal benthic habitats and species is not significant. Thus, is it considered that there will not be any LSE to the potential availability of prey items for the designated features of Buchan Ness to Collieston Coast SPA will be impacted.

Buchan Ness to Collieston Coast SPA can therefore be **screened out** from Appropriate Assessment for temporary habitat disturbance.

Vessel Presence and Visual Disturbance to Birds

The various activities associated with the Installation Phase of the Marine Scheme may result in disturbance and displacement of ornithological receptors. These are described in EAR Volume 2 Chapter 11: Ornithology. Details of potential vessel resources required for the cable installation at both landfalls and also for route preparation activities prior to cable laying, are provided in EAR Volume 2 Chapter 2: Project Description.

The vessel / vessels may move relatively slowly depending on the seabed type encountered, at speeds of between 0.5 km and 5 km per day, appearing effectively stationary.

Between five and ten cable laying campaigns are anticipated, which will consist of vessels being present across a five-year installation period. There may be three months between installation campaigns, and campaigns will avoid the winter months.

The degree of impact that varying levels of noise will have on different species of bird is relatively poorly understood. Research published by the Institute of Estuarine & Coastal Studies in 2013, summarises the key evidence base relating to this impact pathway[4]. Based on the observed responses of waterbirds to noise stimuli, an acceptable receptor dose (i.e., maximum noise level at the bird) of ‘below 70 dB’ has been identified in discussion with Natural England on schemes in England. On other projects, the change in the noise levels experienced by birds, rather than an absolute noise threshold, is used as an

[4] The University’s research is available at the following link: http://bailey.persona-pi.com/Public-Inquiries/M4%20-%20Revised/11.3.67.pdf.

alternative means of impact assessment. There are no formal guidelines for a change threshold (compared to the measured baseline) that is disturbing to waterfowl and waders, and seabirds but they are known to have hearing comparable to humans. For humans, a change of 3 dB is barely perceptible, while a change of 10 dB at the receptor is a doubling in perceived loudness. It is therefore reasonable to assume that an increase of more than 10 dB would run a high risk of causing adverse impacts to bird behaviour, such as flushing, for the duration of exposure.

Disturbance can lead to a number of physiological and behavioural responses which can affect demographic characters of the bird population. Responses to disturbance can result in loss of energy, impaired breeding, unrest through increased vigilance, disruption to incubation, and increased nest failures due to predation and nest abandonment (Valente & Fisher, 2011).

The extent to which seabirds respond to disturbance is dependent upon a number of factors including: period of breeding cycle during which disturbance occurs; duration, type and intensity of the disturbance (e.g. onshore works are likely to be more disruptive to seabirds than the offshore works due to the generation of loud noises and use of machinery); presence of opportunistic predators; and the degree of habituation with the disturbance (Showler, Stewart, & Pullin, 2010). Some seabirds are more resilient to disturbance and/or displacement than others with varying responses depending upon marine activity (MMO, 2018).

Within the marine environment, the evidence base around disturbance and displacement, and subsequent guidance, has been established in relation to assessing the vulnerability of seabird populations to offshore wind farms. However, the disturbance profile of Installation Phase activities for the Marine Scheme are significantly different to that of an Offshore Wind Farm (OWF), particularly in terms of vessel numbers and presence in a given area, i.e., installation vessels will be moving through the Marine Installation Corridor and not within a fixed area. The nature of the works is also temporary and there will be no permanent infrastructure on the sea surface after works are completed, i.e., turbines. With OWFs the potential for construction activities associated with export cable laying, namely the physical presence of the CLV(s), to lead to disturbance and displacement of more sensitive species surrounding the CLV is only considered where the export cable corridor runs through offshore areas that support higher densities of the more sensitive seabird species, typically within or surrounding SPAs, so this impact pathway is not regularly included within OWF EIAs.

For most seabirds, the construction and operation of an OWF can displace birds at up to 2 km from the development, with divers and seaduck more sensitive, with displacement reported at up to 4 km (Furness and Wade (2012), Bradbury (2014) (Joint Natural England & JNCC, 2017)).

For Hornsea Four OWF, where the export cable corridor runs to the north of the Greater Wash SPA (and 200 m south of the Marine Installation Corridor), a 2 km buffer surrounding the cable laying vessel was agreed with Natural England for the purpose of assessing the potential impact of displacement on red-throated diver (Orsted, 2021). Other OWF projects such as Neart na Gaoithe have used a 1 km buffer for construction activities across the wind farm and the export cable corridor.

Given, that the Marine Installation Corridor traverses 2.3 km of the Buchan Ness to Collieston Coast SPA, there is a potential impact pathway for vessel presence and visual disturbance to result in LSE to qualifying bird features of the Buchan Ness to Collieston Coast SPA. Therefore, vessel presence and visual disturbance to seabirds **cannot be screened out** from **Buchan Ness to Collieston Coast SPA** and this SPA is taken forward for Appropriate Assessment.

For the Marine Scheme disturbance from installation vessels will be less than from OWF disturbance for the reasons outlined above, and a 1 km buffer ZoI therefore represents a worst-case scenario for disturbance through visual and audible cues and any resulting displacement of bird species from the Marine Installation Corridor during the Installation Phase. The seabirds associated with the designated sites set out in Table 4 show varying degrees of sensitivity to disturbance and displacement, with shag having the highest sensitivity, auks moderate sensitivity and gulls and gannet low sensitivity.

During the cable installation, there will be several vessels present within the marine environment, as detailed in EAR Volume 2 Chapter 2: Project Description. Vessels have the potential to cause disturbance to seabirds utilising the waters near the installation activities. As identified, different species have different sensitivities associated with visual disturbance due to the presence of vessels. Species

that may be more prone to vessel disturbance are guillemot, razorbill, red-throated diver and shag. The mean maximum foraging distances for these species mean these qualifying species are likely to be present along the Marine Installation Corridor both within and outside of their respective designated sites.

The Marine Scheme's installation vessels will be slow moving, and any potential disturbance will take place in the context of existing sources of disturbance such as fishing vessels, commercial shipping, recreational boating and wind farm service vehicles. As detailed in EAR Volume 2 Chapter 13: Shipping and Navigation, the Marine Installation Corridor, particularly at landfall locations, is a busy area for shipping activity and recreational use, with this part of the North Sea busy with fishing vessels, cargo vessels and increasingly, vessels associated with the offshore renewables industry. Whilst sensitive species such as guillemot and razorbill may be present, they will be occurring against a background of existing vessel presence and shipping activity. The installation vessels generate similar levels of noise to other large marine vessels and the context of the existing environment should be taken into consideration. The installation vessels will not comprise a substantive change from the baseline conditions. Seabirds tend to raft together in groups on the sea, which means that if a vessel passes through or close to a raft, it has the potential to disturb and displace many individuals at once. The effect of the vessel's presence would be disturbance of potential foraging or resting habitat on the sea, causing the birds to move elsewhere, which may result in birds having less time to forage and cause them to expend additional energy. However, effects on energy budgets are extremely unlikely to result in population dynamic effects (i.e., increased adult mortality or effects on reproduction). Given the localised area of disturbance and wider area available, if birds are present, they are likely to find alternative feeding/loafing grounds in the short term.

It is concluded that any disturbance would be minimal compared with the background level of vessel disturbance (see EAR Volume 2 Chapter 13: Shipping and Navigation), and temporary in nature.

Therefore, LSE are considered unlikely to occur, given the following:

- Low numbers of loafing or foraging seabirds are likely to be present within the Marine Installation Corridor and the Marine Scheme's ZoI, and furthermore, much of the Marine Installation Corridor does not represent key foraging areas for seabirds;
- Cable installation works will be temporary and transient in nature;
- Breeding colonies are at a considerable distance from the landfall areas, particularly in the context of existing baseline activities along the Marine Installation Corridor; and
- The generally low sensitivities of the species present to the methods as described in EAR Volume 2 Chapter 2: Project Description.

Noise and visual disturbance to seabirds associated with **Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA, Farne Islands SPA, Flamborough and Filey Coast SPA and Greater Wash SPA can be screened out** from Appropriate Assessment.

