Volume 5: Appendix 12.3 – Shadow Habitats Regulations Appraisal (HRA)

CONTENTS

LIST OF ABBREVIATIONS

BFD: Bird Flight Diverter

BTO: British Trust for Ornithology

CEMP: Construction Environmental Management Plan

CJEU: Court of Justice for the European Union

EcIA: Ecological Impact Assessment

ECoW: Environmental Clerk of Works

ECU: Energy Consents Unit

EIA: Environmental Impact Assessment

EIAR: Environmental Impact Assessment Report

EMF: Electromagnetic Field

ESA: Ecology Survey Area

GEMP: General Environmental Management Plan

GW: Gigawatt

HRA: Habitats Regulations Appraisal

IROPI: Imperative reasons of over-riding public interest

JNCC: Joint Nature Conservation Committee

LDP: Local Development Plan

LOD: Limit of Deviation

LSE: Likely Significant Effect

LUC: Land Use Consultants

NBN: National Biodiversity Network

NESBReC: North East Scotland Biological Records Centre

NVC: National Vegetation Classification

OHL: Overhead Line

OIA: Ornithological Impact Assessment

OPGW: Optical ground wire

PCH: Potential Collision Height

RSPB: Royal Society for the Protection of Birds

SAC: Special Area of Conservation

SEPA: Scottish Environment Protection Agency

SPA: Special Protection Area

SPP: Species Protection Plan

SSSI: Site of Special Scientific Interest

UK Hab: UK Habitat

VP: Vantage Point

WCA: *Wildlife and Countryside Act, 1981 (as amended)*

WeBS: Wetland Bird Survey

1. INTRODUCTION

1.1 The Proposals

1.1.1 Land Use Consultants (LUC) have undertaken a Shadow Habitats Regulations Appraisal (HRA) to provide the competent authority (in this case Scottish Ministers) with sufficient information to allow them to determine whether the proposed construction and operation of a new 400 kV overhead line (OHL) – the Kintore to Tealing 400 kV OHL – and ancillary infrastructure (hereafter known as the Proposed Development) would have an adverse impact on the integrity of any European Site[1]. This appendix should be read in conjunction with **Volume 1, Chapter 3: Project Description** of the EIA Report (EIAR) for full details of the Proposed Development, as well as **Volume 2**, **Chapter 11: Ecology** and **Volume 2, Chapter 12: Ornithology** for an assessment of the effects of the Proposed Development upon ecological and ornithological qualifying features.

1.1.2 This appendix is supported by the following figures (**Volume 3** of the EIAR):

- **Figures 11.1.1 to 11.1.23: The Proposed Development and Ecology Survey Area**;
- **Figures 11.2.1 to 11.2.5: Designated Sites within 10 km, 5 km, and 2 km of the Proposed Development**;
- **Figures 12.1.1 to 12.1.2: The Proposed Development and Ornithology Survey Area**;
- **Figures 12.2.1 to 12.2.2: Ornithological Designated Sites within 20 km and 5 km**; and
- **Figures A12.7.1 to A12.7.5: Bird Flight Diverter Placement**.

1.2 Aims of Report

1.2.1 A Shadow HRA provides the competent authority with objective information to allow it to determine whether the Proposed Development, either alone or in combination with other projects, will have an adverse impact on the integrity of European Sites. It is the responsibility of the competent authority to conduct its own HRA, in consultation with NatureScot, to make that determination. An HRA is commonly considered in stages. These are discussed in detail within the methodology set out in **Section 3** below. In summary, Stage One (Screening) determines whether the project is likely to have a significant effect on a European Site, whether on its own or in combination with other proposals. If such an effect is likely, or there is not enough evidence at Stage One to rule it out, the competent authority must undertake Stage Two (Appropriate Assessment), which determines whether adverse effects to the integrity of a European Site can be ruled out or not. If the Appropriate Assessment concludes that the integrity of the site would be adversely affected, it is then necessary to move to Stage Three (Derogation), is the process which may allow a project to proceed despite an Appropriate Assessment concluding adverse effects on site integrity, provided specific legal tests can be met. Notably, at Stage One, mitigation measures included for the purpose of avoiding or minimising risks to European Sites cannot be taken into account. As discussed in **Section 1.6** below, a relatively recent change in case law from the European Court of Justice has allowed for the possibility of limited exceptions being made to the previous exclusion of all forms of mitigation measures being taken into account.

1.2.2 This document aims to provide the information necessary to assist the competent authority to carry out Stage One (Screening) of the project through the HRA by:

- providing an overview of the Proposed Development, for the purpose of understanding the basis of assessing the project as an infrastructure project in respect of which an HRA is required;
- identifying the European Sites[1] which are connected to and/or could be potentially adversely affected by the Proposed Development;
- providing a description of the ecological and ornithological baselines of the European Sites[1];
- identifying how the Proposed Development may impact on the qualifying features of the European Sites[1];

[1] Defined in this context by Regulation 8 of the Habitats Regulations. See also NatureScot, 2024. *European sites*. [Online] Available at: https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/international-designations/european-sites [Accessed: 5 March 2025].

- identifying whether there is the possibility of adverse significant effects during the construction and/or operation of the Proposed Development that could undermine a European Site's conservation objectives, ie identifying Likely Significant Effects (LSE)[2];
- considering other projects that may have potential in-combination effects on the European Sites[7]; and
- recommending the designated sites which need to be taken forward for further assessment if LSE on their qualifying features cannot be ruled out;

1.2.3 This document also aims to provide the information necessary to assist the competent authority to carry out Stage Two (Appropriate Assessment) of the HRA process by:

- providing an appraisal of the Proposed Development both alone, and in combination with other proposals, having regard to the magnitude and nature of the impacts on the qualifying features that could not be screened out;
- ascertaining whether the Proposed Development will not adversely affect the integrity of a European Site having regard to the Conservation Objectives of the European Site(s); and
- reassessing the impact of the Proposed Development with consideration given to embedded and additional mitigation measures, as defined in **Volume 2, Chapter 12: Ornithology**, **Section 12.11 Mitigation and Monitoring** in place.

1.3 Structure of this Appendix

1.3.1 This appendix has addressed the requirement imposed on the competent authority under The Conservation of Habitats and Species Regulations 2017 to undertake an HRA of the Proposed Development. It sets out how the Applicant intends to assist the competent authority in fulfilling that statutory obligation. The appendix is structured as follows:

- **Section 1**: **Introduction** provides an introduction to the HRA process, including the rationale for the requirement for an HRA for the Proposed Development.
- **Section 2**: **Project for which an electricity act consent is sought** provides a summary of current land use within which the Proposed Development is located, and an outline description of the Proposed Development.
- **Section 3: Method** describes the stages of the HRA process, and the methods applied in delivering the Shadow HRA of the Proposed Development. The methods adopted for both Screening and Appropriate Assessment stages are discussed.
- **Section 4: Stage 1: Screening Assessment** presents the first stage of the Shadow HRA process and includes the identification of relevant European Sites[7] and the pathways by which adverse impacts may be the result of the Proposed Development during construction and/or operation. The section concludes with an assessment of LSEs of the Proposed Development and reaches a conclusion as regards the need for Appropriate Assessment.
- **Section 5: Stage 2: Appropriate Assessment**, which describes the findings of the assessment with embedded and additional mitigation measures in place, which in turn enables the competent authority to make a decision on whether the plan or project would adversely affect the integrity of a European site.

1.3.2 This appendix draws on information presented in the main EIAR, mindful of the separate statutory requirements and legal framework. Cross-referencing is provided, as necessary.

1.4 Requirement for an HRA

1.4.1 The Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) and the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) were initially transposed into UK national legislation by The Conservation (Natural Habitats, &c.) Regulations 1994 (the 1994 Regulations)[3]. Since then, The Conservation of Habitats and Species Regulations 2017 (the

[2] In this context LSE include not only identified effects but also those which cannot be ruled out on the basis of objective information.
[3] NatureScot, 2023. *The habitats directive and habitats regulations*. [Online] Available at: http://nature.scot/professional-advice/protected-areas-and-species/protected-species/legal-framework/habitats-directive-and-habitats-regulations [Accessed: 5 March 2025].

'Habitats Regulations') have replaced the 1994 Regulations for specific reserved and devolved activities on land in Scotland[4], including for consent under Section 37 of the Electricity Act 1989 (and deemed planning permission granted therewith)[5].

1.4.2 The competent authority is empowered to grant an Electricity Act consent for the Proposed Development only if it can determine there would not be any LSE at a European Site as a result of the Proposed Development alone or in combination with other plans/projects or, if there are such LSE, that having conducted an Appropriate Assessment it has ascertained that the Proposed Development will not adversely impact on the integrity of a European Site.[6]

1.4.3 The term 'European Site' is used to refer to what were previously known as 'Natura' sites'[7]. These sites were originally designated as part of the 'Natura 2000' protected areas network[8], a Europe-wide network of sites designated for their ecological value. Since "*exit day*"[9] references to Natura 2000 should now be construed as references to the "*national site network*"[10]. Onshore sites are either designated as Special Areas of Conservation (SACs) under the *Habitats Directive*, the qualifying features for which are habitats or species listed in Annex I or II of the Habitats Directive, or Special Protection Areas (SPAs) under the *Birds Directive*, for which the qualifying species are bird species listed in Annex I of the Birds Directive, or certain regularly occurring migratory species.

1.4.4 Ramsar sites, which support internationally important wetland habitats, are listed under the 'Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971)[11]'. Most Ramsar sites in Scotland, including all that have connectivity to the Proposed Development, are also designated as SPAs or SACs and all are underpinned by Sites of Special Scientific (SSSIs)[12]. Updated policy on the protection of Ramsar Sites came into force on 9 July 2025[13] such that all listed Ramsar Sites in Scotland should be treated as if they were European sites for the purposes of land use change and decision making. As such, this updated policy position is '*a material consideration in the determination of relevant planning and consenting applications in relation to development which impacts on Ramsar sites*'[13]. For the purpose of this Shadow HRA, Ramsar sites have been deemed European sites. The provisions of the Habitats Regulations have been applied to those sites *mutatis mutandis*.

1.4.5 European Sites (SACs, SPAs, and Ramsar sites) receive considerable protection through the Habitats Regulations[3] and these protections are reflected in national and local planning policy and process. There was no substantive change to the protection of SACs or SPAs as a direct result of the United Kingdom's exit from the European Union. The requirements of the Habitats and Birds Directives, as implemented through relevant domestic legislation[14], continue to be preserved under section 2 of the European Union Withdrawal Act 2018 and therefore relevant to the protection and management of European Sites[7].

1.5 Project Requirement for an HRA

1.5.1 The Proposed Development has been identified, through the scoping process (**Volume 1, Chapter 6: Scope and Consultation**) as having the potential for LSE on named European Sites[7] (refer to **Table 12.3.3: Summary of European Sites Considered at**

[4] And in Scottish inshore waters.
[5] Regulation 89 of the Habitats Regulations.
[6] Regulation 63 of the Habitats Regulations. If there are adverse effects the competent authority may nevertheless decide to grant consent if there are imperative reasons of overriding public interest and no alternative solutions, commonly referred to as a "derogation". In light of the conclusions of the Shadow HRA it is not foreseen that a derogation would need considered.
[7] Defined in this context by Regulation 8 of the Habitats Regulations. See also NatureScot, 2024. *European sites*. [Online] Available at: https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/international-designations/european-sites [Accessed: 5 March 2025].
[8] European Environment Agency, 2023. *The Natura 2000 protected areas network*. [Online] Available at: https://www.eea.europa.eu/themes/biodiversity/natura-2000/the-natura-2000-protected-areas-network [Accessed: 5 March 2025].
[9] 31 January 2020 at 11pm (Section 20(1) of the European Union (Withdrawal) Act 2018).
[10] Effect of reg. 3(10) of the Habitats Regulations. National site network is defined in reg.3(1).
[11] Ramsar Convention Secretariat, 2016. *An Introduction to the Convention on Wetlands (previously The Ramsar Convention Manual).* [Online] Available at https://www.ramsar.org/sites/default/files/documents/library/handbook1_5ed_introductiontoconvention_e.pdf [Accessed: 5 March 2025].
[12] NatureScot, 2024. *Ramsar sites*. [Online] Available at: https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/international-designations/ramsar-sites [Accessed: 5 March 2025].
[13] Scottish Government. 2025. Wetlands – protecting Ramsar sites: updated Scottish Government policy. [Online} Available at: Wetlands - protecting Ramsar sites: updated Scottish Government policy - gov.scot
[14] Including the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 which amended the Habitats Regulations in consequence of Brexit.

Screening). With regards to SPAs (and the coincident Ramsar sites), NatureScot noted that '*all proposed routes are within the connectivity distance for foraging geese (15 – 20 km) that could be associated with SPAs and Ramsar sites designated for their non-breeding goose interests*' (refer to **Volume 2, Chapter 12: Ornithology, Table 12.1: Summary of Consultation of relevance to Ornithology**). Connectivity is also present for other SPAs (refer to **Volume 2, Chapter 12: Ornithology, Table 12.7: Statutory Designated Sites with features of Ornithological Interest with potential for connectivity to the Proposed Development**). Further, with regard to European Sites[7] with ecological qualifying features, there is potential for functional connectivity with a number of SACs (refer to **Volume 2, Chapter 11: Ecology, Table 11.5: Statutory Designated Sites with an Impact Pathway to the Proposed Development**). Following scoping consultation (refer to **Volume 2, Chapter 11: Ecology, Table 11.2: Summary of Consultation**), NatureScot has identified the Proposed Development as having LSE prior to mitigation, ie assessment beyond Stage One is required for European Sites noted in **Table 12.3.3: Summary of European Sites Considered at Screening** (also refer to **Table 12.3.2: Summary of consultation responses** and **Section 4** for further details). As such, there is a requirement for the competent authority to conduct an Appropriate Assessment.

Conservation Objectives

1.5.2 Conservation Objectives are in place to protect the qualifying features of a European Site and recognise that it should support and contribute to the achievement of Favourable Conservation Status of those qualifying features present on SACs, and the equivalent aims of the Habitats Regulations in relation to those features present on SPAs and the coincident Ramsar sites. Conservation Objectives also contribute to achieving Favourable Conservation Status in the national site network. They should also inform the selection of measures that may be necessary to prevent their deterioration and disturbance as a result of existing and ongoing activities.

1.5.3 At Stage One (Screening) competent authorities consider LSE having regard to the impacts on the qualifying features of the European Site. The Conservation Objectives of the European Sites[7] are considered at Stage Two (Appropriate Assessment) by making an assessment of any adverse effects or impacts under reference to the Conservation Objectives of the European Site, in order to reach a conclusion as to whether the integrity of the European Site would be adversely affected.

Site integrity

1.5.4 In order to meet the Conservation Objectives of a site, the integrity of the site must be maintained. Deterioration or disturbance is assessed against the conservation status of species and habitats concerned. Site integrity is referred to in Revised Circular 6/1995 as "*… the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or levels of populations of the species for which it was classified*".[15] A site can be described as having a high degree of integrity when:

- the inherent potential for meeting its Conservation Objectives are realised;
- the capacity for self-repair and self-renewal under dynamic conditions is maintained; and
- a minimum of external management of the site is required.

1.5.5 An adverse effect is therefore defined as something that impacts the site features, either directly or indirectly, and results in disruption or harm to the ecological structure and functioning of the site and/or affects the ability of the site to meet its conservation objectives across all parts of the site.

[15] Paragraph 2 of Appendix A to Annex E of Scottish Executive Circular 6/1995 (Revised 2000).

1.6 Recent Case Law Changes

1.6.1 This Shadow HRA has been prepared in accordance with relevant case law, including most notably the '*People over Wind*' and '*Holohan*' rulings from the Court of Justice of the European Union (CJEU).

1.6.2 *The People over Wind*, *Peter Sweetman v Coillte Teoranta* (April 2018) judgment[16] ruled that *Article 6(3) of the Habitats Directive* should be interpreted as meaning that mitigation measures should be assessed as part of an Appropriate Assessment and should not be considered at the screening stage. The precise wording of the ruling is as follows:

> *"Article 6(3) ……must be interpreted as meaning that, in order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of measures intended to avoid or reduce the harmful effects of the plan or project on that site."*

1.6.3 The above ruling has subsequently been clarified by the CJEU in its *Eco Advocacy CLG v An Bord Pleanala* (June 2023) judgment[17]. In its ruling the CJEU stated:

> *"…in order to determine whether it is necessary to carry out an appropriate assessment of the implications of a plan or project for a site, account may be taken of the features of that plan or project … which therefore may have the effect of reducing the harmful effects of the plan or project on that site, where those features have been incorporated into that plan or project as standard features, inherent in such a plan or project, irrespective of any effect on the site."*

1.6.4 As the judgment post-dates the UK's withdrawal from the EU, the decision in the *Eco Advocacy case* is not binding on domestic courts. However, domestic courts are entitled to have regard to it so far as relevant[18] and NatureScot has also taken it into account in its most recent guidance issued in April 2025 on the implications of both these judgements for the competent authorities and developers and their adviser. In the most recent guidance, NatureScot states:

> *"If the plan or project does contain essential or intrinsic elements that could reduce or eliminate its impact on a European site then it would be unreasonable to isolate them from the rest of the proposal when screening for LSE. To do so would mean that we were effectively screening a different plan or project to the one proposed.*
>
> *Examples of the intrinsic elements of a proposal which would not be considered a 'measure' and could be taken into account in a screening would usually be related to design, location, layout or standard conditions. Cases that would need to be considered at AA would include measures specifically included in the proposal in order to mitigate potential impacts, such as conditions, caveats, strategies or other restrictions related to European sites qualifiers. The golden rule is to avoid introducing measures at, or in the lead up to, the screening stage that are designed specifically to avoid harmful effects on European site features for the purpose of seeking to reach a conclusion of 'no LSE[19]'."*

1.6.5 The approach above has been adopted by the Applicant in this Shadow HRA.

1.6.6 This Shadow HRA report has also taken account of the *Holohan v An Bord Pleanala* (November 2018) judgment[20] which stated that:

> *"an 'appropriate assessment' must, on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the conservation objectives of the site."*

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[16] Court of Justice of the European Union (CJEU) case C-323/17. Judgment 12 April 2018, available at https://curia.europa.eu/juris/document/document.jsf?docid=200970&doclang=EN

[17] Court of Justice of the European Union (CJEU) case C-721/21. Judgment 15 June 2023, available at https://curia.europa.eu/juris/document/document.jsf?text=&docid=274644&doclang=EN

[18] Section 6(2) of the European Union Withdrawal Act 2018

[19] This is the approach that has been taken by the Applicant with regards to the Proposed Development described here.

[20] Court of Justice of the European Union (CJEU) case C-467/17. Judgment 7 November 2018, available at https://curia.europa.eu/juris/document/document.jsf?text=&docid=207428&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=27209385

1.6.7 This Shadow HRA considers the potential for effects on species and habitats, including those not listed as qualifying features, to result in secondary effects upon the qualifying features of European Sites[7], including the potential for complex interactions and dependencies. In addition, the potential for off-site impacts, such as through impacts to functionally-linked land, and/or species and habitats located beyond the boundaries of European Sites, but which may be important in supporting the ecological processes of the qualifying features, have also been considered in this report.

2. PROJECT FOR WHICH AN ELECTRICITY ACT CONSENT IS SOUGHT

2.1 Terminology and Study Area

2.1.1 The following terminology is used throughout this appendix:

- **Proposed Development**: Defined as the infrastructure including towers, overhead line (OHL) conductors, access tracks, and temporary working areas within the Limit of Deviation (LOD) (refer to **Volume 3, Figures 3.1.1 to 3.1.29: Proposed Development for which Section 37 Consent *(Electricity Act, 1989)* is sought**; and **Volume 1, Chapter 3: Project Description**).
- **Proposed Alignment:** Defined as the centreline of the OHL (see **Volume 3, Figure 1.1: Overview of the Proposed Development**).
- **Limit of Deviation (LOD)**: The area either side of the Proposed Alignment and ancillary works within which micrositing may take place in accordance with the conditions of the Section 37 Consent.
- **Ecology Survey Area (ESA):** The LOD of the Proposed Development, plus relevant buffers (up to 250 m from the LOD, with the exception of access tracks, tie-ins and tie backs for which a buffer of up to 50 m from the associated LOD was applied), in which all ecology surveys were undertaken in line with good practice guidelines for all ecological features surveyed (refer to **Volume 3, Figures 11.1.1-11.1.23: The Proposed Development and Ecology Survey Area**; details of survey guidance and methods can be found in **Volume 5, Appendices 11.2: Habitat and Vegetation Survey Report, 11.3: Protected Species Survey Report, 11.4: Bat Survey Report** and **Volume 6, Appendix 11.6: Confidential Protected Species Survey Report**);
- **Ornithology Study Area:** as defined by best practice (detailed in **Volume 5, Appendix 12.1: Ornithology Technical Report** and in **Volume 5, Appendix 3.2: General Environmental Management Plans (GEMPs) and Species Protection Plans (SPPs),** together with TG-NET-ENV-524 *Ornithology Methods for Transmission Projects*[21]) as the area within which data collection is completed ie up to 20 km from the LOD, as shown in **Volume 3, Figures 12.2.1-12.2.2: Ornithological Designated Sites within 20 km and 5 km**.
- **Section:** To aid the reader in comprehension of the geographic spread of the ecology baseline data and assessment, the Proposed Development has been divided into six sections (as outlined below, defined fully in **Volume 1, Chapter 3: Project Description** and shown on all figures associated with this chapter with respect to ecology (**Volume 2, Chapter 11: Ecology**) and ornithology (**Volume 2, Chapter 12: Ornithology**):
  - Section A: Emmock 400 kV substation to Forfar, Towers S206 to S164;
  - Section B: Forfar to Brechin, Towers S163 to S106;
  - Section C: Brechin to Laurencekirk, Towers S105 to S52;
  - Section D: Laurencekirk to Hurlie 400 kV substation, Towers S51 to S1;
  - Section E: Hurlie 400 kV substation to River Dee, Towers N96 to N61; and
  - Section F: North of the River Dee to Kintore Substation, Towers N60 to N1.

