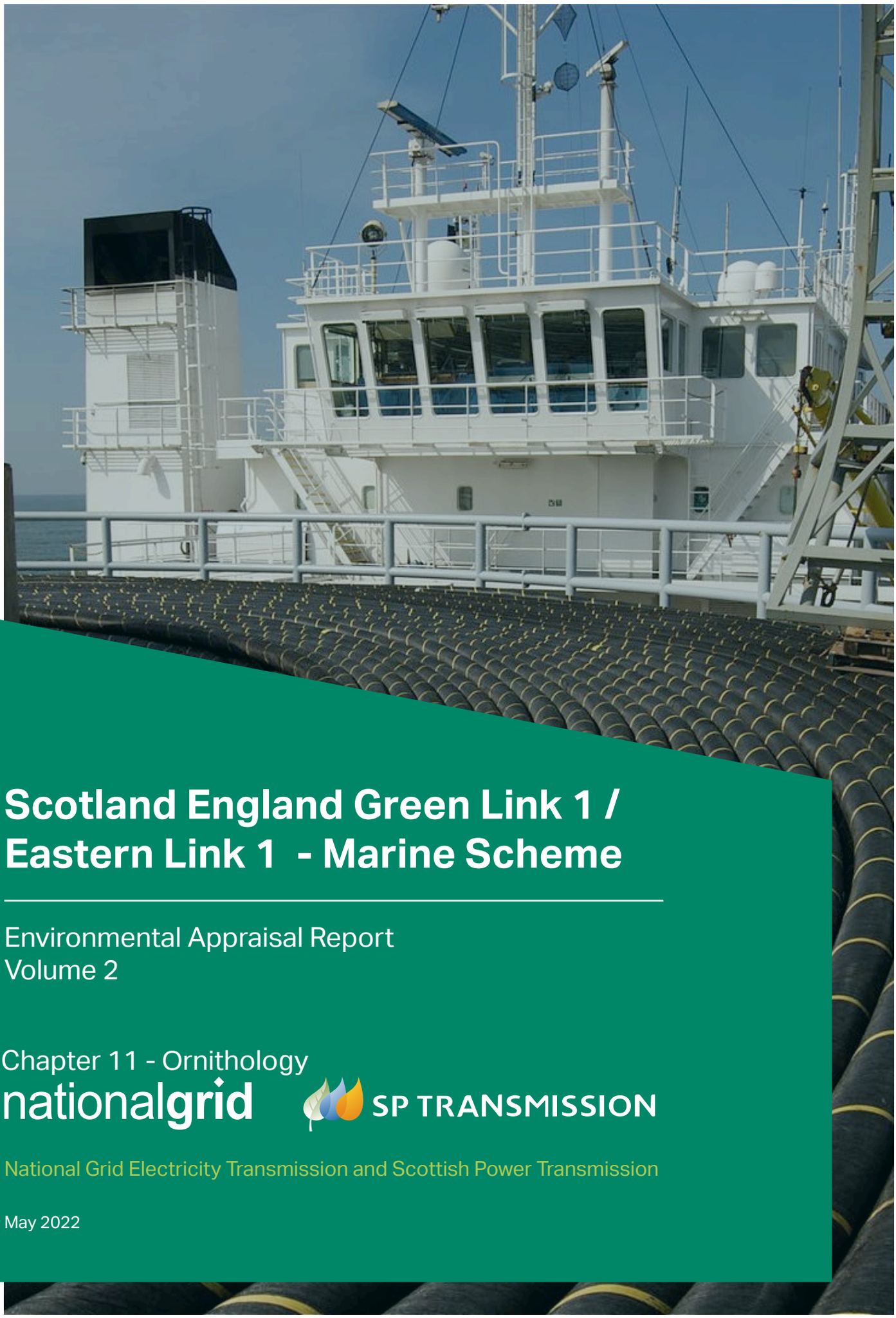

Scotland England Green Link 1 / Eastern Link 1 - Marine Scheme

Environmental Appraisal Report
Volume 2

Chapter 11 - Ornithology

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National Grid Electricity Transmission and Scottish Power Transmission

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Executive Summary

This chapter of the Environmental Appraisal Report (EAR) contains an appraisal of the potential interaction of the Marine Scheme and ornithology, focusing on the marine area between Mean High Water Springs (MHWS) at the Scottish landfall area at Thorntonloch Beach in East Lothian, and MHWS at the English landfall area at Seaham, County Durham. This includes any waterbirds (i.e. wading bird or waterfowl) using intertidal areas between MHWS and Mean Low Water Springs (MLWS) and marine birds (i.e. seabirds) which forage at sea and may be nesting on cliffs on the interface between the Marine Scheme and both the English and Scottish Onshore Schemes.

The appraisal follows the methodology as set out within Chapter 4: Approach to Environmental Appraisal, with the identification and appraisal of effects and mitigation following the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018, and updated September 2019) and based on expert judgments.

The ornithology baseline is presented in Section 11.5 of this EAR chapter. This identifies relevant designated sites which may be impacted by the Marine Scheme, as well as being a source of ornithological features, i.e. cited seabirds, that may occur within the study area (10km) and interact with the Marine Scheme. Determination of the ornithological baseline has also been informed by the extensive studies identified in this chapter reporting the distribution and abundance of ornithological receptors in the western North Sea.

The potential effects of the Marine Scheme on ornithology have been appraised in Section 11.6. Where appropriate, proportionate measures to avoid or mitigate for any identified adverse effects are identified. This appraisal concludes that, potential impacts during the installation, operation (including maintenance and repair) and decommissioning of the Marine Scheme on ornithological receptors are **not significant**.

The potential for interaction between the Project and other plans/projects to result in significant cumulative effects, is considered in Chapter 16: Cumulative and In-Combination Effects. This includes an appraisal of potential cumulative effects between the Marine Scheme and the English Onshore and Scottish Onshore Schemes, as there is the potential for interaction due to proximity of Outer Firth of Forth & St Andrews Bay Complex SPA and the Northumbria Coast SPA / Ramsar site. This appraisal concluded that there will be no cumulative effects upon birds attributed to these projects.

11 Ornithology

11.1 Introduction

This chapter of the Environmental Appraisal Report (EAR) contains an appraisal of the potential interaction of the Marine Scheme and ornithology.

The Marine Scheme comprises the marine component of the Scotland England Green Link 1 (SEGL1)/ Eastern Link 1 (EL1) and extends from Mean High Water Springs (MHWS) at the Scottish landfall on Thorntonloch beach, to MHWS at the English landfall near Seaham. It is located within both English and Scottish territorial waters, within the 12 nautical mile (NM) limit from the coast. The Marine Scheme comprises an installation corridor of approximately 176 km length and 500 m maximum width within which cables will be installed (hereinafter referred to as the 'marine installation corridor'). The marine installation corridor extends from kilometre point (KP) 0, at its landfall in Scotland, to KP 176, at its landfall in England (See Figure 1-3). The Marine Scheme activities cover the following phases: installation, operation (including maintenance and repair), and decommissioning. Detailed descriptions of each of the Marine Scheme phases can be found in Chapter 2: Project Description.

The ornithology baseline is presented in Section 11.5 of this EAR chapter.

The potential effects of the Marine Scheme on ornithology have been appraised in Section 11.6. Where appropriate, proportionate measures to avoid, mitigate or compensate for any identified adverse effects are identified.

The potential for interaction between the Marine Scheme and other plans / projects to result in significant cumulative effects, is considered in Chapter 16: Cumulative and In-Combination Effects.

Impacts to ornithology are interrelated with effects reported in other marine chapters including Chapter 8: Benthic Ecology and Chapter 9: Fish and Shellfish Ecology.

The potential for Likely Significant Effects to the National Site Network (including Special Protection Areas (SPAs) and Ramsar Sites), formerly known as European sites, is presented in EAR Volume 3 Appendix 8.2: Habitats Regulations Assessment Report.

11.2 Legislative and Policy Context

This section outlines legislation, policy and guidance relevant to the appraisal of the potential effects on important ornithological features associated with installation, operation (including maintenance and repair) and decommissioning of the Marine Scheme. For further information regarding the legislative context refer to Chapter 3: Legislative and Policy Framework.

A number of policies and regulations aim to assure that ornithology is taken into account during the planning and execution of projects within UK waters. For the Marine Scheme these include the UK Marine Policy Statement (MPS) and the UK Marine Plans, specifically the Scottish National Marine Plan (Scottish Government, 2015), and the North East Inshore and North East Offshore Marine Plan[1] (HM Govenment, 2021) have a number of relevant policies specific to ornithology which are presented in EAR Volume 3 Appendix 3.1: Marine Plan Compliance Checklist**.**

A number of policies and laws require decision makers to consider the environmental impacts of a project. Legislation and policy relevant to the appraisal of Marine Scheme's effects on marine birds is presented in EAR Volume 3 Appendix 3.2: Topic Specific Legislation.

11.2.1 Guidance

The following guidelines have been considered within this chapter's appraisal methodology:

[1] The Marine Scheme falls entirely within the UK territorial waters (i.e. 12 NM), therefore within the Inshore portion of the North East marine area. The marine plan for the North East area has combined both inshore and offshore portions.

- Assessment guidance follows the Chartered Institute of Ecology and Environmental Management (CIEEM); and
- Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018, and updated September 2019).