Disturbance to Marine Mammals and Fish from Underwater Sound

The sound characteristics of the Marine Scheme activities have been determined on the basis of equipment specifications and literature values (Table 6). Where a range of sound source levels was found in the literature a reasonable but realistic worst-case level has been assumed.

A number of the sound sources, as shown in Table 6, can be screened out of the appraisal either directly on the basis of their inherent acoustic characteristics or have such low sound source intensity that they are effectively masked by, and so can be appraised with, sound from other elements of the Installation Phase activities (EAR Volume 2 Chapter 9: Fish and Shellfish and Chapter 10: Marine Mammals). The only activities associated with the Marine Scheme that are within hearing range of marine mammals and have the potential to have LSEs, are the operation of the Ultra Short Base Line (USBL)[5] and the

[5] USBL, or Ultra Short Base Line, is a method of underwater acoustic positioning which is used to track the operation of subsea equipment and vehicles.

Sub-bottom Profiler (SBP), with only SBP potentially having adverse effects on fish (Chapter 9: Fish and Shellfish).

Table 6: Characteristics of underwater sound sources generated by the Marine Scheme Installation Phase

Survey or cable installation activity	Operating Frequency (kHz)	Sound Pressure Level# (dB re 1µPa@1m)	Sound Source Data Reference	Screened into appraisal?
Swathe or multi-beam echo sounder (MBES)	170 - 450	221 235 (peak)	Genesis Oil and Gas Consultants, 2011	×
Side scan sonar (SSS) (e.g., EdgeTech 4200 Series)	300 - 600	210 - 226	Genesis (2011) and equipment specification sheet	×
Sub-bottom profiling (SBP) (e.g., Innomar SES-2000, Edgetech Chirp & Applied Acoustics 201 boomer)	0.5 – 12	238 (peak)	Equipment specification sheets	✓
USBL (e.g., Kongsberg HiPAP 502)	21 - 31	207 (peak)	Equipment specification sheet	✓ (Marine Mammals Only)
Cable installation (e.g., jet trenching, mechanical trenching)	1 - 15	178	(Nedwell, Langworthy, & Howell, 2003); Nedwell et al., (2008); Hale (2018)	×
Rock placement.	n/a	~172	Vessel Rollingstone (Orsted, 2019)	×
HDD (e.g., break-out)	n/a	129.5	Nedwell et al. (2012)	×
Cable lay vessel (~140 m in length operating with DP)	0.005 - 3.2	180 - 197	Ross (1993) AT&T (2008)	×
Project support vessels including medium (50 m to 100 m) and small (<50) boats	Low to high frequency	160 – 180	Genesis (2011) Richardson *et al.*(1995) OSPAR commission (2009)	×

The dual-metric modelling approach has been used to identify LSEs based on the peak sound pressure level (SPL_{peak}) and the cumulative sound exposure level (SEL_{cum}) provided in Table 7.

Table 7: Maximum estimated distance (m) from USBL and SBP at which the sound level will exceed the SPL_{peak} and SEL_{cum} PTS injury threshold

Acoustic source	Sound Source Level (SPL_{peak})	LF Cetaceans		HF Cetaceans		VHF Cetaceans		Phocids in Water	
		SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}	SPL_{peak}	SEL_{cum}
USBL	207 dB	<10	<10	<10	<10	<10	<10	<10	<10
SBP	238 dB	18	116	<10	<10	251	138	22	62

There are no widely agreed quantitative thresholds for behavioural disturbance, reflecting both a lack of empirical evidence and a high level of variability in behavioural responses, which are often unrelated to the sound level received (Gomez, et al., 2016) (Southall, et al., 2021). Nevertheless, a threshold of 160 dB SPL_{rms} is still adopted by NOAA in relation to behavioural disturbance from impulsive sounds[6].

The closest seal haul-out location to the Marine Installation Corridor is the Ythan Estuary (grey seal), 25 km to the south of the Scottish landfall, significantly beyond any potential ZoI. However, grey seals in particular forage over extensive distances and so there may be individuals in the vicinity of the Marine Installation Corridor. Injury distances from SBP for seals, is up to 62 m and therefore cannot be ruled out without appropriate mitigation. Any disturbance to grey seals would be short-term, temporary and limited to very few individuals. However, underwater sound injury and /or disturbance to grey seals **cannot be screened out** from **Isle of May SAC, Berwickshire and North Northumberland Coast SAC** and **Humber Estuary SAC** and these sites are therefore taken forward for Appropriate Assessment.

The Moray Firth, in north east Scotland, supports the only known resident population of bottlenose dolphin *Tursiops truncatus* in the North Sea. The range of this population has extended southwards since the designation of the SAC, with the population now found as far south as the Firth of Forth and Berwick-upon-Tweed (Hague, Sinclair, & Sparling, 2020; ArsoCivil, et al., 2021). The Firth of Tay and Tay Estuary, and St Andrews Bay have been identified as particularly important areas for bottlenose dolphins from the Moray Firth SAC. However, these areas are over 50 km from the Marine Scheme. Whilst it is possible that a small number of bottlenose dolphin could transiting through the coastal waters around the approach to the Scottish landfall, the area itself is not known as a being important foraging grounds for the species, and the density is not expected to be high (potential disturbance to 0 - 0.03 individuals / km^2 within an assumed 5 km of the geophysical survey, EAR Volume 2 Chapter 10: Marine Mammals Table 10-14) and injury distances for both SBP and USBL is <10 m. This 5 km disturbance range is not likely to affect bottlenose dolphins' ability to transit between the Moray Firth, and the Firths of Tay/Forth. Therefore, the risk of injury and injury and / or disturbance is negligible and not anticipated to have LSE on the population of bottlenose dolphin protected by the Moray Firth SAC both inside and outside its boundary. Thus, underwater sound injury to bottlenose dolphin **can be screened out** from Appropriate Assessment for the **Moray Firth SAC**.

Harbour porpoise, the most abundant marine mammal species in the North Sea and are anticipated to be present across the Marine Installation Corridor in low densities (see EAR Volume 2 Chapter 10: Marine Mammals). Sound propagation calculations indicate injury is possible in harbour porpoise, albeit in low numbers. Injury distances from SBP for harbour porpoise is up to 251 m and therefore cannot be ruled out without appropriate mitigation. An effective deterrent range (EDR) of 5 km recommended by JNCC (2020) for disturbance from geophysical surveys. Approximately 0.152 - 0.888 individuals / km^2 within an assumed 5 km of the geophysical survey have the potential to be disturbed (EAR Volume 2 Chapter 10: Marine Mammals Table 10-14). Given the distance of 18.78 km from the Marine Installation Corridor, underwater sound disturbance to harbour porpoise **cannot be screened out** from the **Southern North Sea SAC** for Appropriate Assessment.

Atlantic salmon, a feature of the River Dee SAC, River South Esk SAC, River Tay SAC, and River Teith SAC, are medium hearing sensitivity fish – species with swim bladders in which hearing does not involve the swim bladder or other gas volume. They are susceptible to barotrauma, although hearing only involves particle motion, not sound pressure.

Other Annex II species present as a feature for site selection of the River Tay SAC, River Teith SAC, River Tweed SAC, Tweed Estuary SAC, Humber Estuary SAC, and River Derwent SAC are sea lamprey and river lamprey. Lamprey are considered to have low hearing sensitivity. They have no swim bladder or other gas chamber and are therefore less susceptible to barotrauma and disturbance.

LSEs to fish from most of the sound generating activities associated with the Marine Scheme were scoped out of the assessment, either because the frequency of the sound source is outside the hearing range of fish (multibeam echosounder, side scan sonar and USBL acoustic positioning) or the sound intensity is either within or is similar to background levels for the North Sea (HDD drilling, cable laying,

[6] See: https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/esa-section-7-consultation-tools-marine-mammals-west

rock placement and vessel movements). However, the operating frequency for SBP is within the hearing range of fish. The appraisal as described in EAR Volume 2 Chapter 9: Fish and Shellfish indicates the distance at which the injury and behavioural disturbance threshold is met is 46 m and 54 m respectively.