2.2 Current Land Use

2.2.1 The Proposed Development, new 400 kV double circuit OHL extends for approximately 105.2 km from Kintore, Aberdeenshire to the proposed substation at Emmock, near Tealing, Angus.

2.2.2 In Angus, the Proposed Development passes over the Sidlaw Hills north of Tealing, then into a landscape dominated by farmland, stretching approximately northeast from Forfar to Edzell. It crosses the River South Esk north of Forfar, and the River North Esk (and into Aberdeenshire) southeast of Edzell. The farmland landscape of Angus is dominated by arable farming, with pockets of woodland and forest which are relatively small and/or isolated. The exception to this pattern of land-use and habitats is where the ESA crosses the Sidlaw Hills, southeast of Glamis; the habitats in this location are dominated by heathland with evidence of grouse management.

[21] SSEN Transmission, 2021. *Ornithology Methods for Transmission Projects* – TG-NET-ENV-524.

2.2.3 The Proposed Development continues into Aberdeenshire approximately northeast of the area near Fordoun; this stretch continues to be dominated by arable farmland with relatively small pockets of woodland, the exception to which are the forestry plantations of Capo Plantation, Inverury Wood and Lady Jane's Plantation. From Fordoun, the ESA continues in a more northerly direction through an area of farmland west of Glenbervie that exhibits increasing livestock farming and relatively smaller field sizes. Northeast of Glenbervie, the ESA enters the forestry plantation of Fetteresso Forest and the location of the proposed Hurlie substation. The ESA continues north over the upland fringe habitats of Craigneil and into the forestry plantation of Durris Forest. North of Durris Forest, the ESA descends into a landscape of mixed farmland south and north of the River Dee, crossing the river near Kirkton of Durris. The ESA continues approximately north of the River Dee, passing east of Echt and west of Dunecht, before turning north-northeast towards the existing Kintore Substation. The landscape north of Durris Forest exhibits relatively smaller field mixed with increased livestock farming and a more extensive network of woodland (relative to the stretch in Aberdeenshire from the River North Esk to Fordoun). There are further extents of forestry plantation forming a mosaic with fields of pasture and arable.

2.3 Proposed Development

2.3.1 The Proposed Development includes the construction of a series of steel lattice towers which would support approximately 105.2 km of overhead cabling (conductors) carrying power from existing and future onshore and offshore energy generation capacity in the east of Scotland to areas of demand. The Proposed Development enables forecasted growth in renewable energy across Great Britain facilitating the delivery of UK[22] and Scottish Governments'[23] 2030 offshore wind targets of 50 gigawatts (GW) and 11 GW, respectively.

2.3.2 The Proposed Development is described in greater detail in **Volume 1, Chapter 3: Project Description** of the EIAR. An explanation of the routeing process, including how key ornithological and ecological constraints were avoided during the design process can be found in **Volume 1, Chapter 4: Alternatives and the Routeing Process** of the EIAR.

[22]UK Government, 2023.*Offshore Wind Net Zero Investment Roadmap.* [Online] Available at: https://assets.publishing.service.gov.uk/media/64a54c674dd8b3000f7fa4c9/offshore-wind-investment-roadmap.pdf[Accessed: 5 March 2025].
[23] Scottish Government, 2020.*Increased Offshore Wind Ambition by 2030*.[Online] Available at: https://www.gov.scot/news/increased-offshore-wind-ambition-by-2030/[Accessed: 5 March 2025].

3. METHOD

3.1 Stages of an HRA

3.1.1 As referred to above, HRA is typically dealt with as a staged process, with each stage concluding whether the next is required. The stages are summarised **in Table 12.3.1: Stages of an HRA**.

3.1.2 Stage 1, known as 'Screening Assessment' or the 'Significance Test' seeks to identify whether a plan or project could give rise to LSE on relevant European Sites[7]. At this stage, a precautionary approach is taken and, crucially, this stage may not consider the application of mitigation (other than mitigation intrinsic to the project not specifically designed to mitigate impacts to a European Site) when considering the potential for LSE.

3.1.3 Where LSE are identified, Stage 2 is undertaken. Stage 2, known as 'Appropriate Assessment' or the 'Integrity Test' builds on Stage 1, relating development detail to the ecological processes underpinning the integrity of relevant European Sites[7] and assessing the predicted effects of the proposals on the qualifying interests and conservation objectives of the sites. The Appropriate Assessment must show whether an adverse effect on site integrity can be ruled out or not. It must be shown, with no reasonable scientific doubt, that the proposal would not have an adverse effect on the integrity of the site *(ie* it should avoid affecting the European Site's[7] Conservation Objectives[24]) before the proposal may go ahead.

3.1.4 At this stage, consideration of mitigation measures is central to the assessment. It is essential that the competent authority consults with NatureScot during Stage 2[25].

3.1.5 If following the Appropriate Assessment adverse effects on site integrity are predicted, Stage 3 must be undertaken. Stage 3 considers whether, notwithstanding the effect on site integrity, the competent authority is satisfied that there are no alternative solutions and the plan or project must proceed for 'imperative reasons of over-riding public interest' (IROPI). Stage 3 also requires the identification of appropriate compensatory measures.

Table 12.3.1: Stages of an HRA

Stage	Task
Stage 1: Screening Assessment (Significance Test)	Describes plan or project. Identifies potentially affected European Sites[7] and factors contributing to their integrity. Assesses LSEs of plan or project alone or in combination with other plans and projects.
Stage 2: Appropriate Assessment (Integrity Test)	Further gathering of data (plan or project, and European Sites[7]). Evaluates plan or project impacts, in view of European Sites'[7] Conservation Objectives. Identifies avoidance or mitigation measures which may reduce the effects of the plan or project. Assesses adverse effects on the integrity of the European Site[7] arising from plan or project.
Stage 3: Derogation	Identifies IROPI. Demonstrates that no alternatives to the plan or project exist. Identify potential compensatory measures.

3.1.6 The remainder of this chapter sets out the approach taken as part of the Shadow HRA of the Proposed Development.

3.2 Guidance and Good Practice

3.2.1 This Shadow HRA has been prepared in cognisance of relevant guidance, good practice and verified data sets. Reference has been made to:

- Standard Data Forms for European Sites[7] published on the JNCC website[26,27];
- NatureScot's SiteLink website[28];

[24] NatureScot *About conservation advice documents for European Sites in Scotland*. [Online] Available at: https://www.nature.scot/doc/about-conservation-advice-documents-european-sites-scotland [Accessed: 5 March 2025].
[25] Regulation 63(3) of the Habitats Regulations.
[26] JNCC, 2015). *River Dee Standard Data Forms*. [Online] Available at: https://sac.jncc.gov.uk/site/UK0030251 [Accessed: 5 March 2025].
[27] JNCC, 2022. *Loch of Skene Standard Data Forms*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9002261.pdf [Accessed: 5 March 2025].
[28] NatureScot, n.d. *SiteLink*. [Online] Available at: https://sitelink.nature.scot/home [Accessed: 5 March 2025].

- NatureScot's advice to planners and developers on protected areas[29];
- NatureScot's HRA Guidance[30];
- NatureScot's River Tay SAC advice to developers when considering new projects which could affect the River Tay SAC[31];
- NatureScot's River South Esk SAC advice to planning applicants[32]; and
- NatureScot's River Dee SAC conservation advice package[33].

3.3 Stage 1: Screening Assessment

3.3.1 The Screening Assessment stage of the Shadow HRA focused on identifying LSE and sought to conclude, based on research and analysis, whether Stage 2 Appropriate Assessment would be required. To identify LSE, the following information was gathered:

- relevant data for the European Sites[7] within the scope of the HRA, including citations, boundaries and known threats and pressures;
- baseline ecological data relating to the ESA;
- baseline data relating to flight activity and foraging of SPA qualifying bird species within 2 km of the Proposed Development;
- proposed Development characteristics (including both construction and operational detail); and
- potential pathways to LSEs, based on ecological principles.

3.3.2 Potential pathways to LSEs were then considered for each European Site[7], drawing on data collated during Stage 1. Applying the precautionary principle, 'likelihood' was determined.

3.3.3 The approach taken for the Shadow HRA in relation to each of the above information gathering tasks, the identification of potential pathways to LSE, and the identification of potentially significant effects, is detailed further below.

Identification of European Sites[7]

3.3.4 European Sites[7] within 10 km of the Proposed Development (20 km for SPAs/Ramsar sites where core foraging ranges of qualifying features may extend to 20 km[34]) were identified for consideration within the Screening Assessment. The qualifying features and Conservation Objectives of relevant European Sites[7], together with current pressures and potential threats were established using the following sources:

- The NatureScot SiteLink website (https://sitelink.nature.scot/home), to identify European Sites with ornithological considerations that may have connectivity to the Proposed Development, together with citation references; and
- The JNCC SAC site list (https://sac.jncc.gov.uk/) to identify European Sites with ecological considerations that may have connectivity to the Proposed Development, together with citation references.

Baseline Ecological and Ornithological data

3.3.5 A suite of ecological and ornithological baseline surveys was undertaken by LUC in relation to the Proposed Development between January 2023 and February 2025. This has included desk study, habitat surveys using UK Habitat (UK Hab) and

[29] https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/planning-and-development-protected-areas
[30] NatureScot, 2024. *Habitats Regulations Appraisal*. [Online] Available at https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra [Accessed: 5 March 2025].
[31] NatureScot, n.d. River Tay Special Area of Conservation (SAC): *Advice to developers when considering new projects which could affect the River Tay Special Area of Conservation*. [Online] Available at: https://digital.nls.uk/pubs/e-monographs/2020/216547661.23.pdf [Accessed: 5 March 2025].
[32] NatureScot, n.d. *River South Esk Special Area of Conservation (SAC): Advice to planning applicants*. [Online] Available at: https://www.angus.gov.uk/sites/default/files/River%20South%20Esk%20Code%20of%20Practice%20for%20Developers.pdf [Accessed: 5 March 2025].
[33] NatureScot, n.d. *River Dee Special Area of Conservation (SAC) conservation advice package*. [Online] Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8357/conservation-advice-package.pdf [Accessed: 5 March 2025].
[34] NatureScot., 2016. *Assessing Connectivity with Special Protection Areas (SPAs)*. [Online] Available at: https://www.nature.scot/sites/default/files/2022-12/Assessing%20connectivity%20with%20special%20protection%20areas.pdf [Accessed: 18 March 2025].

National Vegetation Classification (NVC) surveys, and protected species surveys, along with breeding bird, raptor, black grouse, flight activity surveys and Winter Goose Foraging surveys; the latter two most applicable to this assessment. Surveys were undertaken in line with good practice guidelines. A summary of these data is provided in **Volume 2, Chapter 11: Ecology** and **Chapter 12: Ornithology**, while detailed survey reports are included in **Volume 5, Appendices 11.2: Habitat and Vegetation Survey Report, 11.3: Protected Species Survey Report, 11.4: Bat Survey Report, Volume 6, Appendix 11.6: Confidential Protected Species Survey Report, Volume 5, Appendix 12.1: Ornithology Technical Report** and **Volume 6, Appendix 12.2: Confidential Ornithology Report**. These data, as they relate to the qualifying features of the relevant European Sites[7], were used to inform the HRA Screening Assessment.

Proposed Development Characteristics

3.3.6 Drawing on information presented in **Volume 1, Chapter 3: Project Description**, relevant aspects of the Proposed Development's construction and operational parameters are identified. These include design features, such as the location of infrastructure; construction methods and timescales, such as habitat removal or the use of heavy plant; and operational parameters, including maintenance requirements.

Potential Pathways to LSEs

3.3.7 Potential pathways to LSEs have been identified, drawing on generic ecological principles of good management in terrestrial environments[30]. It is therefore considered that there is potential for the Proposed Development to result in LSE via the following effect pathways:

- physical damage/loss of habitat through direct habitat loss or via run-off/pollution;
- physical disturbance/displacement and/or mortality;
- non-physical disturbance (noise, vibration and light); and
- reduction in water quality (via pollution or sedimentation).

Identifying Effect Significance

3.3.8 NatureScot's good practice guidance[30] highlights that the identification of LSE should be 'relatively quick and straightforward.' As such, only when there is no connectivity present, or where it is obvious that the proposal will not undermine the Conservation Objectives of the European Site despite the presence of a pathway or connectivity, should no LSE be concluded. Otherwise, further investigation through Stage 2 Appropriate Assessment is required.

3.3.9 A risk-based approach involving the application of the precautionary principle is adopted in the Screening Assessment, such that a conclusion of 'LSE' will be reached where it is not possible to rule out the risk that the Proposed Development (including in-combination effects) would not have a significant effect on the conservation objectives, and in turn the integrity, of the European Site[7].

3.3.10 Relevant case law helps to interpret when effects should be considered as being likely to result in a significant effect. In the Waddenzee case[35], the European Court of Justice ruled on the interpretation of *Article 6(3) of the Habitats Directive* including that:

- an effect should be considered 'likely', "*if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site*" (paragraph 44).
- an effect should be considered 'significant', *"if it undermines the conservation objectives"* (paragraph 48).
- where a plan or project has an effect on a European Site[7] "*but is not likely to undermine its conservation objectives, it cannot be considered likely to have a significant effect on the site concerned*" (paragraph 47).

[35] Court of Justice of the European Union, 2004. *Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels- v Staatssecretaris van Landbouw, Natuurbeheer en Visserij (Reference for a preliminary ruling from the Raad van State).* [Online] Available at: *https://curia.europa.eu/juris/document/document.jsf?text=&docid=49452&pageIndex=0&doclang=en*.

In-combination Effects

3.3.11 Regulations require that consideration is given in the Screening Assessment of whether it is likely that a plan or project could have an LSE on a European Site[7] in combination with other plans or projects, even if there is no LSE on its own.

3.3.12 For the purpose of the Screening Assessment, the potential for in-combination effects will only be considered for those Proposed Development components identified as unlikely to have a significant effect alone, but which could act in combination with other plans and projects to produce a significant effect. Consideration of In-combination effects has drawn from cumulative assessments made in an ecological and ornithological context as set out in **Volume 2, Chapter 11: Ecology** and **Volume 2, Chapter 12: Ornithology** (also refer to **Section 4.6** of this Appendix).

3.3.13 The approach to this is largely based on consideration of significant effects arising from other proposed developments and projects in the region of the Proposed Development. This includes Intra (Associated) Developments defined below, and other SSEN Transmission projects, along with third party developments such as Wind Farms, battery energy storage systems, and residential developments (also refer to **Section 4.6** of this Appendix).

3.3.14 Intra (Associated) Developments include:

- Emmock substation[36]; and
- Hurlie substation[37].

3.4 Stage 2: Appropriate Assessment

3.4.1 Where LSE are identified, the potential for adverse effects is considered in greater detail to inform the competent authority's Appropriate Assessment. This process is based on an assessment of the relevant predicted impacts of the Proposed Development (during construction and operation) on the qualifying interests of each European Site[7]. Note that decommissioning has been scoped out of the assessment as discussed further within **Volume 1, Chapter 6: Scope and Consultation**. At this stage, an effect likely to adversely affect the integrity of relevant European Sites[7] is considered. The potential for adverse effects to be predicted on the integrity of a Site have been considered in relation to the following changes where the Proposed Development may:

- cause delays to achieving the Conservation Objectives of the European Site[7];
- interrupt progress towards achieving the Conservation Objectives of the European Site[7];
- disrupt those factors that help to maintain the favourable condition of the European Site[7];
- interfere with the balance, distribution and density of key species that are the indicators of favourable condition of the European Site[7];
- cause changes to the vital defining aspects (eg nutrient balance) that determine how the European Site[7] functions as a habitat or ecosystem;
- change the dynamics of relationships that define the structure or function of the European Site[7] (eg relationships between soil and water, or animals and plants);
- interfere with anticipated natural changes to the European Site[7];
- reduce the extent of key habitats or the population of key species;
- reduce the diversity of the European Site[7];
- result in disturbance that could affect the population, density, or balance between key species;
- result in fragmentation; and/or
- results in the loss of key features.

[36] Emmock substation Planning Application Number: Angus Council 24/00699/FULN. Available online: https://planning.angus.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=SN6VOFCFMUA00.
[37] Hurlie substation Planning Application Number Aberdeenshire Council APP/2024/1951. Available online: https://upa.aberdeenshire.gov.uk/online-applications/simpleSearchResults.do?action=firstPage

3.4.2 In the Shadow HRA Appropriate Assessment, baseline data will be interrogated alongside potential impacts and pathways, within the context of each European Site's[7] Conservation Objectives, ultimately concluding whether effects may be adverse to each site's integrity.

3.5 Consultation

3.5.1 A summary of comments received from Statutory bodies, together with how they have been addressed within this Shadow HRA, is provided in **Table 12.3.2: Summary of consultation responses** below (refer to **Volume 2, Chapter 11: Ecology** and **Volume 2, Chapter 12: Ornithology** for full consultation responses).

Table 12.3.2: Summary of consultation responses

Consultee	Date	Comment	How comments were addressed
SPAs and Ramsar sites (Ornithology)			
NatureScot	31 May 2023	All proposed routes are within the connectivity distance for foraging geese (15 – 20 km) that could be associated with SPAs and Ramsar sites designated for their non-breeding goose interests. Ongoing surveys will enable an assessment of the impact on geese and inform the Habitats Regulations Appraisal (HRA) process.	Level and type of survey agreed with NatureScot to fulfil requirement for an HRA screening and assessment. Flight activity and Winter Goose Foraging surveys carried out as described in Section 4.
NatureScot	06 March 2024	NatureScot likely to object if effects will be adverse and cannot be mitigated satisfactorily. A site-specific plan for each affected area spanning the lifetime of infrastructure should be produced. Sections D and E: Fowlsheugh SPA connectivity noted.	Line diverter type to be installed as per recommendations on high-risk spans, with maintenance across OHL lifespan. Fowlsheugh SPA connectivity with regard to qualifying feature Herring gull has been assessed.
NatureScot	21 November 2024	Firth of Tay and Eden Estuary SPA and Ramsar site. Collision risk issues and associated mitigation required. Not likely to be significant loss of foraging habitat. Outer Firth of Forth and St Andrew's Complex SPA. Unlikely to be connectivity. Recommend bird diverters where OHL crosses waterways with respect to Red-breasted merganser. Loch of Kinnordy SPA and Ramsar site. Within connectivity distance of Proposed Development. Concentration of goose foraging west of Forfar between A94 and B957. Identified as potential for collision risk. Not Significant loss of foraging habitat. Loch of Lintrathen SPA and Ramsar site. Same as Loch of Kinnordy. Also, Whooper swans (*Cygnus cygnus*) with a similar foraging area as geese. Montrose Basin SPA and Ramsar site (including Duns Dish SSSI). Potential connectivity for Pink-footed (*Anser brachyrhynchus*) and Greylag (*Anser anser*) geese. Goose surveys to establish feeding concentrations. Installation of bird diverters required. Fowlsheugh SPA. Not likely to have an effect on features. Loch of Skene SPA and Ramsar site. Potential connectivity. Line marking should be used in high-risk areas.	Fowlsheugh SPA has been scoped out of the assessment stage. Commitment to mitigation through installation of bird diverters to OHL conductors in high-risk areas and over watercourses. Loss of foraging habitat scoped out of assessment with the exception of Loch of Skene SPA and Montrose Basin SPA).
SACs (Ecology)			
NatureScot	31 May 2023	Protected Areas: These must be identified and impacts avoided. Direct or indirect effects must be mitigated satisfactorily to avoid objection. Site specific plans would be required if alignment was unable to avoid a protected area. Plans must detail all aspects of construction, operation and	Protected Areas: Sensitive ecological receptors were taken into account at each stage of the project, including designated sites. Designated sites within 10 km, 5 km and 2 km of the final design of the Proposed Development have been identified and where there is a

Consultee	Date	Comment	How comments were addressed
		maintenance and the mitigation needed to avoid adverse effects. HRA: NatureScot provided advise on completing the required HRA as the Proposed Development will cross several European Sites.	potential impact pathway to a designated site it is assessed within this appendix. HRA: A Shadow HRA has been completed as per this appendix.
NatureScot	21 November 2024	The alignment options cross the River Tay SAC where qualifying features, Atlantic salmon, otter and brook lamprey, are likely to be present, the River South Esk SAC where qualifying features including freshwater pearl mussel may be present and the River Dee SAC where qualifying features Atlantic salmon, otter and freshwater pearl mussel are likely to be present. Careful placement of infrastructure outside the SAC and watercourse boundary is expected to avoid direct effects. Given the scale of the Proposed Development, long-term impacts are not anticipated provided standard mitigation measures are followed, including compliance with both project-wide and site-specific environmental management procedures as detailed within GEMPs, the CEMP and SPPs.	Potential impacts to designated sites identified within **Volume 5, Appendix 11.1: Desk Study and Legal/Policy Context** have been assessed in this appendix. This included the River Tay SAC, River South Esk SAC, River Dee SAC, Loch of Park SSSI and others. The HRA was undertaken with regards to the three SACs which details the potential impacts pre-mitigation, and all mitigation measures which will be employed to avoid impacting the qualifying features.