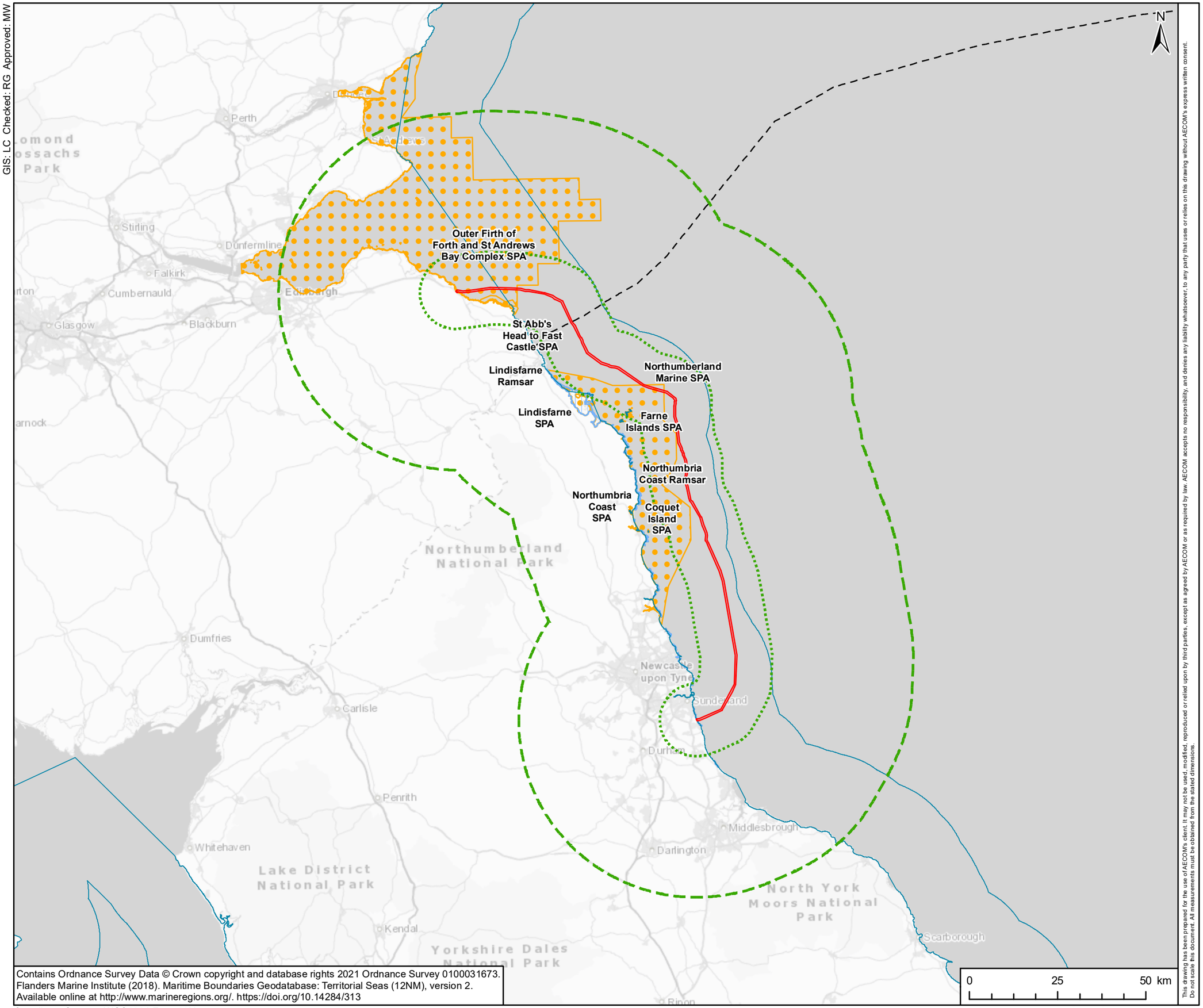
11.3 The Study Area

This chapter focuses on the marine area between MHWS at the Scottish landfall area at Thorntonloch Beach in East Lothian, and MHWS at the English landfall area at Seaham, County Durham. This includes any waterbirds (i.e. wading bird or waterfowl) using intertidal areas between MHWS and Mean Low Water Springs (MLWS) and marine birds (i.e. seabirds) which forage at sea and may be nesting on cliffs on the interface between the Marine Scheme and both the English and Scottish Onshore Schemes.

Recognising the highly mobile and wide-ranging nature of birds in the marine environment and the potential implications of local effects on wider populations, the study area used to identify important ornithological features encompasses all sites designated for birds with a marine component within a 10 km corridor centred on the marine installation corridor and selected sites beyond 10 km in recognition of the cited species' often extensive foraging ranges. This is informed by the breeding season foraging ranges presented in Table 11-5 and further detailed in EAR Volume 3 Appendix 8.2: Habitats Regulations Assessment Report. The appraisal will consider those species cited as a feature on the designation only if they have the potential to be present in the vicinity of the Marine Scheme. For example, wintering waterfowl and waders do not forage offshore, preferring to feed along the coast. Where such birds are important to sites in close proximity to the Marine Scheme, e.g. intertidal habitats, they will be included but for sites further afield, these species are screened out from further appraisal. The effects of the Scottish and English Onshore Scheme are discussed within the 'in-combination' effects section of Appendix 8.2: Habitat Regulations Assessment Report as required by the Conservation of Habitats and Species Regulations 2017 (as amended).

The Marine Scheme and the study area for the ornithology baseline are presented in Figure 11-1.

GIS: LC Checked: RG Approved: MW



Coordinate System: WGS1984 Zone 30N

Scale @ A3 1:1,000,000

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PROJECT

Scotland England Green Link 1 / Eastern Link 1

KEY

- Marine Installation Corridor
- UK Territorial Sea Limit - 12nm
- Scottish Adjacent Waters Boundary
- 10km Study Area
- 50km Study Area - Designated Sites Screening Distance
- Special Protection Area (SPA)
- Ramsar

TITLE

Figure 11-1
Marine Ornithology Study Area

REFERENCE

SEGL1_M_EAR_11-1_v1_20220309

SHEET NUMBER: 1 of 1

DATE: 09/03/2022

11.4 Approach to Appraisal and Data Sources

11.4.1 Appraisal Methodology

The environmental appraisal documented within this EAR follows the methodology as set out within Chapter 4: Approach to Environmental Appraisal. The identification and appraisal of effects and mitigation are based on expert judgments and following the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018, and updated September 2019). In order to do this, the potential magnitude of environmental feature sensitivity and potential effects have been assessed using the terminology outlined in Chapter 4.

A non-statutory Scoping Report, submitted to and consulted on by the Marine Management Organisation (MMO) and Marine Scotland Licensing Operations Team (MS-LOT) in 2021[2], identified aspects of the Marine Scheme that have the potential to impact marine birds during installation, operation (including maintenance and repair), and decommissioning (NGET & SPT, 2021).

11.4.2 Data Sources and Consultations

11.4.2.1 Data Sources

Baseline conditions have been established by undertaking a desktop review of published information and through consultation with relevant organisations. The data sources used to inform the baseline description and appraisal include:

- The Joint Nature Conservation Committee (JNCC) website for details of Special Protection Areas (SPAs) including site information and designation details;
- The British Trust for Ornithology (BTO) website for site specific data from the Wetland Bird Survey (WeBS), a partnership between the BTO, the Royal Society for the Protection of Birds (RSPB) and JNCC (the last on behalf of Natural England (NE), Natural Resources Wales (NRW), Scottish Natural Heritage (SNH) and the Department of the Environment Northern Ireland (DENI)) in association with the Wildfowl and Wetlands Trust (WWT);
- The Joint Nature Conservation Committee (JNCC) atlas of seabird distribution in north-west European waters (Stone, et al., 1995);
- Relevant Environmental Statements and associated appendices detailing the results of other project specific ornithological surveys, such as Berwick Bank Offshore Wind Farm (OWF). Details of relevant source material used are summarised later in Table 11-2;
- Seabird foraging ranges (Thaxter, et al., 2012; Woodward, et al., 2019); and
- FAME (Future of the Atlantic Marine Environment) and STAR (Seabird Tracking and Research) seabird tracking projects.

Consistent with the approach outlined during non-statutory Scoping, no specific marine ornithology surveys have been undertaken for the Marine Scheme; the availability of ornithology data within the North Sea region is considered sufficient to characterise the baseline relevant to the Marine Scheme[3]. This chapter draws on other surveys undertaken for the Project (i.e. the English Onshore Scheme and Scottish Onshore Scheme) at the landfalls, where relevant. Specific survey data used to inform this chapter can be found in the English Onshore Scheme Environmental Appraisal, Chapter 5: (Ecology & Biodiversity) and the Onshore Scottish Scheme: Eastern Link Converter Station and Cables EIA Report Chapter 9: Ecology and Ornithology.

[2] The non-statutory Scoping Report is publicly available on https://marine.gov.scot/sites/default/files/segl_el1_marine_scoping_report_-_base_report_rev_2.0.pdf

[3] The approach is considered proportionate, based on the potential impacts of the Marine Scheme as described in Section 11.6. There will be no direct mortality, e.g. through collision, nor displacement, avoidance or loss of foraging areas from permanent offshore structures. The approach is consistent with that generally required by statutory authorities when considering impacts of export cables from offshore wind farms and is therefore, considered sufficient to characterise the baseline for the Marine Scheme. Further to this the scope of the assessment methodology, including the approach to determining the baseline conditions, has been presented within the non-statutory Scoping Report and therefore, open to comment from consultees.

11.4.2.2 Summary of Consultations

Following the submission of the non-statutory Scoping Report in April 2021, the MMO, MS-LOT and respective consultees and advisers had the opportunity to express their opinions and provide feedback on the proposal and EAR scope, which has been considered in this chapter.

Further details of the consultation process and associated responses are presented in Chapter 6: Consultation and Stakeholder Engagement.

Table 11-1 summarises consultation responses received from relevant statutory and non-statutory consultees in relation to the scope of the ornithology appraisal for the Marine Scheme and outlines how and where this has been addressed in this chapter.

Table 11-1: Scoping Report Consultation

Consultee	Consultee response/ comment	How and where addressed
MS-LOT (Marine Scotland Science)	With respect to marine ornithology, MSS have considered the part of the project in Scottish Waters up to mean-high-water-springs, reviewing the scoping report and the comments from NatureScot (dated 30 May 2021). MSS are in agreement with NS that all relevant designated sites and potential impact pathways for ornithology features have been considered, however we would advise consideration of indirect effects to the foraging features of the Outer Firth of Forth and St. Andrews Bay Complex SPA via impacts to prey and supporting habitats. For example, sediment displacement and increased turbidity and subsequent prey availability, which is scoped in for example, at Lindisfarne SPA (see Appendix C, Table 1).	Noted. The potential indirect effects and impact pathways to relevant ornithological features of relevant designated sites are considered and detailed in Section 11.6.
MS-LOT (Marine Scotland Science)	MSS, in common with NS, agree with the sites with ornithology features scoped in for assessment. MSS support NS's suggestion that mitigation measures should be agreed for during pre-construction and construction for marine birds and sea ducks that are qualifying interests of SPAs. The key issue here is likely to be disturbance from vessel activity. NS advise that this include not steaming through rafts of birds, especially during the immediate post breeding dispersal periods of auks. NS identify this as being from mid-August to mid-September, however MSS note that this period may begin earlier, potentially from early July when fledging occurs for most auk species.	Noted. Mitigation measures in relation qualifying birds during pre-construction and construction are considered and detailed in Sections 11.7 and 11.9.
NatureScot	We are in broad agreement with the proposed approach for this chapter. However please note foraging birds from the coastal breeding sites are likely to be observed within the cable corridor and whist the pre-construction and construction activities are likely to be short term in nature. It is therefore worth identifying potential mitigation measures to be deployed such as vessels not steaming through rafts of birds, particularly in the immediate post breeding dispersal periods of auks (mid-August to mid-September)	Noted. Mitigation measures in relation qualifying birds are considered and detailed in Sections 11.7 and 11.9.
MMO	The proposed works are adjacent to Northumbria Coast Special Protected Area (SPA) and Northumbria Coast Ramsar at the	Noted. Sites where ornithological features are a component of the citation are

Consultee	Consultee response/ comment	How and where addressed
	landfall site of the cable. The indicative cable route is adjacent to Berwick and North Northumberland Coast Special Area Conservation (SAC), Durham Coast SAC, Tweed Estuary SAC and River Tweet SAC Lindisfarne SPA and Lindisfarne Ramsar, Coquet Islands SPA, Farne Island SPA, Northumbria Coast SPA, Northumbria Coast Ramsar. The indicative cable route is also within Northumberland Marine SPA. The MMO agree that these sites and their supporting features should be considered within the Environmental Appraisal Report.	considered in this chapter and Appendix 8.2 Habitats Regulations Assessment Report.