There may be some minor avoidance behaviour, but the vessels will be continuously moving and so the impact zone will also be transient, and any effects would be temporary in nature. As soon as the vessel has moved away normal activity can resume. Thus, the risk of behavioural responses is low for Atlantic salmon, and particularly for lamprey which have lower sensitivity due to the absence of a swim bladder. It is not considered likely that any SBP operations during migratory seasons will present a barrier to movement for diadromous fish or affect the fitness of any individual which may pass through the installation corridor while activities are ongoing. Therefore, underwater sound disturbance to Atlantic salmon, river lamprey, and sea lamprey **can be screened out** from Appropriate Assessment for the **River Dee SAC, the River South Esk SAC, the River Tay SAC, the River Teith SAC, the Tweed Estuary SAC, the Humber Estuary SAC and the River Derwent SAC**. Furthermore, as no LSEs are predicted for salmon, no LSEs are also predicted for freshwater pearl mussels as the only linkage is salmon as a vector.

Vessel Presence (including Collision Risk and Disturbance)

The Installation Phase activities of the Marine Scheme will involve the deployment of a number of vessels including survey vessels, cable laying vessels, guard vessels, rock placement vessel, and additional specialised support vessels such as a jack up barge and dive support vessels for the works at the HDD breakout point in the nearshore as described in EAR Volume 2 Chapter 2: Project Description. However, it is not anticipated that there will be any substantive change from baseline vessel activity in the Marine Installation Corridor (see EAR Volume 2 Chapter 13: Shipping and Navigation). This notwithstanding the Scottish Marine Wildlife Wating Code (an embedded mitigation as described in EAR Volume 2 Chapter 2: Project Description) will be adhered to as a matter of best practice.

The Marine Installation Corridor does not route through any European Sites where marine mammals are qualifying features. However, given their mobile and wide-ranging nature, marine mammals may still be present in the vicinity of the Marine Installation Corridor and hence within the Marine Scheme's ZoI (<1 m for collisions).

Although the occurrence of any collisions could cause injury or death, the likelihood of vessel collision with marine mammals in the Marine Installation Corridor is considered unlikely given the manoeuvrability of marine mammals, the slow vessel operation speeds, and adherence to the Scottish Marine Wildlife Watching Code. As such, the SACs with marine mammal qualifying features are not anticipated to be subjected to LSEs. Therefore, vessel presence (including collusion risk and disturbance) **can be screened out** from Appropriate Assessment for the **Southern North Sea SAC, Berwickshire and North Northumberland Coast SAC, Humber Estuary SAC, Isle of May SAC and Moray Firth SAC.**

Increased SSC and Sediment Deposition

No dredging and disposal activities are included within the Marine Scheme and the trenching of the cable is predicted to create the most sediment disturbance. The largest sediment plumes and highest levels of SSC will be associated with the locations in which installation and trenching of the cable are planned to take place in sediments with the highest proportion of fine particulate material, i.e., muds and clays, that will remain in suspension and settle to the seabed slowly, although they will also be subject to dilution over the period of time they remain in suspension.

The distance travelled before deposition by suspended coarse sand is expected to be around 240 m. Fine sands and silts may however be transported beyond the Marine Installation Corridor with any fine sand settling on the seabed up to 1.5 km from the point where it is mobilised. Based on the calculated settling velocities any silt-sized material may remain in suspension for several days and may therefore travel further distances. However, given that dispersion processes will also act to dilute the concentration of silt carried in suspension, elevated concentration levels at 1.5 km from the source are considered to be negligible. It is considered that there will be no significant elevated concentration levels beyond the travel distance calculated for fine sand which corresponds to 1.5 km from the point of mobilisation within the Marine Installation Corridor (see EAR Volume 2 Chapter 7: Physical Environment).

The EAR concluded that the potential effects of increased SSC and sediment deposition to subtidal benthic habitats and species, irrespective of the value and sensitivity, is not significant (see EAR Volume 2 Chapter 8: Benthic Ecology). It also concluded that impacts to fish, including herring and sandeel (demersal spawners), diadromous fish, and shellfish amongst other marine fish are also not significant (see EAR Volume 2 Chapter 9: Fish and Shellfish).

The qualifying feature of Flamborough Head SAC, with the greatest potential of LSE from the increased SSC and sediment deposition related to the activities of the Marine Scheme are Annex I habitats, reefs. Flamborough Head SAC is located 0.12 km to the north west of the Marine Installation Corridor in English waters at KP422 (closest point).

Regardless of distance from the Marine Scheme activities in this instance, reef species, although sessile, have low sensitivity to turbidity and smothering due to their height (Budd, 2008). The duration of any sediment plumes will be dependent on the sediment composition in which the activity is occurring, but given the patchy nature of these rocky habitats, the presence of high proportions of large particles, and the travel distance calculated for SSC (maximum of 1.5 km), the magnitude of impact to reefs was appraised in the EAR (EAR Volume 2 Chapter 8: Benthic Ecology) as negligible.

Therefore, the activities of the Marine Scheme are not considered to have a LSE on the integrity of the designating features of Flamborough head SAC. Thus, **Flamborough Head SAC can be screened out** from Appropriate Assessment for increased SSC and sediment deposition.

Water Quality

Unplanned release of pollutants (e.g., oil, fuels, lubricants, chemicals) can occur from associated vessels and operations. Any release has the potential to significantly alter water quality which in turn may affect any present waterbirds and/or seabirds in the area. Pollutants such as organic compounds, oil, and heavy metals can directly and indirectly impact waterbirds and/or seabirds, resulting in immunosuppression and genotoxicity disruption (Richard, Southern, Gigauri , & Bellini , 2021).

During the Installation Phase, there is a risk of resuspension of buried contaminants (e.g., heavy metals, hydrocarbons) into the surrounding water column. Furthermore, there is a potential for ships and hydraulic equipment to result in accidental oil leakages / spillages.

Embedded mitigation measures (as described in EAR Volume 2 Chapter 2: Project Description) will be taken to avoid/minimise the risk of accidental leaks and spills irrespective of the presence of European Sites to comply with regulations and guidance on pollution. Since these are not introduced specifically to protect European Sites they can be considered at the Test of LSEs.

As detailed in the EAR Volume 2 Chapter 2: Project Description and EAR Volume 2 Chapter 11: Ornithology, all vessels waste will be managed in accordance with the requirements set out within the International Convention for the Prevention of Pollution from Ships (MARPOL) and contingency plans for marine oil pollution in the form of Shipboard Oil Pollution Emergency Plan (SOPEP) and chemical handling procedures. A CEMP, Emergency Spill Response Plan and Waste Management Plan will be implemented during the Installation Phase of the Marine Scheme to minimise releases. Health, Safety, and Environment (HSE) procedures will also be implemented, with strict weather and personnel limits to reduce any risk of accidental spillage. Furthermore, preparedness and swift response is essential for effective spill management and as such, response plans will be in place should an incident occur.

(John, Meakins, Basford, Craven, & Charles, 2015)It is therefore considered that there will be no LSEs on European Sites as a result of water quality affecting the qualifying bird species from Installation Phase activities. Water quality **can be screened out** from Appropriate Assessment for **Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA, Farne Islands SPA, Flamborough and Filey Coast SPA and Greater Wash SPA.**

Discharge of drilling fluids from HDD works in the shallow subtidal zone of the marine environment has the potential to alter water quality and affect benthic habitats and ecology at each of the landfall locations.

Reefs are a primary reason for the designation of Flamborough Head SAC, which is located 0.12 km from the Marine Installation Corridor at English landfall. Drilling fluids will be selected from the OSPAR List of Substances/Preparations Used and Discharged Offshore which are Considered to Pose Little or No Risk to the Environment (PLONOR). Industry standard drilling fluids and additives required during the HDD operations will also be biologically inert.