4. STAGE 1: SCREENING ASSESSMENT

4.1 Identification of European Sites

4.1.1 Thirteen European Sites were identified within 20 km[38] of the Proposed Development, seven of which are designated as SPAs with six SACs within 10 km of the Proposed Development (refer to **Table 12.3.3: Summary of European Sites Considered at Screening**). Five of the SPAs are also designated as Ramsar sites, while the Firth of Tay and Eden Estuary SAC partially coincides with one of these Ramsar sites.

4.1.2 **Volume 3, Figures 11.2.1-11.2.5: Designated Sites within 10 km, 5 km and 2 km of the Proposed Development** and **Volume 3, Figures 12.2.1-12.2.2: Ornithological Designated Sites within 20 km and 5 km** shows the spatial arrangement of SACs and SPAs, respectively, in relation to the Proposed Development. Further information on the European Sites is provided below.

Firth of Tay and Eden Estuary SAC[39]

4.1.3 This is a large SAC with an area of 15,441 ha, containing three qualifying feature *Habitats Directive Annex I* habitats[40]; an estuary, intertidal mudflats and sandflats and subtidal sandbanks. In this case, the SAC contains two high-quality estuarine systems which are considered together as an integrated site as they form a single large and geomorphologically complex a variety of important estuarine and coastal habitats. Such habitats also include the qualifying features of sandbanks which are slightly covered by sea water all the time, and mudflats and sandflats not covered by seawater at low tide, which are both *Habitats Directive*[28]. The SAC also supports a nationally important breeding colony of the *Habitats Directive II*[41] Harbour seal (*Phoca vitulina*) which utilises the sandbanks, with around 600 adult seals (2% of UK population) using the site to rest, birth their pups, and moult. The Proposed Development is located 7.8 km north of the SAC.

4.1.4 The Firth of Tay and Eden Ramsar site is partially coincident with the SAC of the same name. The interest (qualifying) features are shared with the Firth of Tay and Eden SPA, and these are dealt with below. The Firth of Tay and Eden Ramsar site has no non-ornithological features and no Ramsar criteria are present for the ecological qualifying features of the SAC, thus it is not considered further in relation to the SAC.

River Tay SAC[42]

4.1.5 The River Tay SAC covers are area of 9,461.63 ha, and is designated for its Atlantic salmon (*Salmo salar*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*) and otter (*Lutra lutra*), all of which are *Habitats Directive Annex II* species[41]. Based on rod catch data, the River Tay is consistently one of the best three rivers in Scotland for supporting salmon, with considerable ecological variety, supporting salmon at all its life stages. In 1999, 7,230 salmon were caught in the River Tay, representing 10% of the total Scottish catch for the species that year. The Proposed Development spans the SAC in two locations, oversailing both the Kerbet Water and the Dean Water.

River South Esk SAC[43]

4.1.6 The catchment area of this SAC is 471.85 ha and is primarily selected for supporting freshwater pearl mussel (*Margaritifera margaritifera*) and Atlantic salmon. Pearl mussels are abundant across the river, particularly in its middle section, reaching densities in excess of 20 per m², and the river also supports juvenile mussels with up to 20% of the SAC's population being of juvenile status. The river also supports a high-quality Atlantic salmon population, supporting the species at all stages of its life history. The Proposed Development spans the SAC in two locations, oversailing both the River South Esk and Noran Water.

[38] As explained at 3.3.4 above 10 km for SACs.
[39] JNCC, 2015. *Firth of Tay and Eden Estuary SAC (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030311.pdf [Accessed: 5 March 2025].
[40] JNCC, n.d. *[Annex I] Habitats List.* [Online] Available at: https://sac.jncc.gov.uk/habitat/ [Accessed: 5 March 2025].
[41] JNCC, n.d. *[Annex II] Species List*. [Online] Available at: https://sac.jncc.gov.uk/species/ [Accessed: 5 March 2025].
[42] JNCC, 2015. *River Tay SAC (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030312.pdf [Accessed: 5 March 2025].
[43] JNCC, 2015. *River South Esk SAC (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030262.pdf [Accessed: 5 March 2025)].

Garron Point SAC[44]

4.1.7 This is a relatively small SAC of 15.01 ha which is solely designated for supporting the Narrow-mouthed Whorl Snail (*Vertigo angustior*), a tiny coastal snail which is a *Habitats Directive Annex II* species[41]. The Proposed Development is located 9 km west of the SAC. This snail is threatened in most of its range in Europe, and has very specific habitat requirements, namely marshy ground with high, even humidity and flowing groundwater, but subject neither to deep or prolonged flooding nor to periodic desiccation. As such, this species has isolated, local populations in the UK, with only eight areas in the UK supporting it, inclusive of Garron Point.

River Dee SAC[45]

4.1.8 The catchment area of this SAC is 2,334.48 ha and is primarily selected for supporting Atlantic salmon, freshwater pearl mussel, and otter. The Proposed Development is located within the SAC where it spans the Burn of Sheeoch and River Dee. Pearl mussel is considered common in this river, and the population to be functional, with 30% of the population being juveniles. Atlantic salmon are supported at all stages of its life history, and 4-5% of the total catch in Scotland each year, on average, is from this river. The river system also supports extensive areas of suitable otter habitat including areas for feeding, resting, and breeding. Previous otter surveys have indicated the presence of otter throughout the watercourse, indicating a strong, high-quality population of the species. The Proposed Development spans the SAC in two locations, oversailing both the Burn of Sheeoch and the River Dee.

Red Moss of Netherley SAC[46]

4.1.9 This SAC is designated for its active and degraded raised bogs and is considered one of the largest remaining raised bogs in northeast Scotland, comprising an area of 93.17 ha. The Proposed Development is located 6.5 km west of this SAC. Primarily selected for active raised bog *Habitats Directive Annex I* habitat, the site contains major peat-building bog mosses including *Sphagnum papillosum* and *Sphagnum magellanicum*. Although areas of the active bog have been subject to damage in the past, the hydrological function of the bog remains intact. The site also qualifies for degraded raised bogs that are still capable of natural regeneration.

Firth of Tay and Eden Estuary SPA[47] *and Ramsar site*

4.1.10 A large and geographically fractured SPA, located around 8.5 km south of the Proposed Development, cumulatively forming an area of 6,947.6 ha and designated for *Birds Directive Annex I* species breeding Little tern (*Sternula albifrons*; average 25 pairs, 1% of GB population) and Marsh harrier (*Circus aeruginosus*; four females, 3% of GB population). The SPA is also designated for a variety of wintering waterfowl species including, but not limited to, Bar-tailed godwit (*Limosa lapponica*; 5% of GB population), Greylag goose (*Anser anser;* 1% of UK population), Pink-footed goose (*Anser brachyrhynchus*; 1% of UK population), Redshank (*Tringa totanus;* 1% of E. Atlantic population), Velvet scoter (*Melanitta fusca;* 24% of GB population) , and Eider (*Somateria mollissima*; 18% of GB population). The SPA regularly supports wildfowl numbers in excess of 20,000 individuals.

4.1.11 The boundary of the Ramsar site is coincident with the Firth of Tay and Eden Estuary SPA, which underpins all the bird features of the Ramsar site. The Firth of Tay and Eden Estuary Ramsar qualifies under Ramsar Criterion 2 by supporting breeding Marsh harrier and Little terns; under Ramsar Criterion 5 by regularly supporting waterbirds in numbers of 20,000 individuals or more; and under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds (1990/91 to 1994/95) of Bar-tailed godwit, Redshank, Greylag goose and Pink-footed goose.

4.1.12 The Firth of Tay and Eden Estuary Ramsar site lies within the following SSSIs: Inner Tay Estuary, Monifieth Bay, Barry Links, Tayport-Tentsmuir Coast and Eden Estuary.

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[44] JNCC, 2015. *Garron Point SAC (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030356.pdf [Accessed: 5 March 2025].
[45] JNCC, 2015. *River Dee SAC (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030251.pdf [Accessed: 5 March 2025].
[46] JNCC, 2015. *Red Moss of Netherley SAC (STANDARD DATA FORMS)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030315.pdf [Accessed: 5 March 2025].
[47] JNCC, 2018. *Firth of Tay and Eden Estuary SPA (STANDARD DATA FORMS)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9004121.pdf [Accessed: 5 March 2025].

Outer Firth of Forth and St. Andrews Bay Complex SPA[48]

4.1.13 A marine and estuarine SPA, forming an area of 272,068.1 ha and located around 8.5 km south of the Proposed Development, consists of parts of the adjacent firths of the River Forth and the River Tay and merging in the marine zone off the east coast of Fife. The SPA is designated for its large variety of waterfowl species (regularly supported numbers in excess of 20,000 individuals) and both breeding and non-breeding seabird assemblage. *Birds Directive Annex I* species included in the citation include feeding Arctic tern (*Sterna paradisaea)* and Common tern (*Sterna hirundo*), both from adjacent breeding colonies, Red-throated diver (*Gavia stellata;* non-breeding- 5% of GB population), Little gull (*Hydrocoloeus minutus;* non-breeding – mean 126 individuals 2001/02-2004/05), and Slavonian grebe (*Podiceps auritus*; non-breeding – 2.7% of GB population).

Loch of Kinnordy SPA[49] *and Ramsar site*

4.1.14 This SPA is 85.14 ha located approximately 5.5 km northwest of the Proposed Development and is designated for both Greylag geese and Pink-footed geese. The SPA citation notes that the peak Winter average count (1986/87-1990/91) was 910 for Greylag geese (1% of Iceland/UK/Ireland biogeographic population) and 3,960 for Pink-footed geese (3% of Iceland/UK/Ireland biogeographic population).

4.1.15 The boundary of the Ramsar site is coincident with Loch of Kinnordy SPA, which underpins the bird features of the Ramsar site. The Loch of Kinnordy Ramsar site qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals of a population of Greylag goose and Pink-footed goose. It is also coincident with Loch of Kinnordy SSSI, which underpins the Ramsar habitat features. The site is located upstream of the Proposed Development.

Loch of Lintrathen SPA[50] *and Ramsar site*

4.1.16 This SPA is 186.27 ha and is designated for Greylag geese only. The SPA is located approximately 13 km northwest of Proposed Development. The citation expresses a peak Winter average count (1985/86-1989/90) of 2,100 birds, representing 2% of the Icelandic migratory population.

4.1.17 The boundary of the Ramsar site is coincident with Loch of Lintrathen SPA, which underpins the bird feature of the Ramsar site: it qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds (Greylag goose). It is also coincident with Loch of Lintrathen SSSI.

Montrose Basin SPA[51] *and Ramsar site*

4.1.18 A large SPA of 981.19 ha located approximately 6 km southeast of Proposed Development comprising the enclosed estuary of the River South Esk, and a small eutrophic loch called Dun's Dish, 4 km northwest of the basin. The SPA represents a nationally important roosting site for wintering migratory species to the UK including Pink-footed goose (21,800 individuals, 9% of UK/Greenland/Iceland biogeographic population), Greylag goose (1,080 individuals, 1% of Iceland/Ireland/UK biogeographic population), and Redshank (2,240 individuals, 2% of East Atlantic population). The SPA also regularly supports in excess of 20,000 waterfowl regularly including Oystercatcher (*Haematopus ostralegus*; 1% of GB population), Eider (5% of GB population), Wigeon (*Anas penelope*; 2% of GB population), Knot (*Calidris canutus*; 1% of GB population), Dunlin (*Calidris alpina*; 0.4% of GB population), and Shelduck (*Tadorna tadorna*; 1.8% of GB population).

4.1.19 The boundary of the Ramsar site is coincident with Montrose Basin SPA, which underpins all the bird features of the Ramsar site. The estuary (including saltmarshes) and mudflats are considered to be supporting habitat for the SPA and Ramsar features by providing essential feeding and roosting habitat. Montrose Basin Ramsar site qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds (Pink-footed goose, Greylag goose and Redshank) as well

[48] JNCC, 2020. Outer Firth of Forth and St Andrews Bay Complex SPA *(STANDARD DATA FORMS).* [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020316.pdf [Accessed: 5 March 2025].
[49] JNCC, 2018. Loch of Kinnordy SPA *(STANDARD DATA FORMS).* [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9004051.pdf [Accessed: 5 March 2025].
[50] JNCC, 2022. Loch of Lintrathen SPA *(STANDARD DATA FORMS).* [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9004061.pdf [Accessed: 5 March 2025].
[51] JNCC, 2019. Montrose Basin SPA *(STANDARD DATA FORMS).* [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9004031.pdf [Accessed: 5 March 2025].

as qualifying under Ramsar Criterion 5 by regularly supporting waterbirds in numbers of 20,000 or more, including Oystercatcher, Eider, Wigeon and Knot.

4.1.20 The boundary of the Ramsar site also coincides with Montrose Basin SSSI and Dun's Dish SSSI. Montrose Basin SSSI additionally underpins the estuary and mudflat Ramsar habitat features as mudflats, saltmarsh and transition saltmarsh.

Fowlsheugh SPA[52]

4.1.21 This SPA, located 8.5 km east of Proposed Development, supports a breeding seabird colony greater than 20,000 in number on cliffs spanning 10.15 ha, composed of basalt and conglomerate rocks, across a total area of 1,303.23 ha. The sheer cliffs vary in height from 30 m to 60 m and support breeding guillemot (*Uria aalge*; 5% of GB/ 1.7% of west Europe population), Kittiwake (Rissa tridactyla; 7.5% of GB/ 1.2% of world population), Razorbill (*Alca torda*; 3.9% of GB population), Fulmar (*Fulmarus glacialis*; 0.2% of GB population), and Herring gull (2% of GB population).

Loch of Skene SPA[53] *and Ramsar site*

4.1.22 This Site is located 3 km east of Proposed Development at its closest point. It is a eutrophic loch surrounded by reedbeds and Birch-Willow carr, approximately 10 km west of Aberdeen. The Loch of Skene SPA[53] is designated for non-breeding Greylag goose (5,500 birds; 5% of Iceland/UK/Ireland biogeographic region), Goldeneye (150 birds, 1% of GB population), and Goosander (*Mergus merganser*; 110 birds; 2% of GB population).

4.1.23 The boundary of the Ramsar site is coincident with Loch of Skene SPA, which underpins the bird features of the Ramsar site. The Loch of Skene Ramsar site qualifies under Criterion 4 by supporting the following waterbird species at a critical stage in their life cycles: Goldeneye and Goosander. In addition, the Loch of Skene Ramsar site also qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds (Greylag goose). It is also coincident with Loch of Skene SSSI which underpins the SPA and Ramsar.

Table 12.3.3: Summary of European Sites Considered at Screening

Site Name	Approx. distance from the Proposed Development (at closest point)	Qualifying features	Connectivity to Proposed Development
SAC			
Firth of Tay and Eden Estuary SAC[54][39]	7.8 km south of Proposed Development	Estuaries Sandbanks which are slightly covered by seawater all the time Mudflats and sandflats not covered by seawater at low tide Harbour seal	Hydrological connectivity to the Proposed Development via over 15 km of the Fithie Burn/Dighty Water. The Fithie Burn flows adjacent to the proposed Emmock substation.
River Tay[31] SAC	Proposed Development oversails the SAC where it spans the Kerbet Water and Dean Water	Otter River lamprey Brook lamprey Sea lamprey Atlantic salmon Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels	Hydrological connectivity to the Proposed Development as the SAC flows through the LOD.
River South Esk[32] SAC	Proposed Development oversails the SAC where it spans the River South Esk and Noran Water	Freshwater pearl mussel Atlantic salmon	Hydrological connectivity to the Proposed Development as the SAC flows through the LOD.

[52] JNCC, 2022. *Fowlsheugh SPA (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9002271.pdf [Accessed: 5 March 2025].
[53] JNCC, 2022]., *Loch of Skene SPA (STANDARD DATA FORM)*. [Online] Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9002261.pdf [Accessed: 5 March 2025].
[54] For Firth of Tay and Eden Estuary Ramsar, see the corresponding SPA and Ramsar information.

Site Name	Approx. distance from the Proposed Development (at closest point)	Qualifying features	Connectivity to Proposed Development
Garron Point SAC[44]	9 km east of Proposed Development	Narrow-mouth whorl snail	No hydrological or ecological connectivity to the Proposed Development.
River Dee SAC[45]	Proposed Development oversails the SAC where it spans the Burn of Sheeoch and River Dee	Otter Freshwater pearl mussel Atlantic salmon	Hydrological connectivity to the Proposed Development as the SAC flows through the LOD.
Red Moss of Netherley SAC[46]	6.5 km east of Proposed Development	Active raised bogs Degraded raised bogs still capable of natural regeneration	No hydrological or ecological connectivity to the Proposed Development.
SPA and Ramsar			
Firth of Tay and Eden Estuary[47]	8.5 km south of the Proposed Development	SPA/Ramsar: Bar-tailed godwit (*Limosa lapponica*; non-breeding); Common scoter (non-breeding); Cormorant (*Phalacrocorax carbo*; non-breeding); Dunlin (non-breeding); Eider (non-breeding); Goldeneye (non-breeding); Goosander (non-breeding); Grey plover (*Pluvialis squatarola*; non-breeding); Greylag goose (non-breeding); Icelandic Black-tailed godwit (*Limosa limosa islandica*; non-breeding); Little tern (*Sternula albifrons*; breeding); Long-tailed duck (non-breeding); Marsh harrier (*Circus aeruginosa*; breeding); Oystercatcher (non-breeding); Pink-footed goose (non-breeding); Red-breasted merganser (non-breeding); Redshank (non-breeding); Sanderling (*Calidris alba*; non-breeding); Shelduck (non-breeding); Velvet scoter (non-breeding); waterfowl assemblage (non-breeding).	Potential connectivity with Greylag and Pink-footed geese as within core foraging range of 20 km[34]
Outer Firth of Forth and St. Andrews Bay Complex[48]	8.5 km south of the Proposed Development	SPA: Arctic Tern (*Sterna paradisaea*; breeding); Black-headed gull (*Chroicocephalus ridibundus*; non-breeding); Common gull (non-breeding); Common scoter (*Melanitta nigra*; non-breeding); Common tern (*Sterna hirundo*; breeding); Eider (non-breeding); Gannet (*Morus bassanus*; breeding); Goldeneye (non-breeding); Guillemot (breeding & non-breeding); Herring gull (breeding & non-breeding); Black-legged kittiwake (breeding & non-breeding); Little gull (*Hydrocoloeus minutus*; non-breeding); Long-tailed duck (*Clangula hyemalis*; non-breeding); Manx shearwater (*Puffinus puffinus*; breeding); Puffin (breeding); Razorbill (non-breeding); Red-breasted merganser (non-breeding); Red-throated diver (*Gavia stellata*; non-breeding); seabird assemblage (breeding and non-breeding); Shag (*Phalacrocorax aristotelis*; breeding & non-breeding); Slavonian grebe (*Podiceps auritus*; non-breeding); Velvet scoter (non-breeding).	Potential connectivity with qualifying species due to distance from Proposed Development (gull mean foraging to 10.5 km from their breeding sites[55])
Loch of Kinnordy[49]	5.5 km northwest of Proposed Development	SPA/Ramsar: Greylag goose (non-breeding); Pink-footed goose (non-breeding). Ramsar/ SSSI: Breeding bird assemblage; Eutrophic loch, Open water transition fen, Cowbane (*Cicuta virosa*); Mudwort	Potential connectivity with Greylag and Pink-footed geese as within core foraging range of 20 km.

[55] Thaxter, CB et al., 2019. Avian vulnerability to wind farm collision through the year: Insights from lesser black-backed gulls (Larus fuscus) tracked from multiple breeding colonies. [Online] Available at: https://doi.org/10.1111/1365-2664.13488 [Accessed: 5 March 2025].