11.4.3 Data held by Other Schemes

Areas further offshore in the central North Sea are important as feeding and loafing areas, and as migration routes for a wide range of marine birds. A review of ornithological surveys and monitoring at OWFs and other subsea cable projects in the northern central North Sea and relevant to the Marine Project Scheme (i.e., within 50 km) was undertaken and the key species associated with these sites are provided in Table 11-2.

Table 11-2: Summary of key seabird and waterbird species recorded in the North Sea from Offshore Wind Farm schemes within 50 km of the Marine Scheme.

Scheme name	Proximity to the marine installation corridor	Most recent ornithological monitoring undertaken	Important ornithological features
Neart na Gaoithe OWF	Approximately 30 km to the north	• Ornithology Technical Report 2012 (Ecology, 2012)	Red-throated diver, northern fulmar *Fulmarus glacialis*, Manx shearwater, European storm-petrel *Hydrobates pelagicus*, gannet, cormorant, shag, eider, common scoter, Arctic skua *Stercorarius parasiticus*, great skua *Stercorarius skua*, little gull, black-headed gull, common gull, lesser black-backed gull *Larus fuscus,* herring gull, great black-backed gull *Larus marinus*, kittiwake, common tern, Arctic tern, guillemot, razorbill, puffin.
Berwick Bank OWF	Approximately 40 km to the north	• Berwick Bank Wind Farm Offshore Scoping report (RPS, 2020)	Guillemot, kittiwake, gannet, puffin and razorbill.
Blyth Offshore Demonstrator Phase 2 OWF	Approximately 40 km to the west	• Blyth Offshore Demonstration Project Phase 2 – Supporting Environmental Information (EDF Renewables, 2020) • Pre-construction surveys between March and October 2018.	The most common bird species identified included, guillemot, kittiwake, razorbill, herring gull and puffin.

Scheme name	Proximity to the marine installation corridor	Most recent ornithological monitoring undertaken	Important ornithological features
Inch Cape OWF	Approximately 50 km to the north	• Inch Cape Wind Farm EIA Chapter 11 Ornithology (Limited, 2018)	Gannet, puffin, razorbill, guillemot, kittiwake and herring gull.

11.4.4 Data Gaps and Limitations

The availability of ornithology data within the North Sea region is considered sufficient to characterise the baseline and as such, there is a good understanding of the existing environment. The approach to characterising the ornithological baseline is described in Section 11.3.2.1. As with all ecological data, there are, however some limitations to third party bird data, which form the basis of the baseline. This is primarily due to the highly mobile nature of bird species and the potential variability in usage of the area. The survey data often only provides a seasonal specific description of the composition, abundance and distribution of bird species; with a number of these factors expected to vary both within and between years. As a result, each survey contributing to the available library of research, realistically, only provides a snapshot.

11.5 Baseline Conditions

This section presents the ornithological baseline for the Marine Scheme.

This section describes and evaluates the importance of the Marine Scheme location and adjacent waters for breeding, migratory and over-wintering populations of seabirds and waterbirds using the intertidal area and offshore waters. Whilst it is recognised that the waters off the East Lothian and Durham coasts are important at different times of the year for a number of bird species, birds from designated sites represent priority populations which have been selected as requiring conservation measures and therefore represent birds of highest sensitivity and importance. This section therefore focuses on establishing how important the Marine Scheme is to bird species from potential and existing designated sites.

11.5.1 Relevant Designated Sites

The Marine Scheme passes directly through two sites internationally designated for the protection of seabirds:

- Outer Firth of Forth & St Andrews Bay Complex SPA as it leaves the Scottish landfall; and
- Northumberland Marine SPA for a short distance as the route passes Holy Island south of Berwick-upon-Tweed.

Details and reasons for both designations are summarised in the text below and in Table 11-3.

The Outer Firth of Forth and St Andrews Bay Complex SPA is an extensive site (2,720.68 km^2) off the south east coast of Scotland and complements adjacent SPAs, such as the Firth of Forth SPA, the Forth Islands SPA, the Imperial Dock, Leith SPA and the Firth of Tay and Eden Estuary SPA. The Marine Scheme runs through the SPA for approximately 17.2 km. It is designated for 21 seabird and waterbird species, including both breeding and overwintering species. The site harbours particularly large proportions of the GB populations for eider *Somateria mollissima mollisima* (35.9%), long-tailed duck *Clangula hyemalis* (17.7%), velvet scoter *Melanitta fusca* (23.2%), common tern *Sterna hirundo* (8.8%, breeding) and puffin *Fratercula arctica* (5.3%). A seabird assemblage of 40,000 seabirds also forms a qualifying feature of the site. The SPA also includes the marine foraging grounds for breeding populations of seabirds including common tern *Sterna hirundo*, Arctic tern *Sterna paradisaea* and shag *Phalacrocorax aristotelis* nesting in SPA colonies within the Outer Firth of Forth and St Andrews Bay Complex SPA.

The Northumberland Marine SPA is located off the north-east coast of England. The Marine Scheme runs through the SPA for a distance of approximately 6.3 km and elsewhere, is parallel to the eastern

boundary of the SPA (approximately 600 m at the closest points which are east of Seahouses and Amble on the Northumberland coast). This site is designated for a range of breeding birds, including Arctic tern, common tern, guillemot *Uria aalge*, little tern *Sternula albifrons*, puffin, roseate tern *Sterna dougallii* and Sandwich tern *Thalasseus sandvicensis*. A wider seabird assemblage (breeding) also forms part of the designation.

Table 11-3: Sites designated for ornithology with overlapping boundaries to the Marine Scheme

Designated site (country)	Reason for designation
Outer Firth of Forth and St Andrews Bay Complex SPA (Scotland)	**Non-breeding waterfowl (Annex I)** • Red-throated diver *Gavia stellata* • Slavonian grebe *Podiceps auratus* **Non-breeding waterfowl (Migratory)** • Eider • Long-tailed duck • Common scoter *Melanitta nigra* • Velvet scoter • Goldeneye *Bucephala clangula* • Red-breasted merganser *Mergus serrator* Non-breeding seabird (Annex I) • Little gull *Larus minutus* Non-breeding seabird (Migratory) • Guillemot • Herring gull *Larus argentatus* • Razorbill *Alca torda* • Shag *Phalacrocorax aristotelis* • Common gull *Larus canus* • Black-headed gull *Chroicocephalus ridibundus* • Kittiwake *Rissa tridactyla* Seabird assemblage of more than 20,000 seabirds in the non-breeding season (Article 4.2) **Breeding seabird (Annex I)** • Common tern • Arctic tern Breeding seabird (Migratory) • Shag • Gannet *Morus bassanus* • Puffin • Kittiwake • Manx shearwater *Puffinus puffinus* (present during breeding season, but not breeding) • Guillemot • Herring gull Seabird assemblage of more than 20,000 seabirds in the breeding season.
Northumberland Marine SPA (England)	**Breeding seabird (Annex I)** • Common tern • Arctic tern • Little tern • Roseate tern • Sandwich tern Breeding seabird (Migratory) • Puffin • Guillemot Seabird assemblage of more than 20,000 seabirds in the breeding season.

In addition to this, the following sites designated for the protection of marine and coastal birds are located within the study area (Natural England, 2018):

- St Abb's Head to Fast Castle SPA;
- Lindisfarne SPA / Ramsar site / SSSI;
- Northumbria Coast SPA / Ramsar site, including Durham Coast SSSI;
- Farne Islands SPA / SSSI; and
- Coquet Island SPA / SSSI.

Despite the fact that a number of these sites fall outside the 10 km study area, due to the highly mobile and transient nature of birds in the marine environment it is possible the qualifying features of these sites could interact with the Marine Scheme. Relevant species associated with these sites are, therefore, considered within this appraisal, however, this is set against the context of the project related impact pathways[4].

Details of these designated sites are provided in Table 11-4. The potential for bird species cited within these designations to occur within the marine installation corridor is also considered.