Embedded mitigation measures, as described in EAR Volume 2 Chapter 2: Project Description, will be implemented to minimise the release of drilling fluid leaks from the end of the ducts and any therefore mitigate any associated LSEs (see EAR Volume 2 Chapter 8: Benthic Ecology). The discharged drilling fluids will also be subject to immediate dilution and rapid dispersal within the marine environment, particularly as the release will be in the shallow nearshore area where there is likely to be significant wave and tidal water movement.

The drilling fluid discharges from the Marine Scheme's HDD operations will be single events over a short period of time and rapidly dispersed in an open sea coastal environment. Only receptors in the immediate vicinity of the HDD breakouts are likely to be in contact with drilling fluids, which pose little risk to the environment. The effects were appraised in the EAR to be negligible and therefore not significant. Thus, water quality **can be screened out** from Appropriate Assessment for **Flamborough Head SAC.**

Marine mammals are also sensitive to reductions in water quality. The Southern North Sea SAC, Berwickshire and North Northumberland Coast SAC, Humber Estuary SAC, Isle of May SAC and Moray Firth SAC all have mobile marine mammal species as their qualifying features.

The Isle of May SAC and the Berwickshire and North Northumberland Coast SAC are located approximately 90 km and 38 km to the west of the Marine Installation Corridor respectively. Both sites support important grey seal breeding colonies. The grey seal is also a qualifying feature, but not the primary reason for designation of the Humber Estuary SAC (located approximately 51 km southeast from the Marine Installation Corridor). Grey seals can forage over distances of up to 135 km, though highest densities remain closest to the haul out sites (See EAR Chapter 10: Marine Mammals), meaning it is unlikely, but not impossible, that individuals could be within the Marine Installation Corridor and the Marine Scheme's ZoI.

The Southern North Sea SAC is located 19 km to the southeast of the Marine Installation Corridor: harbour porpoise being its qualifying feature. Harbour porpoise are highly mobile and wide ranging but tend to forage for particular species such as sandeel, herring, whiting, sprat and horse mackerel, often concentrating on specific habitat types due to prey availability (Camphuysen & Siemensma, 2015). For example, the concentration of harbour porpoise in the area protected by the Southern North Sea SAC is thought to be due to a habitat preference for the sandy, coarse sediments which cover much of the site. Thus, harbour porpoise will forage widely but distribution is concentrated around known hotspots, such as the Southern North Sea SAC which supports an estimated 17.5% of the UK North Sea Management Unit (MU) population. In areas outside the designated site the density of harbour porpoise is much lower and the risk of any individuals within the ZoI (footprint of the proposed works plus 1.5 km buffer) is low. Should there be a spill that affects water quality any releases will be small and rapidly dispersed such that the risk of an effect to harbour porpoise is low.

Since the data collected on bottlenose dolphin to inform the designation of the Moray Firth SAC, prior to 2005, the range of this population has extended south beyond the boundary of the SAC, as far south as the Firth of Forth and Berwick-upon-Tweed (Hague, Sinclair, & Sparling, 2020; ArsoCivil, et al., 2021), around 300 km away (Hague, Sinclair, & Sparling, 2020). This means there is potential for individuals of this population to be within the Marine Installation Corridor and the Marine Scheme's ZoI.

Any release of pollutants is expected to be small, and so the effect is expected to be highly localised. Furthermore, it is anticipated that releases will be rapidly dispersed and diluted by wave and tidal movements, and thus have a minor effect on mobile marine mammals. However, considering the embedded mitigation measures as described in EAR Volume 2 Chapter 2: Project Description and the low likelihood of an accidental spillage occurring, it is not considered that this impact pathway will lead to LSE on the Moray Firth bottlenose dolphin population, or the integrity of the European site. Thus, water quality **can be screened out** from Appropriate Assessment for **Southern North Sea SAC,**

Berwickshire and North Northumberland Coast SAC, Humber Estuary SAC, Isle of May SAC and Moray Firth SAC.

Changes in prey availability for seabirds

The availability and provision of food items is essential to support the seabird colonies present throughout the North Sea. The EAR Chapter 9: Fish and Shellfish identifies potential impacts on the fish and shellfish species within the Marine Installation Corridor and surrounding area, which includes assessment of potential prey items of seabirds, the most relevant of which are sandeels, but also European sprat, Goby, Saithe and Whiting. The loss of habitat to these species through construction activities associated with the Marine Scheme will have negligible to minor impact and is therefore not significant. Cable installation will disturb a small proportion of the total prey species in the area and the loss of prey will result in a low level of change for a short period of time. Physical disturbance of the seabed during the route preparation and cable installation activities such as cable trenching by ploughing, trenching or excavating will temporarily increase turbidity and may subsequently result in sediment deposition and smothering of prey species. Sediment-bound contaminants, such as heavy metals and toxins, can also impact prey species including benthic communities, fish and shellfish. Overall, the magnitude of impact to all fish and shellfish and benthic community receptors from physical disturbance to the seabed is predicted to be negligible, with changes in water quality caused by installation activities also predicted to be negligible.

Overall, it is expected that the magnitude of change in prey species will be low. Although, seabirds associated with European Sites are likely to be present within the Marine Installation Corridor, the loss of prey will account for only a small area of the available marine habitats and therefore bird species are unlikely to be sensitive to it and will have high recoverability. It is therefore considered that there will be no LSEs on European Sites as a result of changes in prey availability for qualifying bird species. Changes in prey availability **can be screened out** from Appropriate Assessment for **Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA, Farne Islands SPA, Flamborough and Filey Coast SPA and Greater Wash SPA.**

8.2.5.4 Operation and Maintenance Phase

Permanent Habitat Loss

Rock placement will be required to protect the cables in locations where the minimum depth of lowering cannot be achieved as well as to provide protection at the HDD exit pits, crossings, and joints (EAR Volume 2 Chapter 2: Project Description). The installation of rock placement will result in a permanent loss of benthic habitat (see EAR Volume 2 Chapter 8: Benthic Ecology).

The Buchan Ness to Collieston Coast SPA is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the site in the nearby waters, as well as travelling further afield. The Marine Installation Corridor runs through this SPA for approximately 2.3 km and accounts for an area that is equivalent to 2.1% of the total SPA. This site has no benthic qualifying features, and such there are no direct effects on the conservation of the site. However, it is acknowledged that this SPA is designated in part for its importance as a foraging ground for the seabirds breeding within the SPA, hence habitat loss has the potential to indirectly affect the qualifying bird features of the site through changes in prey species availability.

As per EAR Volume 2 Chapter 8: Benthic Ecology and Chapter 9: Fish and Shellfish, it has also been concluded that the impact to benthic ecology and fish from loss of subtidal benthic habitats and species is not significant. Thus, is it considered that there will not be any LSE to the potential availability of prey items for the designated features of Buchan Ness to Collieston Coast SPA.

Buchan Ness to Collieston Coast SPA can therefore be **screened out** from Appropriate Assessment for permanent habitat loss.

Electromagnetic Fields

Electromagnetic field (EMF) emissions can be emitted by submarine HDVC cables like those proposed by the Marine Scheme. EMF emissions have potential to disrupt sensory mechanisms in magnetosensitive and electrosensitive marine species.

Project specific modelling has shown that magnetic fields above natural geomagnetic levels are only expected to occur close to the cable location (reducing to the earth's natural geomagnetic field strength within approximately 20 m of the cables) (see EAR Volume 3 Appendix 2.1: EMF and Compass Deviation Assessment).

European Sites screened into this test of LSE, have diadromous fish as their qualifying features. Sea lamprey and river lamprey are present as features for the River Tay SAC, the River Teith SAC, the River Tweed SAC, the Tweed Estuary SAC, the Humber Estuary SAC, and the River Derwent SAC. Atlantic salmon is a feature for the selection of the River Dee SAC, the River South Esk SAC, the River Tay SAC, and the River Teith SAC.

These fish species are highly mobile and therefore have the potential to enter the Marine Installation Corridor and the Marine Scheme's ZoI, outside of the European site boundary.