Site Name	Approx. distance from the Proposed Development (at closest point)	Qualifying features	Connectivity to Proposed Development
		(*Limosella aquatica*); Lesser tussock sedge (*Carex diandra*).	Regarding habitat and botanical features there is no ecological connectivity to the Proposed Development[34]. The site is upstream of the Proposed Development, and therefore there is no hydrological connectivity relevant to the assessment.
Loch of Lintrathen[50]	13 km northwest of Proposed Development	SPA/Ramsar: Greylag goose (non-breeding).	Potential connectivity with Greylag geese as within core foraging range of 20 km[34]
Montrose Basin[51]	6 km southeast of Proposed Development	SPA/Ramsar: Dunlin (non-breeding), Eider (non-breeding), Greylag goose (non-breeding), Knot (non-breeding), Oystercatcher (non-breeding), Pink-footed goose (non-breeding), Redshank (non-breeding), Shelduck (non-breeding), Wigeon (non-breeding), waterfowl assemblage. Ramsar/SSSI: Estuary; Mudflat. SSSI: Eider (breeding & non-breeding), wildfowl assemblage.	Potential connectivity with Greylag and Pink-footed geese as within core foraging range of 20 km For estuary and mudflat habitat features, there is no ecological connectivity to the Proposed Development.[34] The site is located downstream of the Proposed Development, with hydrological connectivity via over 25 km of watercourse.
Fowlsheugh[52]	8.5 km east of Proposed Development	SPA: Fulmar (breeding), Guillemot (breeding), Herring gull (breeding), Kittiwake (breeding), Razorbill (breeding), seabird assemblage (breeding). SSSI: Breeding seabird colony (Fulmar, Guillemot, Kittiwake, Puffin, & Razorbill).	Potential connectivity with qualifying species due to distance from Proposed Development (gull mean foraging to 10.5 km from their breeding sites[55]).
Loch of Skene[53]	3 km east of Proposed Development	SPA/Ramsar: Greylag goose (non-breeding) Goldeneye (non-breeding), Goosander (non-breeding). SSSI: Common gull (non-breeding), Goldeneye (non-breeding), Greylag goose (non-breeding), Pink-footed goose (non-breeding).	Potential connectivity with Greylag and Pink-footed geese as within core foraging range of 20 km[34]

4.2 Relevant Ecological Baseline

4.2.1 Ecological baseline collected to inform the Ecological Impact Assessment (EcIA) is presented in **Volume 5, Appendices 11.2: Habitat and Vegetation Survey Report, 11.3: Protected Species Survey Report, 11.4: Bat Survey Report** and **Volume 6, Appendix 11.6: Confidential Protected Species Survey Report**. Data relevant to the qualifying features of each European Site[7] is summarised below.

Firth of Tay and Eden Estuary SAC[39]

4.2.2 No relevant ecological baseline as no qualifying features/habitats associated with this site exist on the connected inland watercourses surveyed including the Fithie Burn.

River Tay SAC[42]

Otter

4.2.3 Desk study data identified fewer than 10 otter records within the study area within 5 km of Section A of the Proposed Development.

4.2.4 No evidence of otter was found on either oversailed watercourse during surveys.

4.2.5 Kerbet Water was deemed to provide sub-optimal habitat for otter as it offers a mixed substrate with some foraging potential for otter and overhanging dense vegetation providing potential resting sites. However, the surrounding land is utilised for cereal crops, and non-native invasive species (Himalayan balsam *Impatiens glandulifera*) are present across the water's edge, reducing water quality and food availability.

4.2.6 Otter were reported to be present on the Dean Water (*per* landowner observations). The Dean Water is also deemed sub-optimal for otter given the potential resting sites within dense, overhanging riparian vegetation and hydrological connectivity to a network of other good quality watercourses within the area, including the Kerbet Water. There is a lack of woodland or trees, although the surrounding terrestrial habitat is comprised of seasonally wet neutral grassland on either side of the river which offers some foraging potential.

Atlantic Salmon

4.2.7 Desk study data found one record of Atlantic salmon within 5 km of Section A.

4.2.8 Kerbet Water was deemed to have limited suitable habitat for Atlantic salmon as the watercourse was typically silty and cloudy with suspended sediment which the Atlantic salmon do not favour. The wider landscape was dominated by agricultural land and is likely to be affecting the watercourse and its overall suitability to support Atlantic salmon. No evidence of Atlantic salmon was found during the surveys.

4.2.9 A field drain connected to the Kerbet Water was also assessed and found to also have limited suitability for Atlantic salmon as the water was cloudy, had suspended sediment present and had a notable barrier present. These factors decrease the suitability for Atlantic salmon.

4.2.10 The Dean Water was deemed to have limited suitability for Atlantic salmon. This is due to the watercourse being canalised, roughly 100 cm deep and of slow flow. The water was cloudy and had suspended sediment present. Substrate was entirely comprised of silt, and there was no evidence of fish presence recorded during surveys, and therefore this watercourse was also deemed to have limited suitability for Atlantic salmon.

Lamprey

4.2.11 No records of lamprey species were found through desk study data within 5 km of Section A.

4.2.12 All three species of lamprey which are qualifying features of the SAC (river lamprey, sea lamprey, and brook lamprey) have very particular habitat requirements in that they require watercourses with gravel beds for spawning, with soft marginal silt with high oxygen levels for larvae to inhabit.

4.2.13 Neither oversailed watercourse provided suitable habitat, with both being of low water quality, and subject to agricultural run-off.

4.2.14 The Kerbet Water was typically silty, and although it had small areas with gravel substrate it was subject to bank erosion, drainage, and run-off from agricultural fields. Invasive species such as Himalayan balsam were also present.

4.2.15 The Dean Water was composed of completely silted substrate, was canalised and subject to run-off from agricultural land.

Clear-water lakes or lochs with aquatic vegetation and Poor to Moderate nutrient levels

4.2.16 Both the Kerbet Water and Dean water are watercourses, rather than lakes or lochs, surrounded by agricultural land, predominantly in the form of arable cereal production, and were found to be subject to agricultural run-off. It is assumed that excess nutrient input into these watercourses is an ongoing scenario, and additional input of run-off (pollution or sediments) could exacerbate nutrient levels.

River South Esk SAC[43]

Freshwater Pearl Mussel

4.2.17 Desk study data, survey locations, methods and results are all confidential and are therefore included within **Volume 6, Appendix 11.6: Confidential Protected Species Report** rather than reported here. To ensure a conservative assessment, freshwater pearl mussel is assumed to be present in this watercourse and its designated tributaries.

Atlantic Salmon

4.2.18 The desk study reported 169 records for Atlantic salmon within 5 km of Sections A and C to F, mostly associated with Sections E and F. No records were identified within the River South Esk SAC.

4.2.19 The Noran Water offered moderate to fast water flow, and a generally moderate water quality level, with areas of high quality. Fish were found to be present in sections of the watercourse during surveys, although the species was not determined. Owing to suitable habitat, it was considered that this watercourse was likely to support Atlantic salmon and this species is therefore assumed to be present.

Garron Point SAC[44]

4.2.20 No relevant ecological baseline is available associated with this site. Narrow-mouthed Whorl snail is an exclusively coastal species which requires coastal marshy grassland habitats that are not found within the areas surveyed in respect of the Proposed Development.

River Dee SAC[45]

Otter

4.2.21 The desk study data revealed numerous records of otter along the River Dee within 5 km of Section E. Numerous in this case comprises numbers more than 20 records.

4.2.22 The Burn of Sheeoch was considered to provide optimal habitat for otter, as it was wide (around 6 m) with good flow at all times of the year. Evidence of otter was recorded during surveys in the form of three old spraints on rocks in the watercourse and four recent spraints further down the watercourse.

4.2.23 The River Dee is designated for otter and is of optimal habitat as it is a large watercourse which flows all year round and is likely to support plentiful food resources. The banksides consisted of rocky areas and overhanging vegetation which offered ample resting up areas and potential sprainting sites. No evidence of otter was recorded during surveys on this watercourse within the ESA.

Freshwater Pearl Mussel

4.2.24 Desk study data, survey locations, methods and results are all confidential and are therefore included within **Volume 6, Appendix 11.6: Confidential Protected Species Report** rather than reported here. To ensure a conservative assessment, freshwater pearl mussel is assumed to be present in this watercourse.

Atlantic Salmon

4.2.25 The desk study revealed that numerous records of Atlantic salmon were found within 5 km of Section E.

4.2.26 The Burn of Sheeoch was considered to be of moderate flow, with some areas of high and slow flow, and was typically 6 m wide, with a range of 5-8 m. The water was clear with little suspended sediment. Although no fish were recorded at the time of the survey, this watercourse comprises habitats likely to support Atlantic salmon and this species is likely present.

Red Moss of Netherley SAC[46]

4.2.27 There is no relevant ecological baseline associated with this site, since the raised bog system is rain-fed and has no hydrological connectivity or ecological connectivity to the site.

4.3 Relevant Ornithological Baseline

4.3.1 Ornithological baseline collected to inform the Ornithological Impact Assessment (OIA) is presented in **Volume 5, Appendix 12.1: Ornithology Technical Report and Volume 6, Appendix 12.2: Confidential Ornithology Report**. Data relevant to the qualifying features of each European Site[7] are summarised below.

Firth of Tay and Eden Estuary SPA[47] and Ramsar site

Greylag Goose

4.3.2 There was no recorded use of the land within the LOD, or within 1 km of the Proposed Development, by Greylag geese during baseline field surveys. Known foraging sites are present within 5 km to the southwest of Section A, where a single flock of 22 birds was recorded foraging approximately 1.5 km from the Proposed Development.

Pink-footed Goose

4.3.3 Seven records of Pink-footed geese within 5 km of the Proposed Development in the last 10 years were found from desk study data (National Biodiversity Network (NBN) Atlas[56]). No significant traditional foraging sites were present within 10 km of the Proposed Development.

4.3.4 Twelve flights, totalling 3,455 birds, were recorded during baseline field surveys near Tealing Substation of which five flights, totalling 421 birds, were recorded crossing the Proposed Development.

Outer Firth of Forth and St. Andrews Bay Complex SPA[48]

Herring Gull

4.3.5 Herring gull were recorded in low numbers only during flight activity surveys in the non-breeding season (maximum count of seven birds) in the area near to Tealing Substation. 80 Herring gull were recorded as part of a mixed gull flock of 200 birds during breeding bird surveys; however, no breeding activity was recorded across the survey effort.

Red-breasted Merganser

4.3.6 No Red-breasted merganser were recorded during field surveys with no suitable foraging available for the species within 2 km of the Proposed Development. British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS)[57] counts did not record the species within 10 km of the Proposed Development.

Loch of Kinnordy & Loch of Lintrathen SPA[50] and Ramsar sites

Greylag Goose

4.3.7 There is much interchange in roosting numbers of Greylag geese between the Loch of Kinnordy and the nearby Loch of Lintrathen. BTO WeBS[57] survey data has shown in the last five years that few Greylag geese now use the Loch of Kinnordy for roosting (despite its importance to the local population in the 1960s-1980s), with an average of 133 birds across the 5-year period (SPA citation was of 910 birds).

4.3.8 BTO WeBS[57] survey data from the last five years at Loch of Lintrathen showed an average of 139 Greylag geese roosting at the Loch, a marked decrease from the SPA citation of 2,100 birds. Traditional foraging grounds associated with Loch of Lintrathen's Greylag geese are in Strathmore to the south and east of the loch, with limited foraging apparent within 10 km of the Proposed Development.

4.3.9 No Greylag geese were record on the ground foraging across surveys associated with these SPAs.

4.3.10 A single flight of 21 Greylag geese was recorded during Winter flight activity surveys and was recorded intersecting with the Proposed Development.

[56] NBN Trust, 2024. *The National Biodiversity Network (NBN) Atlas*. [Online] Available at: https://nbnatlas.org/ [Accessed: 5 March 2025].
[57] BTO, 2024. *Wetland Bird Survey Data*. [Online] Available at: https://www.bto.org/our-science/projects/wetland-bird-survey/data [Accessed: 5 March 2025].

Pink-footed Goose

4.3.11 Similar to Greylag geese, very few Pink-footed geese have been recorded using the Loch of Kinnordy for roosting in recent years. BTO WeBS[57] counts average only seven birds, compared with SPA citation of 3,960 birds.

4.3.12 BTO WeBS[57] survey data from the last five years at Loch of Lintrathen showed an average of 11,909 birds roosting at the Loch. It is therefore assumed, that Pink-footed geese recorded during vantage point watches in Section A and B were mostly likely associated with the Loch of Lintrathen SPA[50].

4.3.13 Flight activity surveys associated with Loch of Kinnordy and Loch of Lintrathen SPAs[50] recorded 41 flights of Pink-footed geese, totalling 12,724 birds. Twenty-five of these flights, totalling 8,067 birds were recorded passing over the location of the Proposed Development.

Montrose Basin SPA[51] and Ramsar site

Greylag Goose

4.3.14 BTO WeBS[57] data in the last five years gave a mean count of 157 for Greylag geese roosting at Montrose Basin, significantly fewer than the SPA citation of 1,080 birds.

4.3.15 During flight activity surveys, only three flights of Greylag geese were recorded from vantage points (VPs) which incorporated a 10 km buffer around the SPA site. One of these flights passed over the location of the Proposed Development. An equivalent of 17 watch days were conducted at VPs associated with the Montrose Basin SPA[51], with approximately 140 Greylag geese considered likely to cross the OHL over the course of a non-breeding season (September – March).

4.3.16 Both Section C and D of the Proposed Development provide limited foraging opportunity for the species, within an area of 20 km out from the Montrose Basin SPA[51], a maximum count of two Greylag geese were recorded foraging in this area.

Pink-footed Goose

4.3.17 Montrose Basin is one of the UK's most important roosting sites for Pink-footed geese, with BTO WeBS[57] counts grossly exceeding the SPA citation in 2020/21, with a maximum count of 84,400 birds from BTO WeBS[57] survey data, compared to the SPA citation of 21,800 birds.

4.3.18 Sixty-two flights, totalling 6,360 birds, were recorded during flight activity surveys of which 26 flights, totalling 3,028 geese were observed passing over the location of the Proposed Development.

4.3.19 Within 2 km of the Proposed Development, Pink-footed geese were observed foraging within Section C and D across several areas including near Edzell and Inchbare (both NO66) and to the north of Laurencekirk (NO67). In addition, birds were also seen near Haulkerton (NO77). Few large flocks were recorded; however, a group of 1,200 Pink-footed geese were seen in rough pasture ground adjacent to the River North Esk and adjacent to the Proposed Development. Birds at Tannadice, ca. 18 km from the Montrose Basin SPA[51] were equidistant from the Loch of Kinnordy SPA[49] but are thought to be associated with Montrose Basin.

Fowlsheugh SPA[52]

Herring Gull

4.3.20 Only a small section of the Proposed Development falls within the mean foraging range for Herring Gull (10.5 km) associated with Fowlsheugh SPA[52].

4.3.21 Herring gull were recorded sporadically during the breeding season, with gulls noted foraging in fields to the east of Easter Auquhollie and with no foraging habitat of note within 5 km of the Proposed Development. Herring gull were also recorded as foraging during the breeding season to the west of Drumlithie and near to the Proposed Development, but over 10 km from the SPA.

4.3.22 Flight activity surveys, focussed on the non-breeding season and with the nearest VP approximately 13 km from the SPA, did not record Herring gull in flight.

Loch of Skene SPA[53] and Ramsar site

Greylag Goose

4.3.23 BTO WeBS[57] data showed that the mean count for Greylag geese at the Loch of Skene over the last 5 years was 43 birds, substantially fewer than the SPA citation of 5,500 birds[58], indicating that the importance of this roost site for Greylag geese has considerably reduced over the years.

4.3.24 Within 10 km of the SPA, 23 flights were recorded of Greylag geese from VPs during flight activity surveys. Nine of these flights, totalling 104 birds, were recorded as crossing the Proposed Development.

4.3.25 Small flocks of Greylag geese were recorded foraging near Kemnay in the presence of Pink-footed geese, and in fields to the south of the loch itself. The largest-sized flocks of Greylags were noted near Landberry, near Marketmuir wood to the southwest of the loch, with up to 105 birds noted here on four different survey visits.

4.4 Proposed Development Characteristics

4.4.1 The Proposed Development is described in detail in **Volume 1, Chapter 3: Project Description**. **Volume 1, Chapter 4: Alternatives and the Routeing Process** explains how key ecological constraints were avoided during the design process. Relevant measures included:

- avoidance of route crossing through European Sites[7], where possible;
- minimisation of route encroaching core foraging ranges of qualifying features of associated SPAs and Ramsar sites;
- wherever possible placing OHL towers in locations set back from the banks of rivers and larger watercourses to reduce the potential for construction related impacts such as sedimentation and pollution;
- avoidance of localised areas of peat-based soils; and
- a LOD applied to allow flexibility in final design to avoid or respond to environmental constraints.

4.4.2 Due to the scale of the infrastructure, and the length of the route, in many cases ecological constraints could not be avoided. As such the Proposed Development makes several watercourse crossings (through oversailing) and will require construction works near watercourses.

4.5 Potential Pathways to Likely Significant Effects

4.5.1 The generic impacts from typical OHL developments are set out in **Table 12.3.4: Impact Pathways and Proposed Development Activity,** which also establishes the pathways by which these impacts may occur. Impacts here are expressed in terms of the Conservation Objectives of the European Sites listed in **Table 12.3.3: Summary of European Sites Considered at Screening**. For example, where the Conservation Objective states that the "*the extent and quality of habitat will be retained and protected from loss and protection*", an impact would subsequently arise from the loss or damage. Impact pathways refer to the ways in which potential impacts may be realised, which are shown in the table, along with how impact pathways may arise from Proposed Development related activity. The impacts identified, arising from the Proposed Development, through the identified pathways, will be used to assess likely significant effects upon the qualifying features of the European Sites.

Table 12.3.4: Impact Pathways and Proposed Development Activity

Proposed Development Activity	Impact Pathway	Impact
• Tower and access track construction • Woodland felling for wayleave and options for micrositing, including management felling activity	• Habitat loss through construction activity • Disrupted distribution of species around Proposed Development as a consequence of construction activity or a possible pollution event • Loss of extent of supporting habitat via fragmentation as a result of clearing for infrastructure	• Physical damage/loss of habitat
• Tower and access track construction	*Physical disturbance:*	• Physical disturbance and/ or mortality

[58] European Union, 2018. *Citation for Special Protection Area: Loch of Skene*. [Online] Available at: https://sitelink.nature.scot/site/8536 [Accessed: 5 March 2025].

Proposed Development Activity	Impact Pathway	Impact
• Woodland felling for wayleave and options for micrositing, including management felling activity • Presence of OHLs throughout operational phase • Presence and operation of machinery and vehicles • Increased human activity (site personnel)	• Change in distribution (displacement) of species in area around Proposed Development through construction activity • Loss of structure, function and supporting processes of supporting habitats *Non-physical disturbance:* • Disturbance to species • Change in distribution of species	• Non-physical disturbance (noise, vibration and light)
• Earthworks and drainage structures associated with construction of infrastructure (tower bases and new access tracks)	• Loss of habitat • Habitat fragmentation • Disturbance of species • Change in distribution of species and habitats	• Changes in water quality (eg pollution event, sedimentation) and local changes in hydrological regime

4.5.1 In the absence of mitigation and in recognition of the requirement to apply the precautionary principle during Screening, it is considered that Proposed Development activity listed in **Table 12.3.4: Impact Pathways and Proposed Development Activity** may result in LSE, requiring further consideration through Stage 2 Appropriate Assessment. The Significance Test undertaken against the activities listed in **Table 12.3.4: Impact Pathways and Proposed Development Activity** is detailed in the following paragraphs.

Special Areas of Conservation

Firth of Tay and Eden Estuary SAC[39]

4.5.2 The only connectivity between the Proposed Development and the European Site in this case is the Fithie Burn, which in turn connects to the Dighty Water which flows into the designated area in the Tay Estuary. Although the Proposed Development (and the associated Emmock substation) is 8 km in distance from the European Site, the total combined length of the watercourses which hydrologically connect the Tay Estuary to the Proposed Development is over 15 km, and therefore given this distance, **it is considered that there would be no LSE impacting on any of the qualifying features of the Firth of Tay and Eden Estuary SAC**[39].

River Tay SAC[42]

4.5.3 Each impact identified in **Table 12.3.4: Impact Pathways and Proposed Development Activity** could be experienced by each of the River Tay SAC's[42] qualifying features, with the exception of clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels, as this feature can only be influenced by changes in water quality and subsequent downstream effects, and the area surrounding the Proposed Development contains no clear-water lakes or lochs.

4.5.4 There are no trees to be felled surrounding the Kerbet Water or the Dean Water for the Proposed Development and therefore bank erosion is not expected, and in turn water quality should not be adversely affected due to construction works. As the watercourses which are over sailed were not suitable for supporting Atlantic salmon or any of the three lamprey species, these impacts would not affect these qualifying features. Furthermore, a study was commissioned to consider the potential for non-physical disturbance through electromagnetic field (EMF) effects on fish and freshwater pearl mussel; this study reported that EMFs from the Proposed Development will have a **Negligible** impact on these receptor species and does not form a likely impact pathway (see **Annex 12.3.2: Electromagnetic field effects on fish and freshwater pearl mussel**). **It is considered that LSE would be present for otter only regarding disturbance during construction**.

4.5.5 Operational activities associated with the Proposed Development will be intermittent and of a much lower intensity than those associated with construction. No LSE have therefore been identified associated with operational activities.

River South Esk SAC[43]*& River Dee SAC*[45]

4.5.6 Each impact identified in **Table 12.3.4: Impact Pathways and Proposed Development Activity** could be experienced by each of the qualifying features of both the River South Esk SAC[43] and the River Dee SAC[45].

4.5.7 Felling of trees is required as part of the construction phase on all associated watercourses with these oversailed SACs. This may lead to bank erosion, and in turn impact water quality, disturb freshwater pearl mussel, otter, and Atlantic salmon, and potentially lead to loss or degradation of habitat used by all of these species. Therefore, it is considered that LSE would be present **for all qualifying features of both SACs as a result of construction activities**.