Table 11-4: Sites designated for ornithology within the study area

Designated site (country)	Reason for designation	Relationship to the Marine Scheme and potential for cited qualifying species to occur within the marine installation corridor
St Abb's Head to Fast Castle SPA (including its marine extension; Scotland)	Breeding seabirds • Razorbill • Guillemot • Kittiwake • Herring gull • Shag Seabird assemblage of more than 20,000 seabirds in any season.	The marine installation corridor is approximately 2 km to the north-east of the St Abb's Head to Fast Castle SPA. Given, the marine installation corridor overlaps with the Outer Firth of Forth and St Andrews Bay Complex SPA boundary, which in part is designated for the protection of important foraging areas for seabirds associated with the St Abb's Head to Fast Castle SPA, the marine installation corridor has the potential to support the breeding seabirds cited on the designation.
Lindisfarne SPA / Ramsar site (England)	**Non-breeding waterbird (Migratory)** • Bar-tailed godwit *Limosa lapponica* • Common scoter • Dunlin *Calidris alpina alpina* • Eider • Golden plover *Pluvialis apricaria* • Grey plover *Pluvialis squatarola* • Greylag goose *Anser anser* • Light-bellied Brent goose *Branta bernicla hrota* • Long-tailed duck • Red-breasted merganser • Redshank *Tringa totanus* • Ringed plover *Charadrius hiaticula* • Sanderling *Calidris alba* • Shelduck *Tadorna tadorna* • Pink-footed goose *Anser brachyrhynchus* • Whooper swan *Cygnus cygnus*	The marine installation corridor is approximately 9.2 km to the east of the Lindisfarne SPA / Ramsar site. Given, the marine installation corridor overlaps with the Northumberland Marine SPA boundary, which in part is designated for the protection of important foraging areas for terns associated with the Lindisfarne SPA / Ramsar site, the marine installation corridor has the potential to support the breeding terns cited on the designation. Given, that the area in which the Northumberland Marine SPA overlaps with the marine installation corridor is in waters approximately 9.2 km east of the Lindisfarne SPA / Ramsar site, the remaining species (non-breeding waterbirds) cited on the designation are not ecologically dependent

[4] It is widely understood and accepted that there are limited impact pathways for significant impacts associated with the installation of a subsea cable. This is largely due to the fact that vessel movements and installation activities present a very small source of potential disturbance against the context of a largely open and unrestricted marine environment, as well as the highly-mobile and transient nature of marine birds.

Designated site (country)	Reason for designation	Relationship to the Marine Scheme and potential for cited qualifying species to occur within the marine installation corridor
	• Wigeon *Anas penelope* **Breeding seabird (Annex I)** • Little tern • Roseate tern Seabird assemblage of more than 20,000 seabirds in any season.	upon the offshore marine environment and are not considered to be present within the marine installation corridor.
Northumbria Coast SPA / Ramsar site (England), including the Durham Coast SSSI (component site of the Northumbria Coast SPA)	**Non-breeding waterbird (Migratory)** • Purple sandpiper *Calidris maritima* • Turnstone *Arenaria interpres* **Breeding seabird (Annex I)** • Arctic tern • Little tern	The marine installation corridor is approximately 420 m to the east and north of the Northumbria Coast SPA / Ramsar site. Given, the marine installation corridor overlaps with the Northumberland Marine SPA boundary, which in part is designated for the protection of important foraging areas for terns associated with the Northumbria Coast SPA / Ramsar site, the marine installation corridor has the potential to support the breeding terns cited on the designation. Purple sandpiper and turnstone associated with the Northumbria Coast SPA / Ramsar site have the potential to be present within the marine installation corridor between MHWS and MLWS at the landfall location at Seaham, which sits between the component sections of the Northumbria Coast SPA / Ramsar site.
Farne Islands SPA (England)	**Breeding seabird (Annex I)** • Arctic tern • Roseate tern • Common tern • Sandwich tern Breeding seabird (Migratory) • Guillemot. Seabird assemblage of more than 20,000 seabirds in any season.	The marine installation corridor is approximately 7.1 km to the east of the Farne Islands SPA. Given, the marine installation corridor overlaps with the Northumberland Marine SPA boundary, which in part is designated for the protection of important foraging areas for terns and seabirds associated with the Farne Islands SPA, the marine installation corridor has the potential to support the breeding terns and seabirds cited on the designation.
Coquet Island SPA (England)	**Breeding seabird (Annex I)** • Arctic tern • Roseate tern • Common tern • Sandwich tern Seabird assemblage of more than 20,000 seabirds in any season.	The marine installation corridor is approximately 14.6 km to the east of Coquet Island SPA. Given, the marine installation corridor overlaps with the Northumberland Marine SPA boundary, which in part is designated for the protection of important foraging areas for terns associated with Coquet Island SPA, the marine installation corridor has the potential to support the breeding terns cited on the designation.
Berwick to St Mary's MCZ (England)	Breeding and non-breeding Eider	The marine installation corridor is, at its closest, approximately 1.4 km to the north and east of the Berwick to St Mary's MCZ. It is unlikely that Eider regularly occur within the marine installation corridor given that water depths are greater than that typically known to be within the diving range for feeding (<15 m).

11.5.2 Breeding seabirds

The study area is located in waters which may be used by foraging seabirds from the designated sites listed in Section 11.5.1. The mean maximum breeding season foraging ranges of seabirds present in these designated sites are presented in Table 11-5 (Woodward, et al., 2019).

Table 11-5: Indicative breeding season foraging ranges for qualifying bird species designated for their breeding population.

Qualifying Bird Species	Mean Maximum Foraging Range (km ± SD) (Woodward, et al., 2019)
Arctic tern	25.7 ± 14.8
Puffin	137.1 ± 128.3
Black-headed gull	18.5
Kittiwake	156.1 ±144.5
Guillemot	73.2 ± 80.5
Common gull	50
Common tern	18.0 ± 8.9
Shag	13.2 ± 10.5
Herring gull	58.8 ± 26.8
Little tern	5
Manx shearwater	1,346.8 ±,1,018.7
Gannet	315.2 ± 194.2
Razorbill	88.7 ± 75.9
Roseate tern	12.6 ± 10.6
Sandwich tern	34.3 ± 23.2

It is also recognised that seabirds from other SPA colonies may also occur in the 10 km study area, 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, et al., 1994) and overall, foraging density of gannet declines with distance from the colony (Camphuysen, 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 west into the Atlantic or eastwards 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.

The Outer Firth of Forth and St Andrews Bay Complex SPA has the largest concentration of common tern in Scotland and during the breeding season, provides feeding grounds for a large assemblage of over 100,000 seabirds, including common tern and Arctic tern. Within the Outer Firth of Forth and St Andrews Bay Complex SPA breeding colonies for Arctic tern and common tern exist on the Isle of May

(for Arctic Tern) and Long Craig (for both Arctic tern and common tern). Foraging areas for the breeding colony of these species were modelled to inform the extension of the SPA boundary in marine areas to protect key foraging areas (Wilson, et al., 2014) . The predicted usage was greatest in the vicinity of the common tern and Arctic tern colonies, with usage predicted to decrease with distance offshore (Figure 11-2). However, the study area overlaps the outer extents of the potential foraging range for both Arctic and common tern associated with the Outer Firth of Forth and St Andrews Bay Complex SPA.

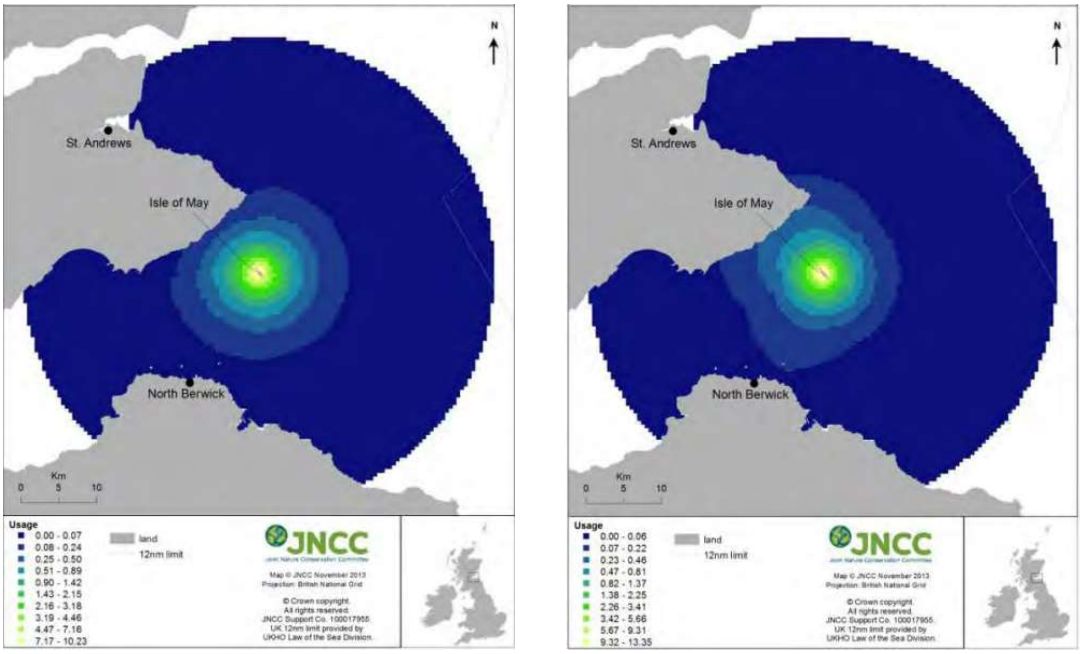

Figure 11-2: Predicted habitat usage by Arctic terns (left) and common terns (right) foraging around the Firth of Forth Islands SPA (Wilson, et al., 2014)

The Northumberland Marine SPA supports important foraging areas for breeding populations of Arctic tern, common tern, little tern, roseate tern and Sandwich tern associated with the Lindisfarne SPA, Farne Islands SPA and Croquet Island SPA. The overall boundary of the Northumberland Marine SPA encompasses these existing SPAs.

Foraging areas for the breeding colony of Arctic tern, common tern and Sandwich tern were modelled to inform the extension of the Farne Islands SPA boundary in marine areas to protect key foraging areas. The predicted usage for Arctic tern, common tern and Sandwich tern was greatest in the vicinity of the colony, with usage predicted to decrease with distance offshore (Figure 11-3) (Wilson, et al., 2014), however, the study area does overlap with the predicted foraging areas of Arctic tern, common tern and Sandwich tern associated with the Farne Islands SPA, and subsequently the Northumberland Marine SPA.