During operation of the HVDC cables, migratory species may respond by changes in swimming speed or adjustments in swimming direction. However, the migratory species identified above have been shown to spend most of their time in the upper reaches (top 10 m) of the water column (See EAR Chapter 9: Fish and Shellfish Ecology, Section 9.5.2.1), therefore are unlikely to experience EMFs above background levels in water depths less than 30 m. Migration routes from rivers in the vicinity of the Marine Installation Corridor are generally in a direction to or from the north of the Marine Scheme, as such, the Peterhead landfall and approaches are the areas where migration routes may be crossed in shallow water. The seabed shelves rapidly on the approaches to Peterhead, and the 30 m depth contour is within approximately 2 km of the shore, as such the area where EMF emissions from the cables have the potential to affect diadromous fish is extremely limited, with no potential for barrier effects to occur. Any responses are expected to be limited locally to the location of the submarine cables within the Marine Installation Corridor. Therefore, the trenched cable is not thought to pose a significant barrier to the migration of diadromous fish and therefore EMF **can be screened out** from Appropriate Assessment **for River Tay SAC, the River Teith SAC, the River Tweed SAC, the Tweed Estuary SAC, the Humber Estuary SAC, the River Derwent SAC, the River Dee SAC, and the River South Esk SAC.**

Cable Maintenance and Repair

As detailed in the EAR Chapter 2: Project Description, the Marine Scheme has been designed to require minimal maintenance during the operational lifetime. However, routine inspection surveys will be conducted through the lifetime of asset to ensure the cables remain in good condition and adequately protected. These surveys may identify the need for preventative repair or maintenance activities which may include:

- Re-trenching if sections become exposed through the natural hydrodynamic process;
- Maintenance and reinstatement of any degraded rock or other protection features; and
- Cable repair in the event of damage.

Maintenance activities and cable repair activities would be carried out using the same or similar methods as that of the Installation Phase and therefore the potential pathways for impact would be the same as those identified for the Installation Phase of the Marine Scheme. Maintenance or cable repair activities would be highly localised to the area of concern, with a suitable vessel possibly requiring several months to complete the works. Therefore, the spatial extent of any effects would be small.

Given the above, any LSEs because of inspection/repair activities are anticipated to be of equal or lesser significance to those identified for the same impact pathways associated with the Installation Phase of the Marine Scheme. Please refer to Section 5.3 for assessments of the Installation Phase.

Changes in prey availability for seabirds

As detailed in Section 0, changes in the distribution of key prey species has the potential to adversely affect ornithological receptors. The EAR Chapter 8: Benthic Ecology, and Chapter 9: Fish and Shellfish identify and assess potential long term effects on benthic, fish and shellfish, species which may result from the operation of the proposed HVDC cable infrastructure. Potential adverse effects may result from pathways including sediment heating, EMF generation, and permanent habitat loss/change resulting from rock placement. However, no significant impacts were found for any of the fish or shellfish species as a result of these potential impacts. It is therefore considered that there will be no LSEs on European

Sites as a result of changes in prey availability for qualifying bird species. Changes in prey availability during operation and maintenance **can be screened out** from Appropriate Assessment for **Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA, Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA, Farne Islands SPA, Flamborough and Filey Coast SPA** and **Greater Wash SPA.**

8.2.5.5 Decommissioning Phase

At the end of the operational life of the cables the options for decommissioning will be evaluated and taking into consideration other project constraints (e.g., technical feasibility, safety and liability), the best practical environmental option would be implemented.

The principal options for decommissioning described in the EAR Chapter 2: Project Description are:

- Leave in situ, buried;
- Leave in situ and provide additional protection where exposed;
- Remove sections of the cable that present a risk; or
- Remove the entire cable.

Should full removal from the seabed be required, this would have the potential to cause similar impacts to the cable installation phase of the Marine Scheme.

During the Operational Phase of the Marine Scheme, it is likely that benthic habitats and communities would have recovered from impacts arising during the Installation Phase of the Marine Scheme.

Impacts during decommissioning may be of a similar magnitude to cable installation, depending upon the decommissioning option chosen, and therefore as a worst case, the potential impacts could be similar to those reported for the Installation Phase.

8.2.6 Information to Inform Appropriate Assessment

Sound & Visual Disturbance to Birds associated with Buchan Ness to Collieston Coast SPA during Installation

Cable installation activities such as those associated with HDD site set up activities, HDD drilling and the cable pull site set up are over 2 km from the main seabird colonies associated with the Buchan Ness to Collieston Coast SPA; a sufficient distance such that noise and visual disturbance will not occur at nesting colonies. This is because noise attenuates by 6 dB with each doubling of distance, even the loudest construction noise i.e., impact piling at 110 dB one metre from source will attenuate below 70 dB after a few hundred metres. The 70 dB threshold has been accepted by Natural England in other areas as the minimum noise volume to cause bird disturbance. Impact piling is not planned as part of the Marine Scheme but is used as an example.

During the Installation Phase activities there will be several vessels present within the marine environment, as described above and detailed in EAR Volume 2 Chapter 2: Project Description. Vessels have the potential to cause disturbance to seabirds utilising the waters near the installation activities. As identified above, different species have different sensitivities associated with visual disturbance due to a vessel's presence. Species which may be more prone to vessel disturbance are guillemot and razorbill.

The Marine Scheme's installation vessels will be slow moving, and any potential disturbance will take place in the context of existing sources of disturbance. Seabirds tend to raft together in groups on the sea, which means that if a vessel passes through or close to a raft, it has the potential to disturb and displace many individuals at once. The effect of the vessel's presence would be disturbance of potential foraging or resting habitat on the sea, causing the birds to have to move elsewhere, which may result in birds having less time to forage and cause them to expend additional energy. Effects on energy budgets are extremely unlikely to result in population dynamic effects (i.e., increased adult mortality or effects on reproduction). Given the wider area available, if birds are present, they are likely to find alternative feeding/loafing grounds in the short term.

For Installation Phase activities at the Scottish landfall, the species potentially affected by disturbance will be those within close proximity. Given, the location of the Scottish landfall within the marine extension of the Buchan Ness to Collieston Coast SPA, there is the potential for species sensitive to disturbance to be present within the vicinity of vessels. As demonstrated in Chapter 13: Shipping and Navigation, Sandford Bay and surrounding waters are known to be busy areas for shipping activity and recreational use and whilst sensitive species may be present, the presence of the Marine Scheme's vessels will not constitute a substantive change from baseline vessel activity. For the Installation Phase activities close to the Scottish landfall, the vessels will be expected to take up to seven days of 24 hour working, giving a total duration of 21 days to carry out the cable pulls. During this period they will be stationary or slow moving. A number of embedded mitigation commitments (refer to the EAR Volume 2 Chapter 2: Project Description) will also reduce to disturbance to seabirds, including:

- All vessels will comply with the Scottish Marine Wildlife Watching Code (SMWWC) to protect ornithological receptors
- A commitment will be included with the CEMP and implemented via the SMWWC, to ensure that transiting vessels move at low speeds allowing any rafts of birds to disperse naturally well in advance of an approaching vessel. This will minimise the energy expended and avoid unnecessary flushing, which is especially important during the immediate post breeding dispersal periods of auks from early July to mid-September.
- Lighting on-board the vessels will be kept to the minimum level required to ensure safe operations and directed towards working areas. This will minimise disturbance to seabird species.

Should any works cause disturbance to seabirds, the effect will be minimal, temporary in nature and set against the context of existing baseline activities. However, at the Scottish landfall, species of moderate sensitivity, i.e., guillemot and razorbill, have the potential to be displaced from resting and foraging areas. However, considering the embedded mitigation, the temporary and transient nature of the effect, the limited area affected, in the context of the extend of the SPA marine extension and set against the background shipping activity levels, the proposed activities are not anticipated to compromise the conservation objectives for the SPA.

Therefore, no adverse effects on the integrity of the Buchan Ness to Collieston Coast SPA are expected as a result if the proposed EGL2 Marine Scheme.