4.5.8 The study undertaken to consider the potential for non-physical disturbance through EMF effects reported that EMFs from the Proposed Development will have a **Negligible** impact on fish and freshwater pearl mussel and would not form a likely impact pathway (see **Annex 12.3.2: Electromagnetic field effects on fish and freshwater pearl mussel**).

4.5.9 Operational activities associated with the Proposed Development will be intermittent and of a much lower intensity than those associated with construction. No LSE have therefore been identified associated with operational activities.

Garron Point SAC[44]

4.5.10 Due to the distance of Garron Point from the Proposed Development (around 9 km), and the absence of hydrological and ecological connectivity to the Proposed Development, given the sole qualifying feature is a species of coastal snail, **it is considered that no LSE is present for Garron Point SAC**[44].

Red Moss of Netherley SAC[46]

4.5.11 This SAC is neither structurally nor hydrologically connected to the site as these raised bogs are rain-fed. In addition, owing to its distance and lack of green corridors, the site is not ecologically, nor hydrologically, connected the Proposed Development. Therefore, **it is considered that that there would no LSE on the qualifying features of the Red Moss of Netherley SAC**[46].

Special Protected Areas (SPAs)

Firth of Tay and Eden SPA, Loch of Kinnordy SPA, Loch of Lintrathen SPA, Montrose Basin SPA and Loch of Skene SPA

4.5.12 All SPAs within 20 km[34] of the Proposed Development that have either Greylag geese or Pink-footed geese as a qualifying feature could be affected by impacts including physical damage and loss of habitat due to their potential core foraging range up to this distance from roosting sites[34] (refer to **Table 12.3.3: Summary of European Sites Considered at Screening** for SPA qualifying features and distance from Proposed Development). The geese could also experience physical disturbance such as displacement from traditional foraging habitat. Additionally, there is a risk of mortality due to collisions with the overhead lines. The presence of the OHL may also create barrier effects. During consultation, NatureScot (21 November 2024; refer to **Volume 2, Chapter 12: Ornithology, Table 12.1: Summary of Consultation of relevance to Ornithology**) considered that the potential impacts on goose SPA species related to loss of foraging habitat, collision risk and potential barrier effects from the Proposed Development. Foraging habitat loss was not considered to be significant for the Firth of Tay and Eden Estuary[47], Loch of Kinnordy[49] and Loch of Lintrathen SPA[50], SSSI and Ramsar sites, however.

4.5.13 **It is considered that LSE would be present for the qualifying features Greylag goose and Pink-footed goose of all SPAs as a result of construction and/or operational activities associated with the Proposed Development**.

Outer Firth of Forth and St. Andrews Bay Complex SPA[48]

4.5.14 There exists potential for impact pathways to LSEs on the qualifying feature Herring gull of the Outer Firth of Forth and St. Andrews Bay Complex SPA[48], due to the species' mean foraging range of 10.5 km[55], which would coincide with the Proposed Development[55]. The Proposed Development is approximately 8.5 km from the European Site[7], this, coupled with the loss of relatively small areas of foraging habitat together with the low area usage of the Proposed Development by Herring gull, it is not considered that there will be LSE for this species. NatureScot (21 November 2024) were in agreement with this finding (in relation to Fowlsheugh SPA)[52] and also considered that connectivity was unlikely between the Proposed Development and the qualifying features of the Outer Firth of Forth and St Andrew's Complex SPA[48] (with the possible exception of Red-breasted merganser, see below). Barrier effects were not addressed directly by NatureScot, but given limited foraging and low collision risk, this potential impact is also considered not likely.

4.5.15 No Red-breasted merganser were recorded during VP watches. BTO WeBS[57] counts from waterbodies to within 10 km of the Proposed Development did not record the species. No suitable waterways for Red-breasted merganser foraging lie within 2 km of the Proposed Development, where potential connectivity to the SPA may be present. As such, no impact (collision mortality or barrier effect) of the Proposed Development on Red-breasted Merganser SPA population is predicted.

4.5.16 Therefore, **it is considered that that there would be no LSE on the qualifying features of the Outer Firth of Forth and St. Andrews Bay Complex SPA as a result of construction and/or operational activities associated with the Proposed Development.**

Fowlsheugh SPA[52]

4.5.17 The qualifying feature of Fowlsheugh SPA[52], Herring gull, has the possibility of connectivity to the Proposed Development given its core foraging range[55]. However, NatureScot (21 November 2024) considered that connectivity was unlikely between the Proposed Development and this qualifying feature. Barrier effects were not addressed directly by NatureScot, but given limited foraging and low collision risk, this potential impact is also considered not likely.

4.5.18 Therefore, **it is considered that that there would be no LSE on the qualifying features of the Fowlsheugh SPA as a result of construction and/or operational activities associated with the Proposed Development**.

Ramsar Sites

Firth of Tay and Eden Ramsar, Loch of Kinnordy Ramsar, Loch of Lintrathen Ramsar, Montrose Basin Ramsar and Loch of Skene Ramsar

4.5.19 All named Ramsar sites are coincident with the SPAs of the same name and have the same qualifying features (namely Greylag and Pink-footed geese). As such, the same impacts and impact pathways described for those SPAs are also present for these sites as noted above.

4.5.20 With regards to the habitat and botanical features of each of the Firth of Tay and Eden Ramsar, Loch of Kinnordy Ramsar and Montrose Basin Ramsar, no likely impact pathway has been identified due to the lack of ecological connectivity, the distance over which hydrological connectivity occurs, and/or the direction of hydrological connectivity (ie the Ramsar is located upstream of the Proposed Development).

4.5.21 **It is considered that LSE would be present for the qualifying features Greylag goose and Pink-footed goose of all Ramsar sites with those ornithological features as a result of construction and/or operational activities.**

Summary Table of Screening Assessment

4.5.22 **Table 12.3.5: Screening Assessment Summary for all European Sites within 10 km of the Proposed Development (20 km where core foraging ranges of qualifying species are present)** summarises the potential pathways to LSE on each European Site[7].

Table 12.3.5: Screening Assessment Summary for all European Sites within 10 km of the Proposed Development (20 km where core foraging ranges of qualifying species are present)

Qualifying feature	Potential Pathway to Impacts on Qualifying Features		
	Physical damage/loss of habitat	Physical disturbance and/ or mortality And non-physical disturbance (noise, vibration and light)	Changes in water quality (eg pollution event, sedimentation) and changes in hydrological regime
Firth of Tay and Eden Estuary SAC[39]			
Estuaries	No LSE	No LSE	No LSE
Sandbanks which are slightly covered by sea water all the time	No LSE	No LSE	No LSE
Mudflats and sandflats not covered by seawater at low tide	No LSE	No LSE	No LSE
Harbour seal	No LSE	No LSE	No LSE
River Tay SAC[42]			
Clear water lakes or lochs with aquatic vegetation and Poor to Moderate nutrient levels	No LSE	No LSE	No LSE
Otter	No LSE	LSE	No LSE

Qualifying feature	Potential Pathway to Impacts on Qualifying Features		
	Physical damage/loss of habitat	Physical disturbance and/ or mortality And non-physical disturbance (noise, vibration and light)	Changes in water quality (eg pollution event, sedimentation) and changes in hydrological regime
Atlantic salmon	No LSE	No LSE	No LSE
Lamprey (all species)	No LSE	No LSE	No LSE
River South Esk SAC[43]			
Freshwater pearl mussel	LSE	LSE	LSE
Atlantic salmon	LSE	LSE	LSE
Garron Point SAC[44]			
Narrow-mouth whorl snail	No LSE	No LSE	No LSE
River Dee SAC[45]			
Otter	LSE	LSE	LSE
Freshwater pearl mussel	LSE	LSE	LSE
Atlantic salmon	LSE	LSE	LSE
Red Moss of Netherley SAC[46]			
Active raised bogs	No LSE	No LSE	No LSE
Degraded raised bogs still capable of natural regeneration	No LSE	No LSE	No LSE
Firth of Tay and Eden Estuary SPA[47] and Ramsar site			
Greylag goose (non-breeding)	No LSE	LSE	No LSE
Pink-footed goose (non-breeding)	No LSE	LSE	No LSE
Other non-breeding wildfowl species	No LSE	No LSE	No LSE
Non-breeding wader species	No LSE	No LSE	No LSE
Marsh harrier (breeding)	No LSE	No LSE	No LSE
Little tern (breeding)	No LSE	No LSE	No LSE
Outer Firth of Forth and St Andrews Bay Complex SPA[48]			
Herring gull (non-breeding)	No LSE	No LSE	No LSE
Red-breasted merganser	No LSE	No LSE	No LSE
Breeding & non-breeding seabirds	No LSE	No LSE	No LSE
Breeding & non-breeding wildfowl	No LSE	No LSE	No LSE
Loch of Kinnordy SPA[49] and Ramsar site			
Greylag goose (non-breeding)	No LSE	LSE	No LSE
Pink-footed goose (non-breeding)	No LSE	LSE	No LSE
Eutrophic Loch	No LSE	No LSE	No LSE
Open water transition fen	No LSE	No LSE	No LSE
Cowbane	No LSE	No LSE	No LSE
Mudwort	No LSE	No LSE	No LSE
Lesser tussock sedge	No LSE	No LSE	No LSE
Loch of Lintrathen SPA[50] and Ramsar site			
Greylag goose (non-breeding)	No LSE	LSE	No LSE
Montrose Basin SPA[51] and Ramsar site			
Greylag goose (non-breeding)	LSE	LSE	No LSE

Qualifying feature	Potential Pathway to Impacts on Qualifying Features		
	Physical damage/loss of habitat	Physical disturbance and/ or mortality And non-physical disturbance (noise, vibration and light)	Changes in water quality (eg pollution event, sedimentation) and changes in hydrological regime
Pink-footed goose (non-breeding)	LSE	LSE	No LSE
Other non-breeding wildfowl	No LSE	No LSE	No LSE
Non-breeding wader species	No LSE	No LSE	No LSE
Estuary	No LSE	No LSE	No LSE
Mudflat	No LSE	No LSE	No LSE
Fowlsheugh SPA[52]			
Herring gull (breeding)	No LSE	No LSE	No LSE
Breeding seabird species	No LSE	No LSE	No LSE
Loch of Skene SPA[53] and Ramsar site			
Greylag goose (non-breeding)	LSE	LSE	No LSE
Goosander (non-breeding)	No LSE	No LSE	No LSE
Goldeneye (non-breeding)	No LSE	No LSE	No LSE

4.6 In-combination Effects

4.6.1 At the screening stage, LSE could not be ruled out for the following European Sites with ornithological features: Loch of Skene SPA/Ramsar[53], Montrose Basin SPA/Ramsar[51], Loch of Kinnordy SPA/Ramsar[49], Loch of Lintrathen SPA/Ramsar[50], or Firth of Tay and Eden Estuary SPA/Ramsar[47].

4.6.2 In addition, LSE could not be ruled out for the following European Sites with ecological features: River Tay SAC[31], River South Esk SAC[32] and River Dee SAC[33].

4.6.3 Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. A list of schemes for which cumulative assessment may be necessary has been identified in **Volume 2, Chapter 16: Cumulative Effects**.

4.6.4 Projects were assessed to within 20 km of the ornithological European Sites[7] where there is potential for Projects to give rise to **Minor** or greater residual effects upon the qualifying interests of these SPAs.

4.6.5 For the ecological cumulative impact assessment, projects within 3 km of the Proposed Development were assessed to determine the potential for in-combination effects upon the qualifying interests of these SACs; consideration was given to whether there is potential for projects to give rise to **Minor** or greater residual effects. Due to the nature of the identified SACs, the potential impact pathways for in-combination effects are via hydrological connectivity; such hydrological connectivity to the relevant SAC and/or the Proposed Development therefore occurs over a greater distance than the direct distance from the Proposed Development. No potential for in-combination effects has therefore been identified at a distance greater than 3 km from the Proposed Development, and a 3 km search area is considered appropriate.

4.6.6 The LSE identified in relation to SACs all arise from activities to remove riparian vegetation to facilitate the construction of the Proposed Development, and construction activities within proximity to the watercourses of the SACs. As such, there are no LSE arising from the operation of the Proposed Development. Similarly, LSE are not considered to occur in relation to operational developments within 3 km.

4.6.7 These criteria have been used as the basis for identification of projects that may act in combination with the Proposed Development.

4.6.8 Wind farm and OHL developments are presented in **Table 12.3.6: In-combination wind farm and OHL Projects with reference to Proposed Development and SPAs and Ramsar sites** below with respect to potential residual effects on the SPA qualifying species Greylag goose and Pink-footed goose (in all cases the Ramsar site and SPA are coincident).

Table 12.3.6: In-combination wind farm and OHL Projects with reference to Proposed Development and SPAs and Ramsar sites

Development	Type	Status	Distance from Proposed Development	Information with respect to SPA qualifying species	Potential for in-combination LSE present
Loch of Skene SPA and Ramsar site					
Hill of Fare	16 Turbine Wind Farm	Operational	Red Line Boundary (RLB) approximately 800 m east of Hill of Fare	Pink-footed goose (PG) flight activity - CRM predicts one bird collision every 5.7 years. Greylag goose (GJ) one flight (1 collision every 114 years). GJ-only SPA qualifying species. As such, No significant residual effects are reported within the EIAR	No prospect of in-combination LSE (Pink-footed geese are not SPA-qualifying species with Greylag goose collision mortality with no prospect of affect)
Meikle Carewe (revised application)	12 Turbine Wind Farm	Operational	RLB 2.6 km northeast of LOD	No information available	No information available
Montrose Basin SPA and Ramsar site					
Tullo Wind Farm	8 Turbine Wind Farm	Operational	RLB 4.5 km east of LOD	No information available	No information available
Loch of Kinnordy SPA and Ramsar site					
Govals Farm	6 Turbine Wind Farm	Consented	RLB 600 m east of the LOD	40 flights of Pink-footed geese with – 2,378 birds (1 Greylag goose flight only) - No barrier effect and most flights above collision risk. Considered No significant residual effects within the EIAR	No prospect of in-combination LSE with negligible collision mortality
Frawney	5 Turbine Wind Farm	Consented	RLB 900 m east of the LOD	One flight of Greylag goose; Six flights of Pink-footed geese; considered Negligible value. No significant residual effects within the EIAR	No prospect of in-combination LSE
Ark Hill	8 Turbine Wind Farm	Operational	RLB 3.8 km west of LOD	limited flight activity (from Non-Technical Summary). No significant residual effects expected from NTS	No prospect of in-combination LSE
Ark Hill 2	4 Turbine Wind Farm	Application	RLB 3.5 km west of LOD	No significant collision risk - four Pink-footed goose flights only. No significant residual effects within the EIAR	No prospect of in-combination LSE
Tullymurdoch	7 Turbine Wind Farm	Operational	RLB 19.5 km west of the LOD	No evidence of regular use of the survey area by geese; low frequency of flights and small number of birds mean that the goose and waterfowl interest recorded is considered to be of less than local importance for nature conservation. No significant residual effects within the EIAR	No prospect of in-combination LSE
Welton of Creuchies	4 Turbine Wind Farm	Operational	RLB 18.8 km west of the LOD	VP surveys suggest that geese numbers limited and site not on a flight path.	No prospect of in-combination LSE

Development	Type	Status	Distance from Proposed Development	Information with respect to SPA qualifying species	Potential for in-combination LSE present
				No significant residual effects within the EIAR	
Loch of Lintrathen SPA and Ramsar site					
Tullymurdoch	7 Turbine Wind Farm	Operational	RLB 19.5 km west of the LOD (5.8 km west of Loch of Lintrathen)	No evidence of regular use of the survey area by geese; low frequency of flights and small number of birds mean that the goose and waterfowl interest recorded is considered to be of less than local importance for nature conservation. No significant residual effects within the EIAR	No prospect of in-combination LSE
Welton of Creuchies	4 Turbine Wind Farm	Operational	RLB 18.8 km west of the LOD	VP surveys suggest that geese numbers limited and site not on a flight path. No significant residual effects within the EIAR	No prospect of in-combination LSE
Drumderg	16 Turbine Wind Farm	Operational	RLB 22 km west of the LOD (8.5 km west of Lintrathen Loch SPA)	No information available	No information available
Greenburn (Drumfork)	11 Turbine wind Farm	Under construction	RLB 25 km west of the LOD (11.5 km west of Lintrathen Loch SPA)	Greylag goose – Three flocks recorded as flying over the site; Pink-footed goose -limited flight activity recorded (*e,g*, no flights recorded in 2014). Flocks of between 18-60 birds were seen during the March and April 2012. CRM -no effects. No significant residual effects within the EIAR	No prospect of in-combination LSE (no requirement of an HRA with reference to SPA)
Firth of Tay and Eden Estuary SPA and Ramsar site					
Ark Hill	8 Turbine Wind Farm	Operational	RLB 3.8 km west of LOD	limited flight activity (from Non-Technical Summary). No significant residual effects expected from NTS	No prospect of in-combination LSE
Ark Hill 2	4 Turbine Wind Farm	Application	RLB 3.5 km west of LOD	No significant collision risk - four Pink-footed goose flights only. No significant residual effects within the EIAR	No prospect of in-combination LSE
Govals	6 Turbine Wind Farm	Consented	RLB 600 m east of the LOD	40 flights of Pink-footed goose – 2,378 birds (1 Greylag goose flight only). No barrier effect and most flights above collision risk. Considered No significant residual effects within the EIAR	No prospect of in-combination LSE with 'no connectivity identified with any of the sites designated for their ornithological interest within 20 km)
Frawney	5 Turbine Wind Farm	Consented	RLB 900 m east of the LOD	One flight of Greylag goose; Six flights of Pink-footed geese; considered Negligible value. No significant residual effects reported	No prospect of in-combination LSE

Development	Type	Status	Distance from Proposed Development	Information with respect to SPA qualifying species	Potential for in-combination LSE present
Lochelbank	12 Turbine Wind Farm	Operational	RLB 35 km southwest of LOD (10 km from SPA)	No information (press release from RSPB notes '*risk to large number of geese*'). No significant residual effects expected from available information	No LSE (from available information)
Binn Eco Park Wind farm	4 Turbine Wind Farm	Operational	RLB 32 km southwest of LOD	Limited information available. No objections from NatureScot or RSPB - geese not mentioned. No significant residual effects reported in available information	No prospect of in-combination LSE (no SPA species noted)
Alyth to Tealing 275 kV OHL Upgrade (to 400 kV)	OHL upgrade works to the capability of the line from 275 kV to 400 kV	Application for Section 37 Consent; submission in 2024	Immediate proximity to Emmock substation and Proposed Development	No significant residual effects identified	No prospect of in-combination LSE
Emmock substation	Proposed Construction and Operation of a 400 kV AC Substation	In planning	OHL connects to substation	No significant residual effects identified – Goose flight activity and foraging activity as described in this Chapter	Reference to those flights and foraging activity reported for the Firth of Tay and Eden Estuary SPA included in this HRA
Emmock and Tealing OHL Tie-ins and Tie-back's	Diversion of short sections of the Alyth to Tealing and Westfield to Tealing 275 kV OHLs to connect with the proposed Emmock substation	Scoping report submitted	Immediate proximity to Emmock substation and Proposed Development	No significant residual effects identified – Goose flight activity and foraging activity as described in this Chapter	Reference to those flights and foraging activity reported for the Firth of Tay and Eden Estuary SPA included in this HRA
Tealing to Westfield 275 kV OHL Upgrade (to 400 kV)	Upgrade of approximately 38 km of OHL. Upgrade capability of OHL from 275 kV to 400 kV	Application for Section 37 Consent; submission in 2024	Immediate proximity to Emmock substation and Proposed Development	No significant residual effects identified	No prospect of in-combination LSE

4.6.9 The in-combination projects considered within 3 km of the Proposed Development are presented in **Table 12.3.7: In-combination projects with reference to the Proposed Development and the Identified SACs and Ramsar sites** below with respect to potential residual effects on the riverine SACs screened into the assessment.

4.6.10 Projects were assessed with regards to their connectivity to the catchments of the riverine SACs, and their distance via watercourse from the Proposed Development. As such, a single project, the Alyth to Tealing OHL Upgrade project, has been identified for further consideration of in-combination effects on the basis that it oversails the Dean Water (part of the River Tay SAC) downstream of the Proposed Development. Although this project is over 15 km from the Proposed Development via the watercourse, both projects intersect directly with the SAC and both across the same tributary.

4.6.11 The remaining projects either: have no connectivity to any of the identified SACs; connectivity to an identified SAC is via an extensive length of non-designated watercourse or indirect via an estuary; or, connectivity to an identified SAC and/or the Proposed Development is over a length of watercourse distance greater than 20 km. The Alyth to Tealing OHL Upgrade project is therefore considered to be the only project with potential to have similar impacts on the European sites as those identified for the Proposed Development, ie it is considered to have similar impact pathways that may affect the conservation objectives noted within the SAC assessment above and at a geographic location with the potential to do so.

4.6.12 Projects for which potential residual effects have been examined for ecological features are discussed further in **Section 5.14**.