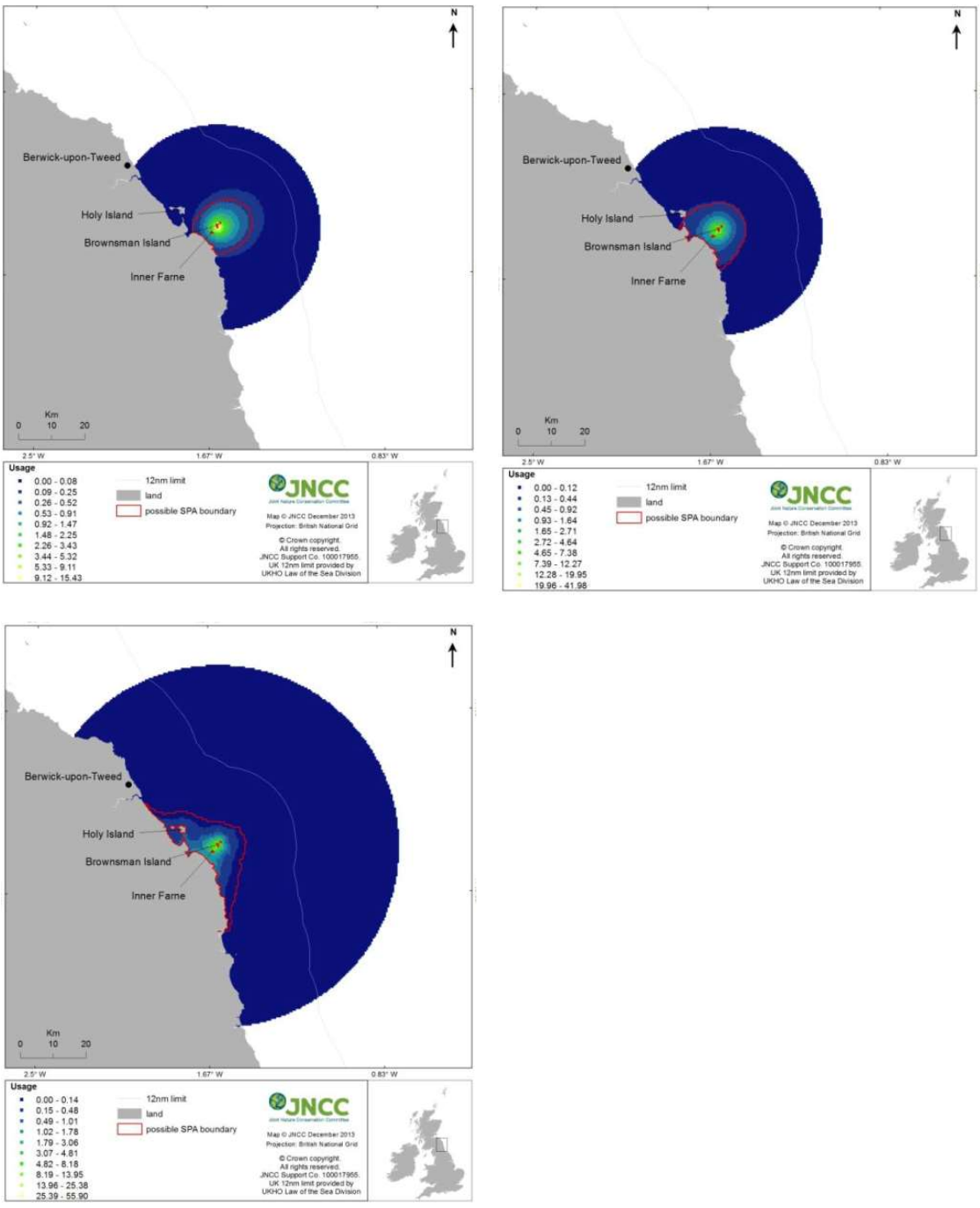

Figure 11-3: Predicted habitat usage by Arctic terns (top-left), common terns (top-right) and sandwich terns (bottom-left) foraging around the Farne Islands SPA (Wilson, et al., 2014)

Little tern is the smallest commonly breeding tern in Britain and has the most limited foraging range (see Table 11-5). Breeding occurs in scattered colonies along much of the east and west coasts of Britain, from the north of Scotland to (and including) the south coast of England (Mitchell, et al., 2004). All British little tern nest on the coast, utilising sand and shingle beaches and spits, as well as tiny islets of sand or rock close inshore (Mitchell, et al., 2004). Shore-based surveys of little tern SPA colonies within several SPAs along the coast including Long Nanny at Northumbria Coast SPA and Lindisfarne SPA, were undertaken to inform the extension of these SPAs to protect tern foraging areas. A specific foraging extent for the Northumberland Marine SPA as a whole is not currently available however, the alongshore and seaward foraging extents and values for Northumbria Coast SPA and Lindisfarne SPA (both of these SPA boundaries overlap within the Northumberland Marine SPA boundary) are shown in

Figure 11-4 and Figure 11-5, respectively. These foraging areas for little tern within the Northumberland Marine SPA (and more specifically the Northumbria Coast SPA and Lindisfarne SPA therein) do not extend into the marine installation corridor as shown in Figure 11-1.

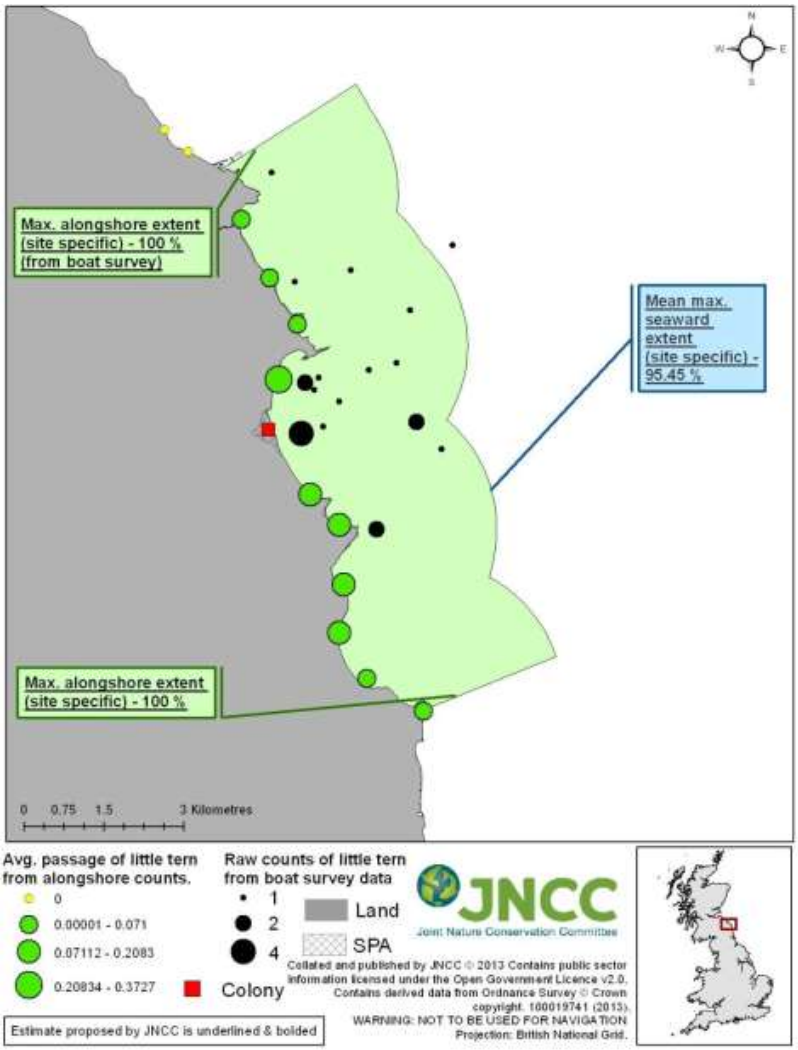

Figure 11-4: Alongshore and specific seaward extents to define boundaries to little tern foraging areas at Northumbria Coast SPA (Natural England, 2015).

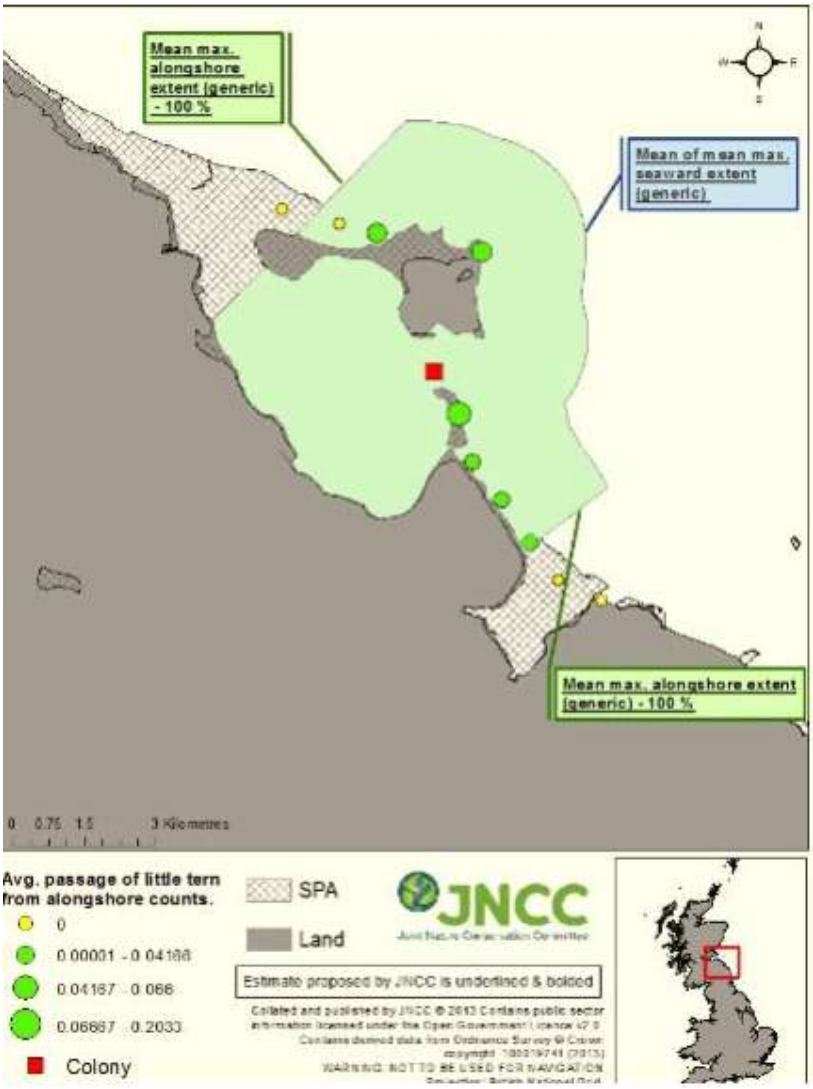

Figure 11-5: Alongshore and generic seaward extents to define boundaries to little tern foraging areas at Lindisfarne SPA (Natural England, 2015).

A summary of foraging seabirds identified from the data sources set out in Section 11.4.2.1 as likely to be present within the study area during the breeding season is provided in Table 11-6.