Disturbance from Underwater Sound to Grey Seal associated with the Isle of May SAC, the Berwickshire and North Northumberland Coast SAC, the Humber Estuary SAC and Harbour Porpoise associated with the Southern North Sea SAC

Grey seal *Halichoerus grypus* is a primary reason for the site selection of Isle of May SAC, Berwickshire and North Northumberland Coast SAC and Humber Estuary SAC. The maximum injury distance from SBP estimated for seals is up to 62 m and <10 m for USBL, although this does not account for the directionality of the equipment, which reduces the impact range. The closest seal haul-out location to the Marine Installation Corridor is the Ythan Estuary (grey seal), 25 km to the south of the Scottish landfall, also significantly beyond any potential ZoI of the Marine Scheme. Any disturbance would be short-term, temporary and limited to very few individuals. This is particularly the case when considering that the vessel is continuously moving and interactions with seals will be of short duration. Disturbance to seals foraging offshore will be limited and is not considered likely to have an adverse impact on foraging ability, with alternative areas for foraging widely available (Chapter 10: Marine Mammals).

The Southern North Sea SAC is designated due to its importance to harbour porpoise. This designated site is located approximately 19 km to the east of the Marine Installation Corridor. Nevertheless, harbour porpoise is widespread across the North Sea and sound propagation calculations indicate injury is possible in harbour porpoise. The maximum injury distance from SBP estimated for harbour porpoise is up to 251 m for SBP and <10 m for USBL.

The harbour porpoise is thought to have a very high metabolic rate compared to terrestrial animals of a similar size (Rojano-Doñate, et al., 2018), requiring individuals to forage almost constantly (Wisniewska, et al., 2016). Thus, temporary disturbance of harbour porpoise from key foraging grounds could affect individual harbour porpoise's ability to eat enough to meet their energy requirements, with consequences for survival and reproduction (Kastelein, Hardeman, & Boer, 1997). Approximately 0.152

- 0.888 individuals / km^2 within an assumed 5 km of the geophysical survey have the potential to be disturbed (Table 10-14. Chapter 10: Marine Mammals).

Given the potential for injury from the use of the SBP, embedded mitigation measures recommended in EAR Volume 2 Chapter 2: Project Description, including the JNCC guidelines for minimising the risk of injury in marine mammals from geophysical surveys (seismic survey guidelines) (JNCC, 2017) will be adopted for SBP activities. Given the extremely limited injury ranges (<10 m) potentially resulting from the use of USBL, there is no realistic risk of injury and no mitigation is proposed. The measures below will be included in a Marine Mammal Protection Plan (MMPP), as part of the CEMP developed for the Marine Scheme.

The JNCC guidance minimises the potential for injury to cetaceans from the SBP activities through the use of marine mammal observation. Thus, before the SBP is activated, there will be a period of observation by a qualified Marine Mammal Observer (or passive acoustic monitoring in the case of operations during the hours of darkness). Thus, the likelihood that any animals are within 500 m of the source, the standard observation zone, at the point at which the SBP is activated is very low. Following the observation period, SBP survey activities will only commence after a period when no animals have been seen. A soft start procedure can form part of the mitigation measures, but this process may not possible for SBP, depending on the equipment used. These measures reduce the risk of injury to any marine mammals from the use of SBP, by minimising presence in close proximity to the noise source.

To conclude, with the inclusion of the embedded mitigation measures for SBP operations, there is no potential for injury to marine mammals as a result of underwater sound generated by the Marine Scheme activities. There will be some behavioural disturbance however, particularly from the operation of the SBP, but with the inclusion of the embedded mitigation measures this will be reduced, and as the vessel are continuously moving any impacts are transient. The duration is considered to be short-term, intermittent and temporary, and the extent of the effect limited in terms of the number of individuals and the level of behavioural response, therefore the proposed activities are no anticipated to hinder the conservation objectives for these sites.

Therefore, no adverse effects on the integrity of the of the Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Humber Estuary SAC and Southern North Sea SAC are anticipated to occur from the Marine Scheme.

8.2.7 In-combination Effects

EAR Volume 2 Chapter 16 identified the following projects to have potential in-combination effects with the Marine Scheme:

- Green Volt Floating Offshore Wind Farm Export Cable;
- ScotWind Proposed Site Area / Option Agreement 6;
- ScotWind Proposed Site Area / Option Agreement 1;
- Seagreen 1A (Bravo) Offshore Wind Farm;
- Berwick Bank Offshore Wind Farm;
- Dogger Bank C / Sofia Export Cables;
- Northern Endurance Carbon Dioxide Pipelines (Teesside and Humber); and
- Hornsea Project Four (HOW04) Offshore Wind Site Export Cable.

The appraisal of in-combination effects resulting from the Marine Scheme and those projects identified in EAR Volume 2 Chapter 16: Cumulative and In-Combination Effects, all ranged from **Negligible** to **Minor** effects, which are **not significant**.

8.2.7.1 In-combination Scoping

Table 8 provides a screening of project interactions for in-combination effects between the Marine Scheme and other projects identified above, including (for completeness) the Scottish and English Onshore Schemes. The following sections of this HRA then only address the potential for LSE on the integrity of the relevant European Sites where a possible pathway has been identified for both the Marine Scheme and the identified project to act in-combination to result in a significant effect.

Table 8: Screening of project interactions for in-combination effects

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
Eastern Green Link 2 – Scottish Onshore Scheme	X	X	X	X	X	X	X	X	X	X	Onshore cable installation activities such as those associated with HDD site set up activities, HDD drilling and the cable pull site set up are over 2 km from the main seabird colonies associated with the Buchan Ness to Collieston Coast SPA; a sufficient distance such that noise and visual disturbance will not occur at nesting colonies. This is because noise attenuates by 6 dB with each doubling of distance, even the loudest construction noise i.e., impact piling at 110 dB one metre from source will attenuate below 70 dB after a few hundred metres. The 70 dB threshold has been accepted by Natural England in other areas as the minimum noise volume to cause bird disturbance. Impact piling is not planned as part of the Marine Scheme but is used as an example. This project is therefore excluded from further assessment due to no possible interaction with the Marine Scheme.
Eastern Green Link 2 – English Onshore Scheme	X	X	X	X	X	X	X	X	X	X	This project is excluded from further assessment due to no possible interaction with the Marine Scheme.
Green Volt Floating Offshore Wind Farm Export Cable	X	✓	✓	X	X	X	X	X	X	X	Screened in for Vessel Presence and Visual Disturbance to Birds and Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance - Due to the sporadic nature of Annex I reef type habitats, and the extent of the area identified, no significant in-combination effects are anticipated to occur between the proposed development and the Marine Scheme. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - The benthic characterisation survey of the Marine Installation Corridor did not identify any prime or sub-prime herring or sandeel habitat, consequently, the in-combination effect of disturbance is predicted to be of negligible, temporary, and localised. • Permanent Habitat Loss - The appraisal has considered that these projects will be constructed before the Marine Scheme, and therefore forms part of the future baseline, against which the potential effects of the Marine Scheme have been assessed. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways.

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
ScotWind Proposed Site Area / Option Agreement 6	X	X	✓	X	X	X	X	X	X	X	Screened in for Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance – This area is dominated by mixed sediments, which typically recovered swiftly after disturbance, rapidly returning to pre-construction baselines and those of adjacent unimpacted areas (RPS, 2019). Therefore, no significant in-combination effect is anticipated. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - As appraised in EAR Chapter 11: Ornithology, effects on ornithological receptors during the Installation Phase of the Marine Scheme are minor to negligible adverse and not significant. Therefore, it is considered unlikely that the potential in-combination effects between the potential developments are likely to cause any significant in-combination effects on ornithological receptors. • Permanent Habitat Loss - the cable crossing between Eastern Green Link 2 and the ScotWind Proposed Site Area / Option Agreement 6 will require cable protection, probably using rock protection, which will result in permanent habitat loss. However, the magnitude of loss has been appraised as low at this location compared to the size of this remaining habitat within the Marine Installation Corridor and wider North Seas area. Due to the distance from European Sites, this is not considered to result in any in-combination effect. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways.