Table 12.3.7: In-combination projects with reference to the Proposed Development and the Identified SACs and Ramsar sites

Development	Type	Status	Distance from Proposed Development	Connectivity to the Identified SACs	Potential for in-combination LSE present
Emmock 400 kV substation	Proposed Construction and Operation of a 400 kV AC Substation	In planning	OHL connects to substation	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Hurlie 400 kV substation	Proposed Construction and Operation of a 400 kV AC Substation	In planning	OHL connects to substation	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Alyth to Tealing 275 kV OHL Upgrade (to 400 kV)	OHL upgrade works to the capability of the line from 275 kV to 400 kV	Application for Section 37 Consent; submission in 2024	Immediate proximity to Emmock substation and Proposed Development	Oversails the Dean Water and River Isla, both part of the River Tay SAC, near Alyth. Over 15 km from the Proposed Development via the watercourse.	Limited potential for in-combination LSE considered in this HRA
Emmock and Tealing OHL Tie-ins and Tie-back's	Diversion of short sections of the Alyth to Tealing and Westfield to Tealing 275 kV OHLs to connect with the proposed Emmock substation	Scoping report submitted	Immediate proximity to Emmock substation and Proposed Development	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Tealing to Westfield 275 kV OHL Upgrade (to 400 kV)	Upgrade of approximately 38 km of OHL.	Application for Section 37 Consent; submission in 2024	Immediate proximity to Emmock substation and Proposed Development	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Glendye Wind Farm Grid Connection	132kV Overhead Line from Glendye Wind Farm to Fetteresso substation	Scoping report submitted	Eastern end of proposed route overlaps with the Proposed Development at existing Fetteresso substation	Connectivity to the Water of Dye, part of the River Dee SAC, via the Water of Charr, Stag Burn and Spital Burn. Over 30 km upstream of the Proposed Development via the watercourse.	No prospect of in-combination LSE
Network Rail Drumlithie	New transformers at Fetteresso substation, and cable connections to rail feeder stations near the railway line	In planning	Site boundary overlaps with the Proposed Development, at the existing Fetteresso substation	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Fiddes 132 kV Grid Replacement	Potential to require a new 132KV connection from the existing Fiddes substation to the existing Fetteresso substation	Early stages of project development	Site boundary overlaps with the Proposed Development, at the existing Fetteresso substation	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE

Development	Type	Status	Distance from Proposed Development	Connectivity to the Identified SACs	Potential for in-combination LSE present
SSEN Transmission offshore grids project	Potential for an onshore HVDC converter station within the vicinity of Hurlie substation, and underground cables from the coast	Early stages of project development	Site boundary overlaps with the Proposed Development, at the proposed Hurlie substation	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Fetteresso Wind Farm Grid Connection and Access Corridor	10 turbine wind farm	Consented	Site boundary overlaps with the Proposed Development, utilising the same track in Fetteresso Forest	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Craigneil Wind Farm Future Connection	Potential for a connection to be required from Craigneil Wind Farm to Fetteresso substation	Early stages of project development	Site boundary overlaps with the Proposed Development north of Slug Road	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Kintore to Craigiebuckler 132 kV OHL (existing) realignment (undergrounding)	1.5 km of the existing 132 kV OHL to be undergrounded near Kintore	Permitted development	Intersects with the Proposed Development at Kintore.	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Fithie Energy Park	Construction and operation of up to 1400 MW battery energy storage system (BESS) and associated infrastructure.	Screening	Adjacent to the proposed Emmock substation and the southern end of the Proposed Development	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Balnuith BESS	Construction and operation of a battery energy storage facility for the storage of up to a 100 MW of electricity with associated infrastructure	Consented	Within 0.5 km of the proposed Emmock substation and the southern end of the Proposed Development	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Myreton BESS	Proposed battery energy storage system with an installed capacity of around 750 MW	Screening	Within 1.5 km of the proposed Emmock substation and the southern end of the Proposed Development	No direct connectivity to the River Tay SAC. Connectivity solely via the Firth of Tay estuary.	No prospect of in-combination LSE
Ark Hill Wind Farm Extension	4 turbine wind farm	Application	Approximately 3.5 km west of LOD	Connectivity to the Dean Water, part of the River Tay SAC, via the Denoon Burn. Over 8 km from the SAC via the watercourse.	No prospect of in-combination LSE
Glendye Wind Farm	26 turbine wind farm	Consented	Approximately 3.0 km northwest of the LOD	Connectivity to the Water of Dye, part of the River Dee SAC, via approximately 2 km of the Kettock Burn. Over 30 km from the Proposed	No prospect of in-combination LSE

Development	Type	Status	Distance from Proposed Development	Connectivity to the Identified SACs	Potential for in-combination LSE present
				Development via the watercourse.	
Laurencekirk Residential Development	Erection of 247 dwellinghouses with associated landscaping and parking	Consented	Approximately 1.8 km southeast of the LOD	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Glenbervie BESS	Installation of a Grid Battery Energy Storage Facility (up to 50 MW)	Proposal of Application Notice	Adjacent to the LOD near Tannachie	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Quithel BESS	Construction and operation of a BESS, with a capacity in excess of 50 MW, with associated access and infrastructure.	Screening	Site boundary overlaps with the Proposed Development at the Hill of Quithel access road.	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
SSEN Transmission Possible Future Wind Farm Connection	Possible future grid connection to existing Fetteresso Substation	Indicative corridor for possible connection for a future wind farm proposal	Adjacent to the west of the Proposed Development	Project is indicative only. Currently no known connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Onshore Transmission Infrastructure for Bowdun Offshore Wind Farm	Onshore transmission infrastructure for Bowdun Offshore Wind Farm including onshore landfall point, underground cables, substation and associated works	Scoping report submitted	Scoping boundary overlaps with the Proposed Development at the proposed Hurlie substation	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Craigneil Wind Farm	11 turbine wind farm	Consented	Site boundary overlaps with the Proposed Development north of Slug Road	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Hill of Fare Wind Farm	17 turbine wind farm	Application	Approximately 0.8 km west of the LOD near Echt	Connectivity to the River Dee SAC at Peterculter, via the Gormack Burn. Over 20 km from the SAC via the watercourse.	No prospect of in-combination LSE
South Leylodge Farm BESS	Formation of BESS, substation, access, and associated infrastructure	Consented	Site boundary overlaps with the Proposed Development at Kintore	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Kintore Substation BESS	Installation of BESS with installed capacity of 49.9 MW, substation and associated infrastructure	Consented	Approximately 0.3 km east of the LOD at Kintore	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Kintore Hydrogen Production Facility	Erection of facility for the production of hydrogen through electrolysis, access, pipelines,	Consented	Site boundary overlaps with the Proposed Development at Kintore	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE

Development	Type	Status	Distance from Proposed Development	Connectivity to the Identified SACs	Potential for in-combination LSE present
	landscaping and all associated works				
Kintore South Solar Array and BESS	Installation of solar photovoltaic (PV) array and a BESS and associated infrastructure 2 km south of Kintore	Screening	Approximately 0.5 km east of the LOD at Kintore	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Womblehill Farm BESS	Installation of a 200 MW BESS and associated infrastructure	Application	Approximately 0.3 km east of the LOD at Kintore	No connectivity to the River Tay SAC, River South Esk SAC, or River Dee SAC.	No prospect of in-combination LSE
Cossans Solar and BESS	Installation of a 49.9 MW solar PV array and a 35 MW BESS, and associated infrastructure	Application	Site boundary overlaps with the Proposed Development near Forfar	Connectivity to the River Tay SAC. A Shadow HRA was undertaken, and the River Tay SAC was screened into Stage 2 (Appropriate Assessment).	Potential for in-combination effects considered in this HRA

4.6.13 Impacts and pathways considered to result in No LSE at the Screening Assessment stage (from the assessment presented in **Section 4.5, Table 12.3.5: Screening Assessment Summary for all European Sites within 10 km of the Proposed Development (20 km where core foraging ranges of qualifying species are present)**) are not predicted to have any potential for in-combination effects that would occur when considered with other projects. As such there is no requirement to consider these in-combination effects at the detailed assessment stage.

5. STAGE 2: APPROPRIATE ASSESSMENT

5.1 Introduction

5.1.1 The Screening Assessment (Stage 1) considered the Proposed Development's design parameters, and how environmental protection measures may be related to those.

5.1.2 For European Sites where an LSE exists or cannot be excluded, an Appropriate Assessment is required to determine potential effects of a project upon site integrity. This Shadow HRA is intended to provide and analyse sufficient information to allow the competent authorities to determine whether the Proposed Development will or will not adversely affect the integrity of European Sites[7]. Appropriate Assessment must consider the implications of the Proposed Development on the qualifying features of the European Site[7] in view of the site's Conservation Objectives and in light of the best scientific knowledge in the field.

5.1.3 The emphasis for Appropriate Assessment is for the competent authority to undertake the Integrity Test described in **Section 3** above. At this stage the assessment will also take into account any avoidance or mitigation measures which will be implemented to avoid or reduce the level of impact from the project, which may include measures proposed specifically to address adverse impacts on European Sites or the use of consenting conditions or restrictions to help avoid adverse effects on site integrity. If the Appropriate Assessment concludes that there will be an adverse effect on the integrity of the European Site (or that it cannot be ruled out) the competent authority must refuse consent, subject to any derogation (see **Section 3** above).

5.1.4 As established in the EcIA and the OIA presented in **Volume 2, Chapter 11: Ecology** and **Chapter 12: Ornithology** respectively of the EIAR, mitigation measures for the Proposed Development have been carefully selected to avoid or reduce impacts. In this this Shadow HRA, the committed mitigation measures referred to in the main EIA chapters of relevance to European Sites[7], are summarised before potential effects identified through Screening are assessed in more detail against each relevant European Site's[7] Conservation Objectives.

5.2 Mitigation

Ecological Constraints Mitigation

5.2.1 A range of mitigation measures have been included in the EcIA as detailed within **Volume 2, Chapter 11: Ecology**. Embedded Mitigation measures, ie those which formed part of the design process and are therefore committed include:

- EC1: Avoidance of statutory designated sites. The Proposed Development has been designed to avoid direct impacts on statutory designated sites and these sites have been excluded from the LOD wherever possible. Where the Proposed Development intersects with statutory designated sites, this is limited to crossings of three riverine SACs which require to be oversailed (to avoid impacts where possible).
- EC5: Design of watercourse crossings to ensure flows are not obstructed or reduced, and maintain passage for fish and aquatic species. Watercourse crossings will minimise risk to aquatic species populations and sensitive watercourse habitats via the following approach:
  - Use of single span crossings wherever possible;
  - Retention/recreation of natural stream beds;
  - Closed pipes used as a last resort; and
  - Commitment to set any pipe culverts below the existing watercourse bed and to make use of natural bed material.

5.2.2 In addition to the measures above, embedded mitigation measures that have been developed to address other topics are also relevant to the protection of ecological features including: avoidance of development within the 200-year + climate change floodplain (HG1), maintaining watercourse buffers in accordance with guidance (HG3), minimising the number of new watercourse crossings (HG4), and avoiding areas of Class 1 and Class 2 peatland (HG5).

5.2.3 Further, the Applicant is committed to a range of applied mitigation measures relevant to this Shadow HRA, including:

- EC6: Adherence to SSEN Transmission's Standard GEMPs and Species Protection Plans (SPPs) during pre-construction and construction phases. Implementation would be overseen by a suitably experienced Advisory ECoW as part of an outline Construction Environment Management Plan (see below).

- EC7: Preparation and implementation of a Construction Environment Management Plan (CEMP). This will incorporate an Ecological and Ornithological Management Plan pursuant to the contractual requirements of the Principal Contractors.
- EC8: The mitigation hierarchy will be applied in relation to sensitive habitats. As such, the priority will be to avoid removal of vegetation in sensitive habitats. This includes woodlands, wetlands and riparian corridors, and avoidance wherever possible, for example through micro-siting, of these and other sensitive habitats. Where vegetation removal is required in sensitive habitats (such as Annex I or SBL priority habitats), this will be reduced wherever possible to the removal of trees only where there is potential for interference with the conductors of the Proposed Development. Native trees that are slow- and/or low-growing will be retained in situ where possible, and particularly where they are close to the edge of the required operational corridor (and therefore relatively more distant from the conductors). Restoration and compensation measures will be applied to habitats impacted by construction of the Proposed Development, in accordance with the principles outlined in **Volume 5, Appendix 3.3: Outline Site Restoration Plan**, **Appendix 9.6: Outline Landscape Mitigation Design Guide** and **Appendix 11.5: Outline Biodiversity Enhancement Plan.**
- EC9: Techniques for tree and vegetation removal in riparian locations will be tailored to the sensitivity of the site to minimise the mobilisation of soils and impacts on water quality. Appropriate procedures and methods of vegetation and tree removal will be employed to minimise disturbance to sensitive riparian habitats including banksides of watercourses, limit the potential for bankside erosion, and rectify any bankside issues noted in works areas. Felling methods will be assessed on case-by-case basis, dependent on the sensitivity of the location and ground conditions. The appropriate methodology will be selected to minimise ground disturbance. This will be strictly adhered to for works within 250 m of the following key locations:
  - River Tay SAC;
  - River South Esk SAC;
  - River Dee SAC; and
  - Loch of Park SSSI.
- EC10: Where the Proposed Development crosses watercourses, removal of adjacent riparian vegetation will be limited to trees that have potential to interfere with the conductors. Felling methods will be assessed on case-by-case basis, dependent on the sensitivity of the location and ground conditions. The appropriate methodology will be selected to minimise ground disturbance. Native trees that are slow- and/or low-growing will be retained in situ wherever possible, and particularly where they are close to the edge of the required operational corridor (and therefore more distant from the conductors). This principle will be applied to all watercourses, and will be strictly adhered to for works adjacent to the following key locations:
  - River Tay SAC;
  - River South Esk SAC; and
  - River Dee SAC.

  Mitigation planting proposed in the **Volume 5, Appendix 9.6: Outline Landscape Design Guide** will complement the retained scrub and trees.
- EC11: Detailed site-specific plans of proposed works (including felling and vegetation clearance) will be produced for all construction-related works within 250 m of the SACs. Felling methods will be assessed on case-by-case basis, dependent on the sensitivity of the location and ground conditions. The appropriate methodology will be selected to minimise ground disturbance. These site-specific plans will be submitted for agreement with stakeholders, to ensure the protection of these statutory designated sites.
- EC13: Appropriate methods of construction work will be employed in sensitive habitats. This will include measures to reduce soil compaction and damage to vegetation in sensitive habitats through methods such as bog-matting, low-pressure vehicles. Methods will be assessed on case-by-case basis, dependent on the sensitivity of the location and ground conditions. The appropriate methodology will be selected to minimise ground disturbance. Appropriate methods will be employed within 250 m of the River Tay SAC, River South Esk SAC or River Dee SAC.
- EC14: Ecological survey updates will be undertaken, to ensure survey data being relied upon during construction is not more than 12 months old, or as per best practice guidelines. Surveys will be undertaken in the species-specific survey season immediately prior to construction. Where surveys find evidence of new protected features (eg resting sites),

micrositing will attempt to avoid effects. If this is not possible, the licensing mechanism will be engaged as per SSEN Transmission's standard SPPs.

- EC15: Micrositing will take into consideration the recommended buffer distances to protected features identified during pre-construction surveys. With these micrositing precautions and procedures in place, should micrositing be utilised, then the significance of effect on ecological receptors will not be greater than those predicted within the EcIA as presented in **Volume 2, Chapter 11: Ecology**.
- EC16: Security lighting will be designed to minimise light-spill on sensitive habitat features such as watercourses, waterbodies, and woodland edges.
- EC17: Works within watercourse buffers will be undertaken under the advice and, where necessary, supervision of the Advisory ECoW.
- EC18: The mitigation hierarchy will be applied in relation to protected species, and as such the priority will be given to avoiding impacts, followed by reducing impacts where they are unavoidable. Where it is not possible to avoid the loss of features confirmed to be used by protected species, compensation is required, and this will be provided in accordance with licensing requirements and SSEN Transmission's SPPs, for any features confirmed to be used by protected species.
- EC19: The mitigation hierarchy will be applied in relation to protected species, and as such the priority will be given to avoiding impacts, followed by reducing impacts wherever possible. Where it is not possible to avoid the loss of features that have potential to be used by protected species, due to vegetation clearance or infrastructure installation, compensation will be provided.
- EC22: Pre-construction fish habitat surveys will be undertaken at watercourse crossings to provide the habitat baseline within a buffer of up to 100 m upstream and to allow micrositing of crossings away from populations and/or potentially sensitive habitats wherever possible.
- EC23: Pre-construction freshwater pearl mussel surveys will be undertaken at confidential locations agreed with NatureScot, to provide the baseline within a buffer of up to 100 m upstream and 500 m downstream and to allow micrositing of crossings away from populations and/or potentially sensitive habitats wherever possible.
- EC24: Where conductors are required to cross watercourses, methods will be used to ensure that conductors do not come to ground, and therefore watercourses and associated habitats will be protected via methods appropriate to their size and conservation status.
- EC26: On-site and off-site measures will be implemented to deliver habitat restoration and compensation (to offset habitat losses), and further to deliver biodiversity enhancement. These measures will be in accordance with the principles outlined in **Volume 5, Appendix 11.5: Outline Biodiversity Enhancement Plan**. Proposals will deliver no less than a 10% net gain in biodiversity (as measured by the SSEN Transmission Biodiversity Toolkit), and will be underpinned by sound ecological principles, designed to deliver qualitative and quantitative enhancement for a range of ecological features.
- EC27: Site restoration and landscaping proposals, including delivery of on-site habitat restoration, compensation and biodiversity enhancement, will be developed in accordance with the principles outlined in **Volume 5, Appendix 3.3: Outline Site Restoration Plan**, **Appendix 9.6: Outline Landscape Mitigation Design Guide**, and **Appendix 11.5: Outline Biodiversity Enhancement Plan**.
- EC28: Survey and monitoring will be undertaken to ensure the ongoing efficacy of mitigation measures and identify any requirement for further intervention. The duration and extent of monitoring will depend on the ecological feature under consideration and the level of impact. Monitoring will be designed by an ecologist suitably experienced in the relevant ecological feature (and licensed where relevant), and in accordance with relevant best practice guidelines in place at the time. Key locations where monitoring will be undertaken include the three riverine SACs.
- EC29: Where sensitive streambed habitats are identified during pre-construction fish habitat and/or freshwater pearl mussel surveys, post-construction surveys and monitoring will be undertaken to ensure that mitigation measures are effective, that crossings maintain fish passage, and that sensitive streambed habitats and freshwater pearl mussel populations (if present) have been retained, and to identify any requirement for improvements or remedial works. Monitoring will be designed by a specialist, suitably experienced in aquatic ecology (and licensed where relevant), and in accordance with relevant best practice guidelines. Key locations where monitoring will be undertaken include the three riverine SACs:

- River Tay SAC;
- River South Esk SAC; and
- River Dee SAC.

Ornithological Mitigation

5.2.4 Embedded mitigation has been included in the OIA as detailed within **Volume 2, Chapter 12: Ornithology**. Embedded mitigation measures, ie those which formed part of the design process and are therefore committed in relation to ornithological constraints includes bird diverters and line marking along the spans of high flight activity areas of the Proposed Development, also incorporating adjacent span marking on neighbouring spans to those designated as high risk (refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA).

5.2.5 O2: Installation of line markers (also known as bird flight diverters (BFDs)) on the OHL as appropriate to reduce collision risk for SPA-qualifying species and other bird species potentially at risk of collision, including at 'hot-spots' identified from VP surveys. Line marking will therefore be installed in the following instances:

- within 5 km of all SPAs that support qualifying species classed as being at relatively high risk of collision (ie waterfowl) across the Proposed Development; and
- where flight activity across any OHL span is judged to be substantial[59], potentially leading to adverse impacts on the SPA populations of at-risk species[60] and where flight lines intersect the Proposed Development (adjacent OHL spans also to be marked); and
- where the OHL spans a waterway (principally to mitigate risk to SPA-qualifying species Red-breasted merganser).

5.2.6 Concern about avian collisions with transmission lines has led to the development of mitigation measures aimed at reducing collisions. A focus of such mitigation measures is intended to make the lines more visible to birds as they fly. Enhancing the visibility of lines involves marking the lines with devices known as flight diverters. As advised in NatureScot guidance on assessment and mitigation of impacts of power lines[61], line marking, when effectively deployed and maintained, has been shown to reduce bird collisions with OHLs; with research showing that it can reduce bird collisions by 50-94%, with birds showing an increase in behavioural avoidance at marked lines compared to unmarked lines[62]. For example, it is known that the use of flight diverters reduces collision mortality in Mute swans (*Cygnus olor*) in the UK, a species with poor manoeuvrability and high wing load[63]. Guidance from NatureScot (2025)[64] gives an avoidance rate for all geese species of 99.8% at wind farms. Post-construction monitoring of the Beauly-Denny 400 kV OHL by Heritage Environmental Limited (2016)[65] recorded an avoidance rate greater than 99.9% for those geese crossing an existing powerline, even when no BFDs were present, at potential collision height (pch).

5.2.7 The most suitable line marker model and optimal spacing design has been determined following consultation with NatureScot. In line with recommendations in Martin (2022)[66], the following line marker design and deployment characteristics have been

[59]Substantial is defined per SPA-watched area as those flights above the 2nd quartile of the flight activity data set. Refer **Volume 5, Appendix 12.1: Ornithology Technical Report.**

[60]Including Schedule 1 species, qualifying features of a SPA within connectivity distance & species from other sensitive regional populations with substantial flight activity levels.