Table 11-6: Presence and seasonal distribution of seabirds within the study area during the breeding season

Receptor	Summary of Data Relevant to the study area	Presence in the study area and marine installation corridor
Puffin	Within the Firth of Forth the species is concentrated around the Isle of May, with foraging extending west into the Firth of Forth, north to St Andrews Bay and east into the North Sea (SNH & JNCC, 2016). The largest puffin colony in England is on the Farne Islands and while the Coquet Island SPA is not designated for puffin, this island now holds the second largest colony in England. Puffin feed primarily on small pelagic fish around 2 to 6 inches long (e.g. sandeel *Ammodytidae*, sprat *Sprattus sprattus*, and herring *Clupea harengus*). During the breeding season, they forage in shallow waters close to the breeding colony.	Yes. The marine installation corridor does not represent key foraging areas for puffin, although the foraging distances for the species could potentially mean that the species does occur, particularly where the marine installation corridor overlaps with the Outer Firth of Forth and St Andrews Bay Complex SPA and Northumberland Marine SPA. However, numbers are likely to be low and occurrence sporadic. The breeding season is between April and late July with the peak breeding activity being in May and June, with numbers declining from July onwards as nest sites are abandoned. Widely distributed throughout the study area all year, but highest numbers present close to nesting colonies between April and July.
Kittiwake	Kittiwake is a qualifying feature of the St Abb's Head to Fast Head SPA, as well as part of the seabird assemblage for the Farne Islands SPA and Coquet Island SPA where they nest on sea cliffs. Smaller colonies are also present at other locations, e.g. along the River Tyne. The species forages widely throughout the Outer Firth of Forth and St Andrews Bay Complex SPA and Northumberland Marine SPA (SNH & JNCC, 2016, NE, 2015). Prey species include capelin *Mallotus villosus*, herring, sprat and sand eel and have been known to take crustaceans such as shrimps.	Yes. Kittiwake are likely to be present throughout the marine installation corridor, albeit, likely in low numbers. The areas where there may be more frequent occurrence are sections of the marine installation corridor which run closer to nesting colonies, such as St Abb's Head and the Farne Islands and Coquet Island. Widely distributed throughout the study area all year, but particularly between May and August.
Guillemot	The largest colonies of over 10,000 individuals are found from Northumberland and northwards up the east coast of Scotland, with important in the Firth of Forth, St Abb's Head and the Farne Islands (SNH & JNCC, 2016, NE, 2015). Prey species predominantly consist of sandeel and clupeids *Clupeidae* spp. Highest numbers recorded in the spring and early summer	Yes. Guillemot are likely to be present throughout the marine installation corridor, albeit, likely in low numbers. The areas where there may be more frequent occurrence are sections of the marine installation corridor which run closer to nesting colonies, such as St Abb's Head and the Farne Islands. Present from April/May with numbers declining from July onwards as nest sites are abandoned. Widely distributed throughout the study area all year, but particularly between April and July.
Shag	The foraging areas of breeding shag in the Outer Firth of Forth and St Andrews Bay Complex are determined by location of the breeding colonies of which the colony on the Isle of May is the largest (SNH & JNCC, 2016). Although shag do forage up to a maximum of approximately 17 km from their colony (Thaxter *et al.* 2012) tracking studies of birds from the Isle of May show that these birds feed within the Firth of Forth with few moving more than 12km (Bogdanova *et al.* 2013).	Yes. The section of the Outer Firth of Forth and St Andrews Bay Complex SPA which overlaps the marine installation corridor is outside the core areas which are understood to be used by foraging shag breeding in the SPA. Notwithstanding, given that the St Abb's Head to Fast Castle SPA is well within the foraging distance for the species, shag are likely to be present within the marine installation corridor, albeit in low numbers.

Receptor	Summary of Data Relevant to the study area	Presence in the study area and marine installation corridor
	The Farne Islands SPA also supports breeding Shag, but not in sufficient numbers to meet criteria for SPA designation (NE, 2015). Studies of the foraging ecology of the Farne Islands shag colony suggest foraging generally took place within the nearshore areas and around the islands (Morgan, 2017) Shag 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.	Along the rest of the marine installation corridor it is unlikely that shag are present and if they are, e.g. where the marine installation corridor overlaps the Northumberland Marine SPA, then numbers are likely to be low and occurrence sporadic. The species is predominantly present between November and June, although recorded throughout the year, but likely to be present in higher numbers within the study area nearest its breeding colonies.
Herring gull	A qualifying feature of the Outer Firth of Forth and St Andrews Bay Complex SPA in Scotland. Opportunistic feeder, taking fish, crustaceans, young birds and even garbage. Recorded throughout the year.	Yes. Present all year round, but likely to be present in higher numbers within the study area and marine installation corridor where it approaches coastal areas. The offshore areas of the marine installation corridor are unlikely to support significant numbers of foraging herring gull.
Manx shearwater	During the breeding season the Outer Firth and forth and St. Andrews Bay Complex SPA provides foraging grounds for this species. They feed at the sea-surface, either making plunge dives from a height of 1-2 m, or making shallow, wing-propelled dives to catch prey items. Prey species include herring, sardine *Sardina pilchardus* and sprat plus sometimes squid.	Yes. Low numbers likely to be present throughout the study area and marine installation corridor between May and August.
Gannet	The nearest gannet colony is the Bass Rock colony located approximately 19 km north of the Marine Scheme, although small numbers (<5 pairs) nest at St. Abbs Head. Recent surveys carried out on this colony showed that gannets dispersed widely around the Bass Rock colony to forage, with high densities concentrated in the outermost Firth of Forth, including the south-eastern boundary of the Outer Firth and forth and St. Andrews Bay Complex SPA, where the marine installation corridor overlaps the SPA boundary. Lower densities were recorded over vast areas 100–450 km from Bass Rock (SNH & JNCC, 2016). The majority of gannet recorded during the surveys were during the summer (June -August) (Camphuysen, 2011). Gannet are pelagic feeders, foraging primarily on lipid-rich pelagic fish up to 30 cm in length such as mackerel *Scomber scombrus*, herring and sandeel.	Yes. Likely to be present throughout the northern sections of study area and marine installation corridor between April and September with highest numbers between June and August and likely only sporadic presence between October and March.
Razorbill	Within the Firth of Forth the species is concentrated around the Isle of May, with foraging extending west into the Firth of Forth, north to St Andrews Bay and east into the North Sea (SNH & JNCC, 2016). Breeding begins in late April with a peak in mid-May. Prey species predominantly consists of sandeel. Highest numbers recorded in the	Yes. The marine installation corridor does not represent key foraging areas for razorbill, although the foraging distances for the species could potentially mean that the species does occur, particularly where the marine installation

Receptor	Summary of Data Relevant to the study area	Presence in the study area and marine installation corridor
	spring and early summer. They feed mainly on small fish (e.g. sandeel, herring, sprat, cod *Gadus morhua*)	corridor overlaps with the Outer Firth of Forth and St Andrews Bay Complex SPA and Northumberland Marine SPA. However, numbers are likely to be low and occurrence sporadic.
Eider	The coastline between Berwick and St. Mary's supports nationally important numbers of breeding and non-breeding Eider, with core breeding sites being the Farne Islands and Coquet Island. The Berwick to St Mary's MCZ has been designated to protect the areas on which Eider are ecologically dependent.	No. Within the study area, the marine installation corridor does not represent key foraging areas for Eider, with water depths greater than that typically used by the species for feeding, i.e. <15 m. Nor is it in proximity to identified nesting locations identified in the MCZ designation. At a distance of approximately 1.4 km (at its closest point) from the MCZ, the sensitivity of the species to installation vessel traffic[5] is unlikely to result in disturbance and/or displacement at this distance.

[5] MMO (2018) suggest that Eider are less sensitive to disturbance and/or displacement from vessel activity than species such as Common Scoter and Red-throated Diver, with displacement ranges being no greater 1 km in studies reported and some evidence to suggest habituation to boat traffic in some areas.

11.5.3 Non-breeding waterbirds

Red-throated diver and Slavonian grebe are Annex I species designated as qualifying species of the Outer Firth of Forth and St Andrews Bay Complex SPA which overlaps with the northern section of the marine installation corridor east of the landfall at Thorntonloch. Red-throated diver and other migratory non-breeding waterbirds protected as qualifying features for this site, such as eider, common scoter, red-breasted merganser and little gull move to coastal areas in winter from their breeding sites.

Red-throated diver, Slavonian grebe and red-breasted merganser 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 and eider feed almost exclusively on molluscs and small crustaceans, diving from the surface to pluck their prey from the seabed. Diving activity varies among species, but average foraging dive depths are shallower than 15 m.

Red-throated diver arrive in UK coastal waters in September and decline in numbers in February, although the main period of occurrence in coastal offshore waters is from October to March (Natural England, 2016). Red-throated diver along with eider, common scoter and red-breasted merganser 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. Aerial surveys used to assess populations of waterbirds in association with the Outer Firth of Forth and St Andrews Bay Complex SPA, showed that the highest densities of red-throated Diver were concentrated around the Firth of Tay estuary with the inshore waters surrounding the Firth of Forth estuary area also supporting high densities of this species (Natural England, 2016). The remaining coast and waters further offshore, had very low densities of red-throated diver, close to or equal to 0 individuals / km^2.

Slavonian grebe arrive in UK waters in March and within the Outer Firth of Forth and St Andrews Bay Complex SPA, peak numbers are between January and March (Evans, 2000). Shore-based surveys show that the Outer Firth of Forth and St Andrews Bay Complex SPA supports one of only two notable concentrations of Slavonian grebe in the east of Scotland (an average of 30 birds) (Natural England, 2016). They occurred in both of the major (Natural England, 2016) estuaries of the Firths but were far more abundant in the Forth. The largest known wintering population of Little Gull in Scotland is in the Outer Firth of Forth and St Andrews Bay Complex SPA. This little gull population was recorded in large numbers (over 300 individuals) during aerial surveys for wintering waterfowl (2003-2004) with the highest density of this species located in the central Firth of Forth, outside of the study area (Natural England, 2016).

Shore based counts have shown that the Outer Firth of Forth and St Andrews Bay Complex SPA supports one of only two large (>1,500 birds) common scoter populations on the east coast of Scotland and it is also one of the most important sites for red-breasted merganser, velvet scoter and goldeneye in Great Britain.

The highest densities of common scoter, red-breasted merganser and velvet scoter are concentrated around the St. Andrews Bay with the inshore waters of the Firth of Forth estuary also supporting high densities of these species (including goldeneye), however the areas where high densities of these species occur do not extend into the study area (Natural England, 2016).