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
ScotWind Proposed Site Area / Option Agreement 1	X	X	✓	X	X	X	X	X	X	X	Screened in for Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance – This area is dominated by as Circalittoral Muddy Sand with Patches of Offshore Circalittoral Mixed Sediment (NEXTGeosolutions, 2022), which typically recovered swiftly after disturbance, rapidly returning to pre-construction baselines and those of adjacent unimpacted areas (RPS, 2019). Therefore, no significant in-combination effect is anticipated. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - As appraised in EAR Chapter 11: Ornithology, effects on ornithological receptors during the Installation Phase of the Marine Scheme are minor to negligible adverse and not significant. Therefore, it is considered unlikely that the potential in-combination effects between the potential developments are likely to cause any significant in-combination effects on ornithological receptors. • Permanent Habitat Loss - the cable crossing between Eastern Green Link 2 and the ScotWind Proposed Site Area / Option Agreement 6 will require cable protection, probably using rock protection, which will result in permanent habitat loss. However, the magnitude of loss has been appraised as low at this location compared to the size of this remaining habitat within the Marine Installation Corridor and wider North Seas area. Due to the distance from European Sites, this is not considered to result in any in-combination effect. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways
Seagreen 1A (Bravo) Offshore Wind Farm	X	X	X	X	X	X	X	X	X	X	This project is excluded from further assessment due to no possible interaction with the Marine Scheme.
Berwick Bank Offshore Wind Farm	X	X	X	X	X	X	X	X	X	X	This project is excluded from further assessment due to no possible interaction with the Marine Scheme.

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
Dogger Bank C / Sofia Export Cables	X	X	✓	X	X	X	X	X	X	X	Screened in for Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance – This area is dominated by as Circalittoral Muddy Sand with Patches of Offshore Circalittoral Mixed Sediment (NEXTGeosolutions, 2022), which typically recovered swiftly after disturbance, rapidly returning to pre-construction baselines and those of adjacent unimpacted areas (RPS, 2019). Therefore, no significant in-combination effect is anticipated. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - The benthic characterisation survey of the Marine Installation Corridor did not identify any prime or sub-prime herring or sandeel habitat. Increased SSC has been appraised as resulting in not significant effects in EAR Chapter 9: Fish and Shellfish. Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. Therefore, it is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect on prey availability. • Permanent Habitat Loss - The magnitude of both habitat disturbance and loss has been appraised in the EAR as negligible at this location, compared to the size of this remaining habitat within the Marine Installation Corridor and wider North Sea area. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways.

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
Northern Endurance Carbon Dioxide Pipelines (Teesside and Humber)	X	X	✓	X	X	X	X	X	X	X	Screened in for Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance – The habitat type at KP380 was identified as Rippled Offshore Circalittoral Sand with Megarippled Waves and Occasional Patches of Offshore Circalittoral Mixed Sediment. These habitats typically recovered swiftly after disturbance, rapidly returning to pre-construction baselines and those of adjacent unimpacted areas (RPS, 2019). Therefore, no significant in-combination effect is anticipated. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - The benthic characterisation survey of the Marine Installation Corridor did not identify any prime or sub-prime herring or sandeel habitat. Increased SSC has been appraised as resulting in not significant effects in EAR Chapter 9: Fish and Shellfish. Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. Therefore, it is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect on prey availability. • Permanent Habitat Loss - The greatest change in habitat and species composition will occur when external protection is placed on sandy sediments, which were identified in the vicinity of KP380. However, the magnitude of loss is considered not significant at this location compared to the size of this remaining habitat within the Marine Installation Corridor and wider North Sea area. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways

Project	Interaction Pathway										Comment / Justification
	Temporary Habitat Disturbance	Vessel Presence and Visual Disturbance to Birds	Disturbance to Marine Mammals and Fish from Underwater Sound	Vessel Presence (Collision Risk and Disturbance of Marine Mammals)	Increased SSC and Sediment Deposition	Water Quality	Changes in prey availability for seabirds	Permanent Habitat Loss	Electromagnetic Fields	Cable Maintenance and Repair	
Hornsea Project Four (HOW04) Offshore Wind Site Export Cable	X	X	✓	X	X	X	X	X	X	X	Screened in for Disturbance to Marine Mammals and Fish from Underwater Sound. All other pathway interactions considered not to have a LSE on qualifying features or the integrity of European Sites (full assessment presented in Section 8.2.5). A summary of pathways excluded is provided below. • Temporary Habitat Disturbance – Temporary habitat disturbance has been appraised as resulting in no significant effects in EAR Chapter 8: Benthic Ecology in the area of Hornsea Project Four, which is in close proximity to the Marine Scheme between KP425 and KP431 on the approaches to the English landfall. The habitat type at this location was identified as medium to fine sand and gravel, pebbles and/or shingle. In these areas which are dominated by sediments, which following a review of cable installation activities in similar habitats, found that these habitats typically recovered swiftly after disturbance, rapidly returning to pre-construction baselines and those of adjacent unimpacted areas (RPS, 2019). Therefore, no significant in-combination effects are anticipated to occur between the proposed developments and the Project Marine Scheme. • Vessel Presence (Collision Risk and Disturbance of Marine Mammals) - Vessel activity is unlikely to significantly increase the risk of collision with marine mammals when considered against background shipping levels. • Increased SSC and Sediment Deposition - Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. • Water Quality - The risk of an accidental spill occurring is unlikely. Should an accidental spill or leak occur, it would be very small in extent and subject to immediate dilution and rapid dispersal within the marine environment. • Changes in prey availability for seabirds - The benthic characterisation survey of the Marine Installation Corridor did not identify any prime or sub-prime herring or sandeel habitat. Increased SSC has been appraised as resulting in not significant effects in EAR Chapter 9: Fish and Shellfish. Any works would be spatially and temporally separated allowing any localised increases in SSC to disperse and dilute. Therefore, it is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect on prey availability. • Permanent Habitat Loss - Hornsea Project Four are proposing to use external rock placement for up to 10% of their cable route in addition to that required for crossings, hence there is potential for rock placement to be used in close proximity to the Marine Scheme. Since the Marine Scheme has committed to trenching the cables inshore of KP426.7, which is not located within a European Site, it is considered that there is limited potential for the effect on benthic habitats and species as a result of permanent loss to result in a significant in-combination effect. • Electromagnetic Fields - It is considered that there is no potential for this effect to accumulate sufficiently to result in a significant in-combination effect. • Cable Maintenance and Repair – As per above which would reflect installation interaction pathways

8.2.7.2 Green Volt Floating Offshore Wind Farm Export Cable

The Green Volt floating offshore wind farm project, which received its Scoping Opinion in April 2022, is located approximately 75 km east of the Aberdeenshire coast in an area of approximately 144 km^2. The proposal is for up to 30 floating Wind Turbine Generators with a total installed capacity of approximately 300 Megawatt (MW). Construction is scheduled over two years, with the aim of connecting Buzzard platform (an O&G asset) to the UK grid Q2 2025. The OWF will be connected to Buzzard and this will be energised 2026. Construction is expected to start with the installation of the substation, offshore export cable and final connection to the Buzzard platform. This cumulative assessment considers the export cable only due to geographical overlap.

The impact pathways included in the cumulative effects appraisal for Green Volt and screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Temporary disturbance and displacement from installation activities associated with sound, visual impacts, and presence from vessel and construction activity; and
- Underwater sound.

If Installation Phase activities for the Marine Scheme and another identified project were to occur simultaneously, cumulative effects of disturbance and displacement of birds from construction activities could occur. The development will likely undergo Environmental Impact Assessment, and therefore it is assumed that any significant effects will be mitigated against, resulting in no significant residual effects. However, should potential impacts not be mitigated, it is considered possible that effects may range from minor to major adverse significance, depending on the value of the receptor being impacted.