[61] NatureScot, 2025. *Guidance - Assessment and mitigation of impacts of power lines and guyed meteorological masts on birds*. [Online] Available at: https://www.nature.scot/doc/guidance-assessment-and-mitigation-impacts-power-lines-and-guyed-meteorological-masts-birds [Accessed 18 March 2025].

[62] Bernandino, J., Bevanger, K., Barrientos, R., Dwyer, J.F., Margques, A.T., Martins, R.C., Shaw, J.M., Silva, J.P. and Moreira, F., 2018. Bird collisions with power lines: State of the art and priority areas for research. Biological Conservation, 222, 1-13. doi.org/10.1016/j.biocon.2018.02.029.

[63] Frost D., 2008. The use of 'flight diverters' reduces mute swan *Cygnus olor* collision with power lines at Abberton Reservoir, Essex, England. Conservation Evidence, 5, 83-91.

[64] NatureScot, 2025). *Wind farm impacts on birds - Use of Avoidance Rates in the NatureScot Wind Farm Collision Risk Model*. [Online] Available at: https://www.nature.scot/doc/wind-farm-impacts-birds-use-avoidance-rates-naturescot-wind-farm-collision-risk-model [Accessed: 18 March 2025].

[65] Heritage Environmental Limited, 2016. *Beauly-Denny 400 kV Overhead Transmission Line: Post construction Bird Monitoring – Final Report to SSE and Scottish Power*.

[66] Martin G.R., 2022. Vision-Based Design and Deployment Criteria for Power Line Bird Diverters. Birds 2022, 3, 410–422. https://doi.org/10.3390/birds3040028.

sought and implemented to maximise detectability by birds whose flight paths may intersect the Proposed Development. The line marker design should promote:

- as large a surface area as possible of the diverter to enable sight from as great a distance as possible;
- repeat chromatic patterns to generate a high degree of internal contrast so that markers are detectable regardless of landscape background conditions (rather than relying upon the markers contrasting with the landscape background);
- movement or flicker (ie an oscillating or rotating device), which will allow markers to be detected more readily than static markers;
- small intervals of deployment along the spans of the OHL (depending on bird diverter type, placement is recommended from between 3 m to 10 m intervals); and
- high durability of markers to minimise wear and tear.

5.2.8 Improvements have been made in BFD design in recent years to incorporate these features[67] with BFDs such as Hawk Eye™ (approved by NatureScot for the SSEN Transmission Skye Reinforcement Project) now available. Implementation of line marking along the identified spans of the Proposed Development is also expected to reduce collision risk to other bird species.

5.2.9 In line with NatureScot guidance[68], the condition of line markers will be monitored at regular intervals, with maintenance protocols in place to ensure they remain functional and in the correct position throughout the lifetime of the Proposed Development.

5.2.10 BFDs will be installed on the OHL (the OPGW and/or the conductors). The OPGW, at the top of the OHL configuration, is generally the thinnest of the wires and lies above the conductors. As such, this is considered the main cause of bird collision[69].

5.3 Assessment of Adverse Effects

5.3.1 The following sections set out the findings to support the competent authority's Appropriate Assessment of the Proposed Development on those European Sites scoped in from the Shadow HRA's Stage 1 process (see **Section 4**). The approach has been to consider whether previously identified pathways to determine LSE could result in adverse effects on the integrity of European Sites, considering the application of mitigation. By considering each pathway set out in good practice guidance, and through consideration of potential impacts identified through the EcIA and OIA as summarised in **Table 12.3.5: Screening Assessment Summary for all European Sites within 10 km of the Proposed Development (20 km where core foraging ranges of qualifying species are present)**, taking a precautionary approach, any adverse effect on integrity of the European Sites in view of their Conservation Objectives is assessed according to the best available scientific evidence.

5.4 River Tay SAC[42]

5.4.1 The River Tay SAC has the following Conservation Objectives in relation to the assessed qualifying feature (otter)[70]:

- 1. To ensure that the qualifying features of River Tay SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status; and
- 2. To ensure that the integrity of the River Tay is maintained by meeting objectives 2a, 2b and 2c for otter:
  - 2a. Maintain the population of otter as a viable component of the site.
  - 2b. Maintain the distribution of otter throughout the site.
  - 2c. Maintain the habitats supporting otter within the site and availability of food.

[67] Ferrer, M., Morandini, V., Baumbusch, R., Muriel, R., De Lucas, M. and Calabuig, C. 2020. Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines. Global Ecology & Conservation, 23, e01130

[68] NatureScot, 2025. *Guidance - Assessment and mitigation of impacts of power lines and guyed meteorological masts on birds*. [Online] Available at: https://www.nature.scot/doc/guidance-assessment-and-mitigation-impacts-power-lines-and-guyed-meteorological-masts-birds [Accessed 18 March 2025].

69 EirGrid, 2016. EirGrid Evidence Based Environmental Studies Study 5: Birds – Literature review and evidence-based field study on the effects of high voltage transmission lines on birds.

[70] NatureScot. 2020. River Tay SAC: Conservation Advice Package. [Online] Available at: https://sitelink.nature.scot/site/8366 [Accessed July 2025]

Qualifying Feature Assessed: Otter

Physical disturbance/mortality & non-physical disturbance

5.4.2 The River Tay tributaries (Kerbet Water and Dean Water) were both assessed as providing sub-optimal habitat for otter. No evidence was identified during surveys, although otter sightings on the Dean Water were reported during consultation. It is therefore assumed that otter could be present on these watercourses.

5.4.3 Update otter surveys will be undertaken immediately prior to construction during the survey season. Where new protected features relevant to otter are found such as holts or, more likely, resting sites, micrositing will attempt to avoid effects. If necessary, the licensing mechanism will be engaged as per SSEN Transmission's standard SPP for the species, and the Advisory ECoW will advise on mitigation for otter not already covered by SSEN Transmission's standard SPP as required.

5.4.4 The Principal Contractors will each appoint a minimum of one Environment Manager and two roles of Advisory ECoW. The Advisory ECoW will support the design and implementation of mitigation. The Advisory ECoW will be on-site during construction and will provide advice on and monitor compliance with the CEMP, GEMPs, SPPs, the environmental requirements that the Applicant places upon the Principal Contractors, and relevant legislation (see the following ecological mitigation measures: EC6-EC11, EC13-EC19, EC22, EC24, EC26-EC29 in **Volume 2, Chapter 11: Ecology**).

5.4.5 The habitats recorded during field surveys comprise dense riparian vegetation, but there is a lack of trees and woodland and there is no requirement for removal of trees around the oversailed Kerbet Water and Dean Water. Therefore, resting opportunities are assessed to be largely temporary, and it is unlikely that otter will be disturbed as a result of the construction activities. Despite this, the LOD has been restricted where the Proposed Alignment crosses the SAC in recognition of the sensitive location. Micrositing of watercourse crossings away from potentially sensitive habitat is less constrained due to the lack of trees, therefore the limited resting opportunities that exist would be maintained. The SPP and licensing regime are considered to be sufficient to address any potential for disturbance identified during pre-construction surveys. Any such disturbance would be short-term and reversible, and would not undermine the conservation objectives of the SAC with regards to otter.

5.4.6 **After application of committed mitigation measures, no adverse effects on site integrity with respect to otter and the conservation objectives of the River Tay SAC are predicted as a result of physical disturbance/mortality and non-physical disturbance**.

5.4.7 As a means to ensure that the integrity of the River Tay SAC is maintained, objectives 2a, 2b and 2c should be maintained for each qualifying feature. As noted above, no adverse effects on the integrity of the River Tay SAC have been identified from the Proposed Development. As such, the following Conservation Objectives are considered maintained:

- 2a. Maintain the population of otter as a viable component of the site:
  - The population of otter will not be significantly affected by the Proposed Development.
- 2b. Maintain the distribution of otter throughout the site:
  - The distribution of otter will not be significantly affected by the Proposed Development.
- 2c. Maintain the habitats supporting otter within the site and availability of food:
  - The habitats supporting otter within the site and availability of food will not be significantly affected by the Proposed Development.

5.5 River South Esk SAC[43]

5.5.1 The River South Esk SAC has the following Conservation Objectives in relation to the assessed qualifying features (freshwater pearl mussel, Atlantic salmon)[71]:

- 1. To ensure that the qualifying features of the River South Esk SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status; and

[71] NatureScot. 2020. River South Esk SAC: Conservation Advice Package. [Online] Available at: https://sitelink.nature.scot/site/8364 [Accessed July 2025]

- 2. To ensure that the integrity of the River South Esk SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel):
- Freshwater pearl mussel:
  - 2a. Restore the population of freshwater pearl mussel as a viable component of the site.
  - 2b. Restore the distribution of freshwater pearl mussel throughout the site.
  - 2c. Restore the habitats supporting freshwater pearl mussel within the site and availability of food.
  - 2d. Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats.
- Atlantic salmon:
  - 2a. Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.
  - 2b. Restore the distribution of Atlantic salmon throughout the site.
  - 2c. Restore the habitats supporting Atlantic salmon within the site and availability of food.

Relevant to all qualifying features (ie Freshwater Pearl Mussel and Atlantic Salmon)

Physical damage or loss of habitat

5.5.2 Surveys of the River South Esk and its tributaries concluded that suitable habitat for both designated species was present, although no evidence of their presence was identified at the time of the surveys. Freshwater pearl mussel and Atlantic salmon are known to be present on the mainstem river, and it is assumed that these species could be present on the Noran Water.

5.5.3 There will be extremely limited habitat loss or fragmentation that could impact the qualifying features of the River South Esk SAC[43] as a result of permanent changes in land use for the Proposed Development. Riparian vegetation removal is limited only to trees that would interfere with the OHL, within the Operational Corridor for the Proposed Alignment, thus the potential for bankside erosion as a result of this minimal riparian habitat loss and fragmentation is limited. The LOD has been restricted where the OHL crosses the SAC (the River South Esk at Craigeassie and the Noran Water near Wellford) in recognition of the sensitive location.

5.5.4 Design parameters (embedded mitigation measures: EC1, EC5) ensure minimisation of watercourse crossings, maintain fish passage and retain sensitive habitats. The Principal Contractors will each appoint a minimum of one Environment Manager and two roles of Advisory ECoW. The Advisory ECoW will support the design and implementation of mitigation. The Advisory ECoW will be on-site during construction, and will provide advice on and monitor compliance with the CEMP, GEMPs, SPPs, the environmental requirements that the Applicant places upon the Principal Contractors, and relevant legislation (see the following ecological mitigation measures: EC6-EC11, EC13-EC19, EC22-EC24, EC26-EC29 in **Volume 2, Chapter 11: Ecology**). This includes undertaking pre-construction fish habitat surveys and freshwater pearl mussel surveys, along with monitoring during the construction phase to ensure mitigation measures are effective. Where conductors are required to cross watercourses, the installation process will ensure that conductors do not come into contact with the watercourse and associated habitats (ecological mitigation measure EC24 in **Volume 2, Chapter 11: Ecology**).

5.5.5 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River South Esk SAC are predicted as a result of physical damage or loss of habitat.**

Physical disturbance/mortality & non-physical disturbance

5.5.6 Physical disturbance to freshwater pearl mussel and Atlantic salmon are a possibility at watercourses which are oversailed as part of the construction phase of the Proposed Development as a result of bank erosion caused by the removal of small areas of riparian vegetation. The LOD has been restricted where the Proposed Alignment crosses the SAC in recognition of the sensitive location.

5.5.7 As noted, pre-construction surveys will be undertaken at watercourse crossings to provide the habitat baseline within a suitable buffer upstream and downstream and to allow micrositing of crossings away from potentially sensitive habitats wherever possible (ecological mitigation measures EC22 and EC23 in **Volume 2, Chapter 11: Ecology**). All works within watercourse buffers will be undertaken in accordance with advice from the Advisory ECoW, who will monitor the works and implementation of mitigation, including with regards to the delivery of the SPP, GEMPs and CEMP; micrositing will be adopted where water

crossings are found to be in proximity to sensitive habitats (see the following ecological mitigation measures: EC6-EC11 and EC13-EC17 in **Volume 2, Chapter 11: Ecology**). Where necessary, specific mitigation measures will be designed and implemented, including the timing of works, to avoid spawning seasons, while retaining suitable spawning substrates, following SPPs. The LOD has been restricted where the Proposed Alignment crosses the SAC in order to limit the extent of works undertaken within these sensitive locations.

5.5.8 Mitigation measures, as established in the CEMP (ecological mitigation measure EC7 in **Volume 2, Chapter 11: Ecology**) and monitoring programmes (ecological mitigation measures EC28 and EC29 in **Volume 2, Chapter 11: Ecology**), will ensure wider mitigation responds to contemporary data, including spawning sites for salmon, and areas of high density of pearl mussel. Crossings will maintain fish passage and ensure that potentially sensitive habitats are retained (ecological mitigation measure EC5 in **Volume 2, Chapter 11: Ecology**), and monitoring will identify any potential for improvements or remedial works as part of the mitigation strategy. Appropriate procedures and methods of removal of trees will be employed to minimise disturbance to banksides and watercourses, limit the potential for bankside erosion, and rectify any bankside issues noted in works areas (ecological mitigation measures EC6-EC11 and EC15-EC17 in **Volume 2, Chapter 11: Ecology**).

5.5.9 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River South Esk SAC are predicted as a result of physical disturbance/mortality and non-physical disturbance.**

Changes in Water Quality

5.5.10 The LOD has been restricted where the Proposed Alignment crosses the SAC in recognition of the sensitive location. Measures to protect the water environment will be implemented through the SPPs, GEMPs, and the site-specific CEMP (ecological mitigation measures EC6 and EC7 in **Volume 2, Chapter 11: Ecology**), including a site-specific pollution prevention plan to minimise surface water run-off to the designated site and its tributaries in the vicinity of construction working areas. The Advisory ECoW will advise on and monitor works with the potential to affect sensitive watercourse habitats and protected species (ecological mitigation measures EC6-EC11, EC13-EC19, EC22-EC24 and EC26-EC29 in **Volume 2, Chapter 11: Ecology**). All watercourse crossings will be designed and constructed in line with current good practice guidance and in accordance with a Construction Site Licence (from SEPA) that will be necessary before works commence. Ongoing monitoring activity will ensure water quality is maintained for the benefit of freshwater pearl mussel, Atlantic salmon and other aquatic species, and that mitigation measures are effective (ecological mitigation measures EC28 and EC29 in **Volume 2, Chapter 11: Ecology**).

5.5.11 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River South Esk SAC are predicted as a result of changes in water quality.**

Summary

5.5.12 As a means to ensure that the integrity of River South Esk SAC is maintained, objectives 2a, 2b and 2c should be maintained for each qualifying feature of the SAC, and 2d in relation to freshwater pearl mussel. As noted above, no adverse effects on the integrity of the River South Esk SAC have been identified from the Proposed Development. As such, the following Conservation Objectives are considered maintained:

- 2a. Restore the populations of freshwater pearl mussel and Atlantic salmon as viable components of the site:
  - The populations of the qualifying species of the River South Esk SAC (Atlantic salmon and freshwater pearl mussel) will not be significantly affected by the Proposed Development.
- 2b. Restore the distribution of freshwater pearl mussel and Atlantic salmon throughout the site:
  - The distribution of the qualifying features of the River South Esk SAC (Atlantic salmon and freshwater pearl mussel) will not be significantly affected by the Proposed Development.
- 2c. Restore the habitats supporting freshwater pearl mussel and Atlantic salmon within the site and availability of food:
  - The habitats supporting the qualifying features of the River South Esk SAC (Atlantic salmon and freshwater pearl mussel) within the site and availability of food will not be significantly affected by the Proposed Development.
- 2d: Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats:
  - The distribution and viability of freshwater pearl mussel host species and their supporting habitats within the River South Esk SAC will not be significantly affected by the Proposed Development.

5.6 River Dee SAC[45]

5.6.1 The River Dee SAC has the following Conservation Objectives in relation to the assessed qualifying features (freshwater pearl mussel, Atlantic salmon, otter)[72]:

- 1. To ensure that the qualifying features of the River South Esk SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status; and
- 2. To ensure that the integrity of the River Dee SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel):
- Freshwater pearl mussel:
  - 2a. Restore the population of freshwater pearl mussel as a viable component of the site.
  - 2b. Restore the distribution of freshwater pearl mussel throughout the site.
  - 2c. Restore the habitats supporting freshwater pearl mussel within the site and availability of food.
  - 2d. Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats.
- Atlantic salmon:
  - 2a. Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.
  - 2b. Restore the distribution of Atlantic salmon throughout the site.
  - 2c. Restore the habitats supporting Atlantic salmon within the site and availability of food.
- Otter:
  - 2a: Maintain the population of otter as a viable component of the site.
  - 2b: Maintain the distribution of otter throughout the site.
  - 2c: Maintain the habitats supporting otter within the site and availability of food.

Relevant to all qualifying features (Otter, Freshwater Pearl Mussel and Atlantic Salmon)

Physical damage or loss of habitat

5.6.2 The River Dee and its tributaries within the ESA were considered to provide habitat with the potential to support all three designated species. The LOD has been restricted where the Proposed Alignment crosses the SAC (the Burn of Sheeoch and the River Dee near Kirkton of Durris) in recognition of the sensitive location.

5.6.3 There will be extremely limited habitat loss or fragmentation that could impact the qualifying features of the River Dee SAC[45] as a result of permanent changes in land use for the Proposed Development. Riparian vegetation removal is limited only to trees that would interfere with the OHL, within the Operational Corridor for the Proposed Alignment, thus the potential for bankside erosion as a result of this minimal riparian habitat loss and fragmentation is limited.

5.6.4 Design parameters (ecological mitigation measures EC1 and EC5 in **Volume 2, Chapter 11: Ecology**) ensure minimisation of the number of watercourse crossings, maintain fish passage and retain sensitive habitats. The Principal Contractors will each appoint a minimum of one Environment Manager and two roles of Advisory ECoW. The Advisory ECoW will support the design and implementation of mitigation. The Advisory ECoW will be on-site during construction, and will provide advice on and monitor compliance with the CEMP, GEMPs, SPPs, the environmental requirements that the Applicant places upon the Principal Contractors, and relevant legislation (see the following ecological mitigation measures: EC6-EC11, EC13-EC19, EC22-EC24 and EC26-EC29 in **Volume 2, Chapter 11: Ecology**). This includes undertaking pre-construction fish habitat surveys and freshwater pearl mussel surveys, along with monitoring during the construction phase to ensure mitigation measures are effective. Where conductors are required to cross watercourses, the installation process will ensure that conductors do not come into contact with the watercourse and associated habitats (ecological mitigation measure EC24 in **Volume 2, Chapter 11: Ecology**).

5.6.5 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River Dee SAC are predicted as a result of physical damage or loss of habitat.**

[72] NatureScot. 2020. River Dee SAC: Conservation Advice Package. [Online] Available at: https://sitelink.nature.scot/site/8357 [Accessed July 2025]

Physical disturbance/mortality & non-physical disturbance

5.6.6 Physical disturbance to freshwater pearl mussel, Atlantic salmon, and otter are a possibility at watercourses which are oversailed as part of the construction phase of the Proposed Development. The LOD has been restricted where the OHL crosses the SAC in recognition of the sensitive location.

5.6.7 As noted, pre-construction surveys will be undertaken at watercourse crossings to provide the habitat baseline within a suitable buffer upstream and downstream and to allow micrositing of crossings away from potentially sensitive habitats wherever possible (ecological mitigation measures EC22 and EC23 in **Volume 2, Chapter 11: Ecology**). All works within watercourse buffers will be undertaken in accordance with advice from the Advisory ECoW who will monitor the works and implementation of mitigation, including with regards to the delivery of the SPP, GEMPs and CEMP; micrositing will be adopted where water crossings are found to be in proximity to sensitive habitats (see the following ecological mitigation measures: EC6-EC11 and EC13-EC17 in **Volume 2, Chapter 11: Ecology**). Where necessary, specific mitigation measures will be designed and implemented, including the timing of works, to avoid spawning seasons, while retaining suitable spawning substrates, following SPPs.

5.6.8 The habitats recorded during field surveys comprise riparian woodland; although no resting sites were identified, opportunities for shelter are likely to be present or may develop prior to construction. Update otter surveys will be undertaken immediately prior to construction during the survey season (ecological mitigation measure EC14 in **Volume 2, Chapter 11: Ecology**). Where new protected features relevant to otter are found such as holts or, more likely, resting sites, micrositing will attempt to avoid effects (ecological mitigation measures EC15 and EC18 in **Volume 2, Chapter 11: Ecology**). If necessary, the licensing mechanism will be engaged as per SSEN Transmission's standard SPP for the species, and the Advisory ECoW will advise on mitigation for otter not already covered by SSEN Transmission's standard SPP as required. The SPP and licensing regime are considered to be sufficient to address any potential for disturbance identified during pre-construction surveys. Any such disturbance would be short-term and reversible, and would not undermine the conservation objectives of the SAC with regards to otter.