Marine surveys showed that during the non-breeding season guillemot were found throughout the North Sea although there was a clear abundance offshore of the large Scottish east coast colonies from the Scottish Borders to Caithness. During winter a regular aggregation of guillemot (more than 2,000 individuals) occurs in much the same areas of the Outer Firth of Forth and St Andrews Bay Complex SPA as gannet and puffin during the breeding season and this non-breeding population therefore extends into the Survey Area (Natural England, 2016).

The presence of non-breeding waterbirds within the study area is summarised in Table 11-7.

Table 11-7: 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 and marine installation corridor
Red-throated diver	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering red-throated diver, with the species favouring the shallower waters of the inner Firth of Forth and Firth of Tay and not noted in significant numbers elsewhere within the study area.
Slavonian grebe	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering Slavonian grebe, with the species favouring the coastal waters of the inner Firth of Forth and not noted in significant numbers elsewhere within the study area.
Eider	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016). The species is likely to occur throughout the Berwick to St Mary's MCZ.	No. The marine installation corridor does not represent key foraging areas for non-breeding eider, with the species favouring the coastal waters of the inner Firth of Forth and Firth of Tay and Berwick to St Mary's MCZ. Eider are not noted in significant numbers elsewhere within the study area.
Long-tailed duck	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering long-tailed duck, with the species favouring the coastal waters of the inner Firth of Forth and Firth of Tay. Long-tailed duck are not noted in significant numbers elsewhere within the study area.
Common scoter	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering common scoter, with the species favouring the coastal waters of the inner Firth of Forth and Firth of Tay. Common scoter are not noted in significant numbers elsewhere within the study area.
Velvet scoter	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering velvet scoter, with the species favouring the coastal waters of the inner Firth of Forth and Firth of Tay. Velvet scoter are not noted in significant numbers elsewhere within the study area.
Goldeneye	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the inshore waters of the Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering goldeneye, with the species favouring the coastal waters of the inner Firth of Forth and not noted in significant numbers elsewhere within the study area.
Red-breasted merganser	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated around the Firth of Tay estuary and the inshore waters of the	No. The marine installation corridor does not represent key foraging areas for overwintering red-breasted merganser, with the species favouring the coastal waters of the inner Firth of

Receptor	Summary of data relevant to the study area	Presence in the study area and marine installation corridor
	Firth of Forth estuary (SNH & JNCC, 2016).	Forth and Firth of Tay. Red-breasted merganser are not noted in significant numbers elsewhere within the study area.
Little gull	Within the Outer Firth of Forth and St Andrews Bay Complex SPA the species is concentrated in the central Firth of Forth estuary (SNH & JNCC, 2016).	No. The marine installation corridor does not represent key foraging areas for overwintering little gull, with the species favouring the central Firth of Forth. Little gull are not noted in significant numbers elsewhere within the study area.
Non-breeding seabirds, including guillemot, gulls and other auks	Widely distributed throughout the Outer Firth of Forth and St Andrews Bay Complex SPA, but with concentrating overlapping with the waterbirds listed above.	Yes. The marine installation corridor is unlikely to represent key foraging areas for the non-breeding seabirds, but low numbers are likely to be encountered sporadically through the study area and across the marine installation corridor.

11.6 Appraisal of Potential Impacts

This section discusses the potential effects of the Marine Scheme on the important ornithological receptors identified in Table 11-7 and Table 11-8 during installation, operation (including maintenance and repair), and decommissioning phases of the Marine Scheme as presented in Chapter 2: Project Description.

The appraisal has been undertaken in accordance with the methodology presented in Chapter 4: Approach to Environmental Appraisal. A summary of the potential effects provided in Table 11-8.

Table 11-8: Potential effects of the Marine Scheme to ornithology receptors

Phase	Activities	Receptor[6]	Potential Effect
Installation phase	Route preparation and cable installation	Puffin Kittiwake Guillemot Shag Herring gull Manx shearwater Gannet Razorbill	Temporary physical disturbance and displacement of species associated with sound, visual effects and presence from vessel and construction activity
		Puffin Kittiwake Guillemot Shag Herring gull Manx shearwater Gannet Razorbill	Disturbance to seabed resulting in changes in prey availability
		Puffin Kittiwake Guillemot Shag Herring gull Manx shearwater Gannet Razorbill	Alteration of water quality due to increased suspended sediment concentrations (SSC), unplanned releases, accidental leaks and spills from vessels and plant

[6] Includes both breeding and non breeding assemblages.

Phase	Activities	Receptor[6]	Potential Effect
Operation (including maintenance and repair) phase	Maintenance and cable repair	Puffin Kittiwake Guillemot Shag Herring gull Manx shearwater Gannet Razorbill	The potential effects of maintenance and cable repair will result in low level temporary disturbance and will be less than route preparation and cable installation in all but worst case scenario of full removal, which will be the same or similar.
Decommissioning phase	Decommissioning works	Puffin Kittiwake Guillemot Shag Herring gull Manx shearwater Gannet Razorbill	Potential effects will be less than route preparation and cable installation for all but worst case scenario of full removal.

11.6.1 Embedded Mitigation

The following mitigation has been built into the Marine Scheme to avoid and minimise effects to the environment, including marine ornithological receptors, and is presented in Table 11-9. This mitigation has been developed with consideration of consultee comments and will be either incorporated into the consented scheme design and construction programme or secured via consent condition through the marine licence issued by MS-LOT and MMO in Scotland and England respectively:

Table 11-9: Ornithology Embedded Mitigation

Measure	Description
Pre-installation Phase	
Construction Environmental Management Plan (CEMP)	A CEMP, including an Emergency Spill Response Plan, Waste Management Plan, Marine Mammal Protection Plan, Fisheries Liaison and Co-existence Plan and Fisheries Management and Mitigation Strategy will be developed prior to commencement of works.
Legislative requirements and mitigation for vessels	• All vessels will follow the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and International Convention for the Safety of Life at Sea 1974 (SOLAS)
Route preparation works	Route preparation works would be carried out as locally as possible to minimise disturbance to sensitive habitats potentially suitable for ornithological receptors.
Installation Phase	
Biodegradable drilling fluids	Drilling fluids used will be biologically inert and will be selected from the Centre from Environment, Fisheries, and Aquaculture Science (Cefas) approved list of drilling fluids, and the OSPAR List of Substances/Preparations Used and Discharged Offshore which are Considered to Pose Little or No Risk to the Environment (PLONOR). During drilling, drilling fluids will be recycled, treated, and reused, and any waste drilling fluid will be transported offsite for treatment and disposal.
Transiting vessels to move at low speeds	For cable installation works, where the marine installation corridor passes through the Outer Firth of Forth & St Andrews Bay Complex SPA as it leaves the Scottish landfall and the Northumberland Marine SPA for a short distance off Holy Island south of Berwick-upon-Tweed, a commitment will be included with the CEMP, 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. This is especially important during the immediate post breeding dispersal periods of auks from early July to mid-September.

11.6.2 Installation Phase

11.6.2.1 Temporary physical disturbance and displacement of species associated with sound, visual effects and presence from vessel and construction activity

Various activities associated with the route preparation and cable installation phases of the Marine Scheme may result in disturbance and displacement of ornithological receptors. The main disturbing activities are likely to be those associated with:

- Horizontal Directional Drilling (HDD) and cable pulls at the landfalls in Scotland and England, including physical presence of vessels and disturbance associated with works;
- Route preparation activities, including, ploughing, de-trenching of out of service cables by grapnelling, pre-lay grapnel runs, pre-sweeping, cable burial and rock placement; and
- Subsea cable laying including physical presence of vessels and disturbance associated with works.

HDD installation of the cables at landfall will be employed. This installation method does not require any trenching works in the intertidal zone (between MHWS and MLWS). HDD work may take up to six months to complete at each landfall, with several vessels potentially required to install the cables, including a cable laying vessel (CLV), cable laying barge (CLB), jack-up rig. Details of potential vessel resources are provided in the Chapter 2: Project Description.

Installation will be a 24-hour operation to minimise overall installation time, maximise use of fair-weather windows, and take advantage of vessel and equipment availability. The CLV and / or CLB may be supported by vessels including guard and anchor handling vessels.

Prior to installation of the cables a series of route preparation activities are likely to be undertaken. These are described in more detail in Chapter 2: Project Description and will require the presence of vessels in the marine installation corridor.

Installation of subsea cables may utilise the following methods:

- Simultaneous cable lay and burial; and
- Surface cable lay followed by post lay burial (PLB) of the cables.

During simultaneous cable lay and burial the CLV may also deploy the burial equipment, or it may be deployed by another vessel following less than 1 km behind the CLV, creating a single large group of vessels and equipment. 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.

When surface cable lay is followed by PLB of the cable, the two parts of the operation are discrete operations, separated in distance and time. There may be significant physical distance and time between the surface lay of the CLV and the following burial vessel. The CLV can progress at speeds of up 7 km per day, with the burial vessel following behind more slowly. Further details of indicative vessel speeds are provided in Chapter 2: Project Description.

Between two and four cable laying campaigns may be required, the duration of each related to the cable carrying capacity of the CLV or CLB, and coordination with other activities such as HDD at the landfalls. In total it is anticipated that the campaigns will consist of vessels being present for 176 days during a two-year installation period. There may be three months between installation campaigns, and campaigns will avoid the winter months.

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, et al., 2010). Some seabirds are more resilient to

disturbance and / or displacement than others (MMO, 2018). Furness and Wade (2012) have assessed the vulnerability of seabird populations to offshore wind farms and as part of that study ranked species of concern in the context of disturbance and, or displacement from habitat (incorporating disturbance by ship and helicopter traffic, habitat flexibility and conservation importance). Bradbury (2014) provided an update to the Furness and Wade (2012) paper to consider seabirds in English waters. The *Joint Natural England and JNCC and NE Interim Advice Note: Presenting information to inform assessment of the potential magnitude and consequences of displacement of seabirds in relation of Offshore Windfarm Developments* (Joint Natural England & JNCC, 2017) provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from OWFs. This concludes that 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 at up to 4 km.

The disturbance profile of cable installation activities for the Marine Scheme are significantly different to that of an OWF, particularly in terms of vessel numbers and presence in a given area. For example, cable installation vessels for the Marine Scheme will tend to be continuously moving through the marine installation corridor and will not remain for long periods within a fixed area, this contrasts with vessels associated with installation of turbine arrays, which may remain in the OWF area for prolonged periods. The nature of the Marine Scheme works is temporary and there will be no permanent infrastructure visible in the marine environment.