As appraised in Chapter 11: Ornithology, effects on ornithological receptors during the Installation Phase of the Marine Scheme are minor to negligible adverse and not significant. Therefore, it is considered unlikely that the potential cumulative effects between the potential developments are likely to cause any significant cumulative effects on ornithological receptors. Thus, the potential in-combination effects from the Marine Scheme and Green Volt project are considered to be, at worst, minor adverse and therefore not significant.

If Installation Phase activities for the Marine Scheme and Green Volt were to occur simultaneously, in-combination effects of underwater sound resulting from sound generating activities could occur. However, with the exception of a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised.

In addition, as Installation Phase vessels for either project would only be at any particular location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The Green Volt project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.7.3 ScotWind Proposed Site Area / Option Agreement 6

Developers, DEME, Aspiravi and Qair, obtained Option Agreement in January 2022, for 1,008 MW capacity. This project is currently in the pre-planning stage and therefore, development timescales are unknown (The Crown Estate Scotland, 2022).

The ScotWind Proposed Site Area/ Option Agreement 6 crosses between KP64 and KP73 of Marine Installation Corridor. The impact pathways included in the cumulative effects appraisal for the ScotWind Proposed Site Area / Option Agreement 6 and screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Underwater sound.

If Installation Phase activities for the Marine Scheme and ScotWind Proposed Site Area / Option Agreement 6 project were to occur simultaneously, in-combination effects of underwater sound resulting from sound generating activities could occur.

However, except for a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised to the activities.

In addition, as Installation Phase vessels for either project would only be at any particular location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The ScotWind Proposed Site Area / Option Agreement 6 project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.7.4 ScotWind Proposed Site Area/ Option Agreement 1

Developers, BP and EnBW, obtained an Option Agreement for this project in January 2022, for 2,907 MW capacity. This project is currently in the pre-planning stage and therefore development timescales are currently unknown (The Crown Estate Scotland, 2022).

The ScotWind Proposed Site Area / Option Agreement 1 crosses at KP91 and KP92 of Marine Installation Corridor. The impact pathways included in the cumulative effects appraisal for the ScotWind Proposed Site Area / Option Agreement 1 and screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Underwater sound.

If Installation Phase activities for the Marine Scheme and ScotWind Proposed Site Area / Option Agreement 1 project were to occur simultaneously, in-combination effects of underwater sound resulting from sound generating activities could occur.

However, with the exception of a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised.

In addition, as installation vessels for either project would only be at any location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The ScotWind Proposed Site Area / Option Agreement 1 project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.7.5 Dogger Bank C / Sofia Export Cables

The Dogger Bank C / Sofia offshore wind farms are located next to each other on the Dogger Bank, in the North Sea. These offshore export cables will run in parallel for more than 200 km to the landfall between Redcar and Marske-by-the-Sea. Offshore construction is planned to commence in 2022 and the development is planned to be operational in 2026 (Dogger Bank Wind Farm, 2022).

The impact pathways included in the cumulative effects appraisal for the Dogger Bank C/ Sofia Export Cable and screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Underwater sound.

If cable installation activities for the Marine Scheme and Dogger Bank C / Sofia Export Cables were to occur simultaneously, in combination effects of underwater sound resulting from sound generating activities could occur.

However, except for a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised.

In addition, as Installation Phase vessels for either project would only be at any location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The Dogger Bank C / Sofia Export Cables project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.7.6 Northern Endurance Carbon Dioxide Pipeline (Teesside and Humber)

The Northern Endurance Carbon Dioxide Pipelines (Teesside and Humber) are the pipelines transporting carbon dioxide to the Endurance Store beneath the North Sea. An Oil and Gas Authority (OGA) Carbon Dioxide Appraisal and Storage Licence, and Permit, will be required for the offshore storage element (i.e., below MHWS). The offshore CO_2 pipelines will also require consent under the

Petroleum Act 1998. The Teesside pipeline crosses the Marine Installation Corridor at KP380, however this KP does not overlap with a European site. The impact pathways included in the cumulative effects appraisal for the Northern Endurance Carbon Dioxide Pipeline (Teesside pipeline only) screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Underwater sound.

If Installation Phase activities for the Marine Scheme and Northern Endurance Carbon Dioxide Pipeline (Teesside) project were to occur simultaneously, in-combination effects of underwater sound resulting from sound generating activities could occur.

However, with the exception of a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised.

In addition, as Installation Phase vessels for either project would only be at any particular location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The Northern Endurance Carbon Dioxide Pipeline (Teesside) project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.7.7 Hornsea Project Four (HOW04) - Offshore Wind Site Export Cable

Hornsea Project Four is a proposed offshore wind farm with generation assets which will be located approximately 65 km offshore the East Riding of Yorkshire in the Southern North Sea. Hornsea Four will include both offshore and onshore infrastructure including offshore turbines, export cables to landfall, and connection to the electricity transmission network. This project is currently undergoing examination for a DCO. Construction is planned 2024-2029 (Orsted, 2022).

The impact pathways included in the cumulative effects appraisal for the Hornsea Project Four (HOW04) - Offshore Wind Site Export Cable and screened in for further assessment in Table 8, due to possible interaction with Marine Scheme were:

- Underwater sound.

The Hornsea Project Four (HOW04) - Offshore Wind Site Export Cable runs adjacent to the Marine Installation Corridor between KP425 to KP431.

If Installation Phase activities for the Marine Scheme and Hornsea Project Four (HOW04) - Offshore Wind Site Export Cable project were to occur simultaneously, in-combination effects of underwater sound resulting from sound generating activities could occur.

However, with the exception of a few acoustic sources, the number of vessels generating underwater sound and the sound levels were not significantly above background levels from regular vessel movements in the North Sea. The impact appraisal (See EAR Volume 2 Chapter 10: Marine Mammals) determined that the only activity with the potential to cause injury or disturbance in marine mammals were associated with the operation of the SBP and the USBL acoustic positioning system.

However, injury thresholds were only met in very close proximity to the vessel and considering the adoption of JNCC measures for geophysical survey (JNCC, 2017) for SBP, and the very low density of cetaceans in the Marine Installation Corridor, injury was considered highly unlikely to occur. The estimated maximum distance for disturbance effects was determined to be 5 km and so any effect would be highly localised.

In addition, as Installation Phase vessels for either project would only be at any particular location for short periods of time, and the area where they interact is very small, any period of cumulative sound would be very limited. Considering that the sound levels produced by the project are similar to background levels, there was found to be no potential for impacts to marine mammals from the Marine Scheme vessel and cable lay sound. Where higher sound intensity sources are used on other projects this will effectively mask the sound from the Marine Scheme for this short period of time.

The Hornsea Project Four (HOW04) - Offshore Wind Site Export Cable project is therefore not considered to have any in-combination effect on European Sites, or their mobile qualifying features, associated with the Marine Scheme.

8.2.8 Conclusions

This HRA Report has been prepared to support MLAs to the MS-LOT and the MMO for the Eastern Green Link 2 Marine Scheme.

A total of 48 European Sites were considered within the scope of the assessment, and ten potential impact pathways were identified.

Except for the Buchan Ness to Collieston Coast SPA, the Isle of May SAC, Berwickshire and North Northumberland Coast SAC, the Humber Estuary SAC and the Southern North Sea SAC, all other designated sites were screened out from the need for Appropriate Assessment for all impact pathways.

Information has been provided to inform an Appropriate Assessment of sound and visual disturbance to birds associated with Buchan Ness to Collieston Coast SPA. It was determined that no adverse effects on the integrity of the Buchan Ness to Collieston Coast SPA are anticipated from the EGL2 Marine Scheme.

Additionally, information has also been provided to inform an Appropriate Assessment of disturbance from underwater sound to grey seals associated with the Isle of May SAC, the Berwickshire and North Northumberland Coast SAC, the Humber Estuary SAC and harbour porpoise associated with the Southern North Sea SAC. It was determined that no adverse effects on the integrity of these European Sites will occur from the Marine Scheme.

No adverse effects, alone or in combination with other plans or projects, are anticipated.

A conclusion of no adverse effect on site integrity can therefore be determined, and no further stages of Habitats Regulations Assessment are required.

8.2.9 References

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