Offshore wind farm projects such as Neart na Gaoithe have used a 1 km buffer for construction activities across the wind farm and the export cable corridor. For the Marine Scheme disturbance from cable installation vessels will be less than from offshore wind farm 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 subsequent displacement of bird species from the marine installation corridor during the installation phase. Based on the above sources and with reference to Sections 11.5.3 and 11.5.4, which sets out the ornithological features likely to be present within the ZoI, the following sensitivities to disturbance and displacement have been assigned:

- Puffin – Moderate;
- Kittiwake – Low;
- Guillemot – Moderate;
- Shag – Very High;
- Herring Gull – Low;
- Manx Shearwater – Very Low
- Gannet – Very Low; and
- Razorbill – Moderate.

Note that the sensitivities listed above are derived from Bradbury (2014) and are based on different parameters to the Marine Scheme. They have informed but do not match the sensitivities outlined later in this appraisal.

As detailed in Section 11.5, only low numbers of seabirds are likely to be present within the study area.

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 1.8 km from the main seabird colonies associated with the St Abb's Head to Fast Castle SPA; a sufficient distance that noise and visual disturbance will not occur at nesting colonies.

During the offshore cable installation there will be several vessels present within the marine environment, as described above and detailed in 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 puffin, guillemot, razorbill and shag.

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 commercial shipping, recreational

boating and wind farm service vehicles. 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.

At the landfall locations, where marine activities will include the vessels undertaking the HDD works, the abundance of seabirds, including those species sensitive to disturbance from vessels, as identified in Section 11.5, is low throughout the year.

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. As demonstrated in Chapter 19: Navigation and Shipping, this part of the North Sea is busy with fishing vessels, cargo vessels and increasingly, vessels associated with the offshore renewables industry. It is likely birds are used to both hearing and seeing vessels within the areas they are utilising for foraging and resting.

Should any works cause disturbance to seabirds, it will be minimal and temporary in nature with low magnitude. Given that low numbers of seabirds are likely to be present within the Marine Scheme area and 10 km study area , the temporary nature of the cable installation works, particularly in the context of existing baseline activities along the marine installation corridor, and the generally medium to low sensitivities of the species present to the preparation and installation methods, the effect on seabirds in offshore waters has been appraised as **minor** to **negligible** and therefore **not significant**.

Of all the species present, given their high sensitivity to vessel movements, shags are the species which could be temporarily affected whilst at sea. However, as the impact is temporary and short-term in nature, and the number of individuals in the marine installation corridor potentially affected is likely to be low, the effect remains of **minor** to **negligible** and therefore **not significant**.

11.6.2.2 Disturbance to seabed and/or water quality due to increased SSC resulting in changes in prey availability

Various activities associated with the route preparation and cable installation phases of the Marine Scheme may result in disturbance and displacement of ornithological receptors from indirect effects such as disturbance to seabed and/or water quality resulting in changes in prey availability in offshore waters. The main disturbing activities are likely to be those associated with:

- HDD; and
- cable burial by ploughing, trenching or excavating.

Impacts could occur at the two breakout points for the HDD conduits which are located between four and 10 metres below lowest astronomical tide (LAT) within the marine installation corridor, at the Scottish and English landfalls. Drilling fluid will be used during the HDD process. During HDD works the estimated discharge to the sea per borehole is up to 2,000 m^3 of fluid and up to 80 m^3 of solids. There is therefore estimated to be a total of up to 12,000 m^3 of fluid and 480 m^3 of solid discharged from up to 6 boreholes at each landfall.

This HDD process has the potential to result in changes to marine water quality arising from the re-suspension of contaminated sediments or the release of chemicals used during the construction process into the water column. This may include drilling fluid released during the HDD process. Changes in water quality could therefore affect prey (e.g. fish and shellfish) availability in the area.

Most drilling fluids and additives, such as bentonite, which are required during the HDD operations, are biodegradable and have no harmful effect on the marine environment. Being PLONAR substances they will likely be selected from the pre-approved OSPAR/CEFAS list of approved substances for offshore/marine usage. Furthermore, as detailed in Chapter 9: Fish and Shellfish Ecology, overall, the magnitude of impact to all fish and shellfish receptors from changes in water quality caused by installation activities is predicted to be negligible. Therefore, based on this information it is expected that the effect on prey species from changes in water quality is likely to be **negligible** and therefore **not significant.**

Physical disturbance of the seabed during the route preparation and cable installation activities such as cable burial by ploughing, trenching or excavating will temporarily increase SSC (i.e. 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. The effect on benthic communities and fish and shellfish is considered further in Chapter 8: Benthic Ecology and Chapter 9: Fish and Shellfish Ecology. 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.

The distribution of foraging seabirds in the marine environment is dictated by the abundance of prey species. Chapter 8: Benthic Ecology and Chapter 9: Fish and Shellfish Ecology considers this further where it has been determined that the installation activities associated with the Marine Scheme will have **negligible** to **minor** effects which are **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. Overall, it is expected that the magnitude of change will be low. Although, seabirds associated with internationally important 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. Based on this information it is expected that the effect on prey species is likely to be **negligible** and therefore **not significant.**

11.6.2.3 Alteration of water quality due to unplanned releases, accidental leaks and spills from vessels and plant

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, et al., 2021).

All efforts to avoid/minimise effects to water quality will be taken, including adherence to relevant guidance (e.g. Pollution Prevention Guidance). 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.

When considering the control measures outlined above, the likelihood of occurrence for accidental release / spillage is low. Therefore, the expected impact to seabirds from altered water quality resulting from pollution events is low, with the magnitude deemed negligible and the effect **negligible** and therefore **not significant**.

11.6.3 Operation Phase

11.6.3.1 Cable maintenance and repair

As outlined in Chapter 2: Project Description, the marine installation corridor has been designed to require minimal maintenance during the operational lifetime. However, possible maintenance activities that may be required include:

- inspection surveys to monitor cable burial;
- re-burial 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 cable installation 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.

Overall, effects of maintenance and cable repair works on ornithological receptors would be of smaller magnitude when compared to cable installation and the effects on ornithological receptors are predicted to be **negligible** and therefore **not significant**.

11.6.4 Decommissioning Phase

11.6.4.1 Decommissioning works

At the end of the operational life of the cable the options for decommissioning will be evaluated and taking into consideration other project constraints (e.g. safety and liability), the least environmentally damaging option would be chosen if possible.

The principal options for decommissioning described in 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 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 route preparation and cable installation phases of the Marine Scheme. Thus, the less environmentally damaging options would leave the cable and any protection (e.g. rock, concrete mattresssing or scour protection) entirely or in part *in situ* thereby minimising or avoiding any further impact to benthic ecology receptors.

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 effect to ornithological receptors is predicted to be **minor** to **negligible** and therefore **not significant**.

11.7 Mitigation and Monitoring

No significant effects are predicted on seabird receptors as a result of the marine installation, operation (including maintenance and repair) and decommissioning; therefore, no additional specific mitigation measures are required.

No significant impacts are predicted as a result of post construction monitoring of the cable route.

11.8 Residual Impacts

No significant residual effects are predicted for seabird receptors.

11.9 Cumulative and In-Combination Effects

The full cumulative and in-combination effects appraisal is presented in Chapter 16: Cumulative and In-Combination Effects.

This includes an appraisal of potential cumulative effects between the Marine Scheme and the English Onshore and Scottish Onshore Schemes, as there is the potential for interaction due to proximity of Outer Firth of Forth & St Andrews Bay Complex SPA and the Northumbria Coast SPA / Ramsar site. This appraisal concluded that there will be no cumulative effects upon birds attributed to these projects because:

- Construction methods (HDD used at both the Scottish and English landfalls);

- Breakout points are at a sufficient distance from the Scottish Onshore Scheme that impacts of noise will not coincide with the onshore works;
- Vessel works are also expected to commence after completion of HDD in most instances; and
- A commitment will be included within the CEMP to ensure that transiting vessels move at low speeds allowing any rafts of birds to disperse naturally well in advance of an approaching vessel where the marine installation corridor passes through the Outer Firth of Forth & St Andrews Bay Complex SPA.

In-combination effects are where receptors could be affected by more than one environmental impact. Where a receptor has been identified as only experiencing one effect or where only one topic has identified effects on that receptor, there is no potential for in-combination effects. The receptor groups within this chapter do not interact between chapters, therefore receptors have been wholly appraised within this respective topic chapter.

11.10 Summary of Appraisal

This chapter has considered the potential effects of the Marine Scheme on ornithological receptors. A summary of the effects is presented in Table 11-10.

No significant effects are predicted during installation, operation (including maintenance and repair), and decommissioning of the Marine Scheme.

Table 11-10: Summary of environmental appraisal

Project Phase	Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Project Specific Mitigation	Significance of residual effect
Installation	Temporary disturbance and displacement from installation activities	Shag	High	Low	**Minor** to **negligible**	No specific mitigation required.	**Minor** to **negligible** which is **not significant**
	Temporary disturbance and displacement from installation activities	Puffin	Medium	Low	**Minor** to **negligible**	No specific mitigation required.	**Minor** to **negligible** which is **not significant**
		Kittiwake	Low				
		Guillemot	Medium				
		Herring gull	Low				
		Manx shearwater	Low				
		Gannet	Low				
		Razorbill	Medium				
	Disturbance to seabed resulting in changes in prey availability	Shag Puffin Kittiwake Guillemot Herring gull Manx shearwater Gannet Razorbill	Low	Low	**Negligible**	No specific mitigation required.	**Negligible** which is **not significant**
	Alteration of water quality due to increased suspended sediment concentrations (SSC), unplanned, releases, accidental	Shag Puffin Kittiwake Guillemot Herring gull	Low	Low	**Negligible**	No specific mitigation required.	**Negligible** which is **not significant**

Project Phase	Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Project Specific Mitigation	Significance of residual effect
	leaks and spills from vessels and plant	Manx shearwater Gannet Razorbill					
Operation and maintenance	Temporary disturbance during cable repairs and maintenance	Shag Puffin Kittiwake Guillemot Herring gull Manx shearwater Gannet Razorbill	Low	Low	**Negligible**	No specific mitigation required.	**Negligible** which is **not significant**
Decommissioning	Potential effects of the decommissioning phase are the same as the installation phase.						

11.11 References

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