5.6.9 Mitigation measures, as established in the CEMP (ecological mitigation measure EC7 in **Volume 2, Chapter 11: Ecology**) and monitoring programmes (ecological mitigation measures EC28 and EC29 in **Volume 2, Chapter 11: Ecology**), will ensure wider mitigation respond to contemporary data, including spawning sites for salmon, and areas of high density of pearl mussel. Crossings will maintain fish passage, and ensure that potentially sensitive habitats are retained (ecological mitigation measure EC5 in **Volume 2, Chapter 11: Ecology**), and monitoring will identify any requirement for improvements or remedial works as part of the mitigation strategy. Appropriate procedures and methods of removal of trees will be employed to minimise disturbance to banksides and watercourses, limit the potential for bankside erosion, and rectify any bankside issues noted in works areas (ecological mitigation measures EC6-EC11 and EC15-EC17 in **Volume 2, Chapter 11: Ecology**).

5.6.10 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River Dee SAC are predicted as a result of physical disturbance/mortality and non-physical disturbance.**

Changes in Water Quality

5.6.11 The LOD has been restricted where the Proposed Alignment crosses the SAC in recognition of the sensitive location. Measures to protect the water environment will be implemented through the SPPs, GEMPs, and the site-specific CEMP (ecological mitigation measures EC6-EC7 in **Volume 2, Chapter 11: Ecology**), including a site-specific pollution prevention plan to minimise surface water run-off to the designated site and its tributaries in the vicinity of construction working areas. The Advisory ECoW will advise on and monitor works with the potential to affect sensitive watercourse habitats and protected species (ecological mitigation measures EC6-EC11, EC13-EC19, EC22-EC24 and EC26-EC29 in **Volume 2, Chapter 11: Ecology**). All watercourse crossings will be designed and constructed in line with current good practice guidance and in accordance with a Construction Site Licence (from SEPA) that will be necessary before works commence. Ongoing monitoring activity will ensure water quality is maintained for the benefit of freshwater pearl mussel, Atlantic salmon and other aquatic species, and that mitigation measures are effective (ecological mitigation measures EC28 and EC29 in **Volume 2, Chapter 11: Ecology**).

5.6.12 **After application of committed mitigation measures, no adverse effects on site integrity with respect to the qualifying features and the conservation objectives of the River Dee SAC are predicted as a result of changes in water quality.**

Summary

5.6.13 As a means to ensure that the integrity of River Dee SAC is maintained, objectives 2a, 2b and 2c should be maintained for each qualifying feature, and 2d in relation to freshwater pearl mussel. As noted above, no adverse effects on the integrity of the River Dee SAC have been identified from the Proposed Development. As such, the following Conservation Objectives are considered maintained:

- 2a. Restore/maintain the populations of the qualifying features as viable components of the site:
  - The populations of the qualifying features of the River Dee SAC (freshwater pearl mussel, Atlantic salmon, and otter) will not be significantly affected by the Proposed Development.
- 2b. Restore/maintain the distribution of the qualifying features throughout the site:
  - The distribution of the qualifying features of the River Dee SAC (freshwater pearl mussel, Atlantic salmon, and otter) will not be significantly affected by the Proposed Development.
- 2c. Restore/maintain the habitats supporting the qualifying species and availability of food:
  - The habitats supporting the qualifying features of the River Dee SAC (freshwater pearl mussel, Atlantic salmon, and otter) within the site and availability of food will not be significantly affected by the Proposed Development.
- 2d: Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats:
  - The distribution and viability of freshwater pearl mussel host species and their supporting habitats within the River Dee SAC will not be significantly affected by the Proposed Development.

5.7 SPAs and Ramsar sites

5.7.1 All SPAs identified through screening have the following Conservation Objectives:[73]

- 1. to avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- 2. to ensure for the qualifying species that the following are maintained in the long-term:
  - 2a. Population of the species as a viable component of the site;
  - 2b. Distribution of the species within site;
  - 2c. Distribution and extent of habitats supporting the species;
  - 2d. Structure, function and supporting processes of habitats supporting the species; and
  - 2e. No significant disturbance of the species.

5.7.2 These Conservation Objectives underpin European Site[7] (SPA) integrity and are considered with respect to the qualifying ornithological features of the SPAs where LSE has been identified, as defined below.

5.7.3 The following SPAs are also designated as Ramsar sites: Firth of Tay and Eden Estuary; Loch of Kinnordy; Loch of Lintrathen; Montrose Basin; and Loch of Skene. All Ramsar interest features for these sites are covered by the conservation objectives of the associated SPAs. The exceptions to this are the Loch of Kinnordy Ramsar site and the Montrose Basin Ramsar site, which also have conservation objectives relating to habitat and/or botanical interest features, but only ornithological interest features have connectivity to the Proposed Development and therefore have no pathways for LSE in respect to non-ornithological interest features.

5.7.4 The identification of pathways for LSE considered in **Section 4: Stage 1: Screening Assessment** noted that there were two potential impact pathways identified for the SPA/Ramsar qualifying interests with regards to the Proposed Development:

- physical damage or loss of habitat; and
- physical disturbance/mortality and non-physical disturbance

[73] Refer to NatureScot. About Conservation Advice Document for European sites in Scotland [Online] https://www.nature.scot/doc/about-conservation-advice-documents-european-sites-scotland#:~:text=Therefore%20if%20a%20feature%20is,elements%20described%20in%20the%20objectives.

5.7.5 The impact pathways are present through the following potential effects on the SPA/Ramsar qualifying features:

- barrier effects to the species' movements during the operational phase (impact pathway *Physical disturbance and/or mortality*);
- collision mortality with OHLs during the operational phase (impact pathway *Physical disturbance and/or mortality*); and
- loss of foraging habitat during the construction and operational phases of the Proposed Development (impact pathway *Physical damage/loss of habitat*).

5.7.6 The predicted operational phase effects are long-term during the lifespan of the Proposed Development. Barrier effects and collision mortality have the potential to affect the Conservation Objective *Population of the species as a viable component of the site.*

5.7.7 Loss of foraging habitat may be temporary during the construction phase where birds are displaced away from potential foraging habitat or permanent across the lifespan of the Proposed Development whereby habitat is removed from further usage for the species as a result of direct habitat loss from the infrastructure. These potential impacts have the potential to affect the Conservation Objectives *Distribution and extent of habitats supporting the species* and *Structure, function and supporting processes of habitats supporting the species.*

5.7.8 No significant effects are predicted of disturbance and distribution of the species within the SPAs given the distance of the Proposed Development from the roost sites. Conservation Objectives: *Distribution of the species within site* and *No significant disturbance of the species* are discussed briefly, only, for each SPA qualifying species.

5.8 Firth of Tay and Eden Estuary SPA[47] and Ramsar site

5.8.1 There are two potential impacts posed to the Firth of Forth SPA/Ramsar qualifying interests identified as having potential connectivity with the Proposed Development:

- barrier effects to the species' movements during the operational phase; and
- collision mortality with OHLs during the operational phase.

5.8.2 These operational effects are long-term during the lifespan of the Proposed Development and the potential pathway to impact for both fall under **physical disturbance/mortality & non-physical disturbance** and potential to affect Conservation Objective 2a *Population of the species as a viable component of the site*.

5.8.3 Baseline VP surveys were undertaken over Winter 2023/2024 to determine potential collision risk from the Proposed Development to the qualifying goose species' SPA populations (refer to **Volume 5, Appendix 12.1: Ornithology Technical Report**).

Table 12.3.8: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Firth of Tay and Eden Estuary SPA/Ramsar

Designation	Qualifying species	Citation population	Overall Flight Activity		Flights over Proposed Development		Flights at pch[74]		% SPA citation @ pch
			Flights	Number birds	Flights	Number birds	Flights	Number birds	
Firth of Tay and Eden Estuary SPA/Ramsar[47]	Pink-footed goose	2,800	12	3,455	5	528	1	450	16.1%
	Greylag goose	1,200	0	0	0	0	0	0	0%

Greylag Goose (Conservation Status: Unfavourable declining)

5.8.4 The SPA citation for the Firth of Tay and Eden Estuary is 1,200 Greylag geese with BTO WeBS[57] counts of the Tay estuary section averaging 300 birds; the species declining at this roost site as described for the other SPA roosts.

[74] Flights and number of birds recorded at potential collision height (pch; 10-75 m agl) within the LOD.

Physical disturbance and/or mortality

Conservation Objective: 2a. Population of the species as a viable component of the site

Collison mortality

5.8.5 Populations of qualifying goose species at the Firth of Tay and Eden Estuary SPA/Ramsar[47] may be impacted by collision mortality, and potential barrier effects.

5.8.6 No Greylag geese were recorded during the flight activity surveys in 2023/24.

5.8.7 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese. Embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese; and/or
- lie within 5 km of the Firth of Tay and Eden Estuary SPA/Ramsar[47].

5.8.8 At the Firth of Tay and Eden Estuary SPA/Ramsar[47], those spans considered as high risk, are based on combined flight activity of Greylag and Pink-footed geese. No part of the Proposed Development lies within 5 km of the Firth of Tay and Eden Estuary SPA/Ramsar[47].

5.8.9 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Firth of Tay and Eden Estuary SPA/Ramsar[47] qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers Gantry2 to S203; and
- Towers S202 to S197.

5.8.10 With the embedded mitigation, and no Greylag goose flight activity recorded collision mortality is not predicted to have an impact, and the Proposed Development will not result in a long-term reduction in the population or distribution of Firth of Tay and Eden Estuary SPA/Ramsar[47] Greylag geese.

Barrier Effects

5.8.11 Barrier effects have been reported when new infrastructure interrupts traditional migration routes or foraging corridors for birds, mainly in relation to wind farms[75]. A single flock of 22 Greylag geese was recorded foraging in pasture fields approximately 1.5 km to the west of the Tealing Substation in early 2023, during Winter Goose Foraging Survey.

5.8.12 Mitchell (2012)[89] notes that records of Greylag geese foraging from the Firth of Tay and Eden Estuary SPA/Ramsar[47] had declined from 2007. From the distribution maps presented, it appears that most Greylags from this SPA forage within Fife and potentially to the northeast, more than 5 km from the Proposed Development. As such, no barrier impact of the Proposed Development is expected for the Firth of Tay and Eden Estuary SPA/Ramsar[47] population of Greylag geese.

5.8.13 With no recorded flights at potential collision height crossing the Proposed Development and with the OHL not presenting a barrier to habitual movement, it is considered that with the embedded mitigation, collision mortality and barrier effects are not predicted for the Firth of Tay and Eden Estuary SPA/Ramsar[47] Greylag goose population, such that site integrity would be affected.

5.8.14 The Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Greylag geese at the Firth of Tay and Eden Estuary SPA/Ramsar[47].

Pink-footed Goose (Conservation Status: Favourable)

5.8.15 Baseline VP surveys of the Proposed Development were undertaken over Winter 2023/2024 (refer to **Volume 5, Appendix 12.1: Ornithology Technical Report**).

[75] Humphreys, E.M., Cook, A.S.C.P., and Burton, N.H.K 2015. Collision, Displacement and Barrier Effect Concept Note. BTO Research Report No. 669

Physical disturbance and/or mortality

Conservation Objective: 2a. Population of the species as a viable component of the site

Collison mortality

5.8.16 The VP surveys recorded only five Pink-footed goose flights across the Proposed Development, with a maximum of 450 birds in a single flight. Of these flights, a single flight (of 450 birds) crossed the Proposed Development at pch. The Proposed Development will closely follow the routes of existing OHLs in the area where suitable foraging habitat is present, such that the works will not introduce a new feature into an area without OHLs. This means that the wintering goose population is likely to be habituated to the presence of OHLs.

5.8.17 The flight of 450 Pink-footed geese does represent approximately 16% of the SPA citation population of the species (refer to **Table 12.3.8: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Firth of Tay and Eden Estuary SPA/Ramsar**). With only a single VP overlooking the Proposed Development, 18 hours of watches were recorded to obtain a rate of 25 Pink-footed geese crossing the Proposed Development at pch per hour of watch. This may be considered a very high rate across the season, with foraging geese also recorded at fields to the west of the existing Tealing Substation. The use of embedded mitigation in the guise of bird diverters is therefore required on these spans of the Proposed Development where there is an elevated risk of collision mortality to these SPA/Ramsar geese. Geese have been described elsewhere in this document (see **paragraph 5.2.6**) as having a high avoidance rate of turbines and OHLs[76] with line marking considered to increase avoidance further. Therefore, embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese; and/or
- lie within 5 km of the Firth of Tay and Eden Estuary SPA/Ramsar[47].

5.8.18 At the Firth of Tay and Eden Estuary SPA/Ramsar[47], those spans considered as high risk are based on combined flight activity of Greylag and Pink-footed geese (no Greylag flights were recorded). No part of the Proposed Development lies within 5 km of the Firth of Tay and Eden Estuary SPA[47].

5.8.19 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Firth of Tay and Eden Estuary SPA/Ramsar[47] qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers Gantry2 to S203; and
- Towers S202 to S197.

5.8.20 With the embedded mitigation, no significant impact of collision mortality is predicted, and as such the Proposed Development will not result in a long-term reduction in the population or distribution of Firth of Tay and Eden Estuary SPA/Ramsar[47] Pink-footed geese.

Barrier Effects

5.8.21 During baseline surveys Pink-footed geese were the only qualifying species recorded flying over the site of the Proposed Development. The area where the Proposed Development interacts with goose foraging habitat is largely confined to the site near the existing Tealing Substation together with the proposed Emmock substation development. Several existing OHLs are present in the local area and birds continue to move between feeding areas and the SPA/Ramsar roost site in the presence of this infrastructure. Any potential localised avoidance by birds of the Proposed Development OHL, requiring flights over or around the Proposed Development, is unlikely to entail a large additional energetic requirement, given the small extent of the foraging habitat present in an area with OHLs already present and given that the birds were recorded as foraging in fields to the south of the Proposed Development and away from direct interaction with the infrastructure. The Proposed Development is therefore not predicted to result in barrier effects that would affect the population or distribution of Firth of Tay and Eden Estuary SPA/Ramsar[47] Pink-footed geese.

[76] NatureScot, 2025). *Wind farm impacts on birds - Use of Avoidance Rates in the NatureScot Wind Farm Collision Risk Model*. [Online] Available at: https://www.nature.scot/doc/wind-farm-impacts-birds-use-avoidance-rates-naturescot-wind-farm-collision-risk-model [Accessed: 18 March 2025].

5.8.22 With the embedded mitigation and with no prospect of a barrier effect produced by the Proposed Development OHL, it is considered that collision mortality or barrier effects are not predicted for the Forth of Tay and Eden SPA/Ramsar Pink-footed geese population, such that site integrity would be affected.

5.8.23 The Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Pink-footed geese at the Firth of Tay and Eden Estuary SPA/Ramsar.[47]

Conclusion – Site Integrity of Firth of Tay and Eden Estuary SPA/Ramsar

5.8.24 Given the 'favourable' status of Pink-footed goose in the SPA and Ramsar site, and consideration of the Conservation Objectives for the site against the data collected for the study site, it is concluded that there will be no effect on site integrity with respect to Pink-footed goose as a qualifying feature of the Firth of Tay and Eden Estuary SPA[47] and Ramsar site.

5.8.25 The Firth of Tay and Eden Estuary SPA/Ramsar[47] population of Greylag geese is defined as 'unfavourable declining'. Given that all Conservation Objectives are predicted to be maintained for this SPA species it is concluded that there will be no effect on site integrity with respect to Pink-footed goose as a qualifying feature of the Firth of Tay and Eden Estuary SPA[47] and Ramsar site.

5.8.26 Given the consideration of the Conservation Objectives for the site against both historical data and survey data collected for the study site, it is concluded that there will be no adverse effect on site integrity with respect to the qualifying features of the Firth of Tay and Eden Estuary SPA[47]/Ramsar site.

5.9 Loch of Kinnordy SPA and Ramsar site[49]

5.9.1 There are two potential impacts identified for the Loch of Kinnordy SPA/Ramsar[49] qualifying interests identified as having potential connectivity with the Proposed Development:

- barrier effects to the species' movements during the operational phase; and
- collision mortality with OHLs during the operational phase.

5.9.2 The operational phase effects are long-term during the lifespan of the Proposed Development and the potential pathway to impact for both fall under **physical disturbance/mortality & non-physical disturbance** and potential to affect Conservation Objective 2a *Population of the species as a viable component of the site*.

5.9.3 The results of the flight activity watches are summarised in **Table 12.3.9: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Kinnordy SPA/Ramsar** for the Proposed Development that lies within 10 km of the SPA/Ramsar site.

Table 12.3.9: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Kinnordy SPA/Ramsar

Designation	Qualifying species	Citation population	Overall Flight Activity		Flights over Proposed Development		Flights at pch[77]		% SPA citation @ pch
			Flights	Number birds	Flights	Number birds	Flights	Number birds	
Loch of Kinnordy SPA[49]/Ramsar	Pink-footed goose	3,960	42	12,789	24	8,046	6	403	10.2%
	Greylag goose	910	1	21	1	21	0	0	0%

Greylag Goose (Conservation Status: Favourable recovered)

5.9.4 The SPA citation for Greylag geese at Loch of Kinnordy SPA/Ramsar[49] is 910 birds. Recent BTO WeBS[57] counts show a reduced site usage with a mean peak of 133 birds (2018/19-2022/23). The SPA population is considered as unfavourable no change, reflecting the reduced population of the species. It is considered likely that the majority of recorded geese during surveys pertain to the Loch of Lintrathen SPA/Ramsar[50], however the species is assessed within the context of Loch of Kinnordy SPA/Ramsar[49] here.

[77] Flights and number of birds recorded at potential collision height (pch; 10-75 m agl) within the LOD.

Physical disturbance and/or mortality

Conservation Objective: 2a. Population of the species as a viable component of the site

Collison mortality

5.9.5 Populations of qualifying goose species at the Loch of Kinnordy SPA[49]/Ramsar may be impacted by collision mortality, and potential barrier effects.

5.9.6 The results of the flight activity watches are summarised **Table 12.3.9: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Kinnordy SPA/Ramsar** for the Proposed Development that lies within 10 km of the Loch of Kinnordy SPA/Ramsar[49].

5.9.7 Few Greylag geese were recorded, as expected, with only one flight of 21 birds recorded during the watches. This flock did commute over the Proposed Development; however, this flight was not at potential collision height. No collision risk mortality for Greylag geese predicted from the survey results.

5.9.8 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese. Embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese; and/or
- lie within 5 km of the Loch of Kinnordy SPA/Ramsar[49].

5.9.9 At Loch of Kinnordy SPA/Ramsar[49], those spans considered as high risk, are based on combined flight activity of Greylag and Pink-footed geese. No part of the Proposed Development lies within 5 km of the SPA or Ramsar site.

5.9.10 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Loch of Kinnordy SPA/Ramsar[49] qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers S170 to S156; and
- Towers S155 to S148.

5.9.11 With the embedded mitigation, no impact of collision mortality is predicted, and as such the Proposed Development will not result in a long-term reduction in the population or distribution of Loch of Kinnordy SPA/Ramsar[49] Greylag geese.

Barrier effects

5.9.12 A single flock of 220 Greylag geese was recorded during surveys near the Milton of Ogilvie and 1.5 km east of the Proposed Development. Mitchell (2012)[89], pointing to the decrease in site usage by the species, also notes that foraging birds associated with the SPA are likely to be from Loch of Lintrathen SPA/Ramsar[50]. Both SPA Greylag goose populations tend to forage in the Strathmore area, to the east of the Proposed Development. As such, no barrier impact of the Proposed Development is expected for the Loch of Kinnordy SPA/Ramsar[49] population of Greylag geese.

5.9.13 With no recorded flights at potential collision height on crossing the Proposed Development and with no likelihood of a barrier effect produced by the Proposed Development OHL, it is considered that with the embedded mitigation, it is considered that collision mortality or barrier effects are not predicted for the Loch of Kinnordy SPA/Ramsar[49] Greylag goose population, such that site integrity would be affected. .

5.9.14 The Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Greylag goose at Loch of Kinnordy SPA/Ramsar[49] .

Pink-footed Goose (Conservation Status: Unfavourable declining)

Conservation Objective: 2a. Population of the species as a viable component of the site

Collision mortality

5.9.15 A total of 42 flights of Pink-footed geese were recorded from the three VPs which overlooked the area where Proposed Development overlaps with the 10 km buffer from the Loch of Kinnordy SPA/Ramsar[49] (refer to **Table 12.3.9: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Kinnordy SPA/Ramsar**. Of these flights, more than half (24),

with a total of 8,046 birds were estimated to intersect the Proposed Development OHL. Six of these flights (403 birds) were recorded as passing at pch, a rate of almost nine birds per hour of watch across the area. These figures represent approximately 10% of the SPA citation recorded across the 45 hours of watches, estimated as over 22,000 passes across the watch period given available flight time (over 2,500 hours). Assuming a 99.8% avoidance of collision, this would suggest approximately 45 birds killed per non-breeding season. This represents over 1% of the SPA citation population. This is number is considered unrealistic, however. Goose foraging associated with Loch of Kinnordy SPA[49]/Ramsar has been identified as being in the Strathmore area to the southwest of the loch and away from the Proposed Development. As such, it is expected that many of the recorded flights relate to birds on migration and moving between roosting areas, rather than between areas used for foraging. Most flights recorded were noted in October and November 2023, with some flights also noted in December 2023 and again in February 2024. These flights would therefore be more likely birds on migration with there being a reduction in 'available' flying time between September and March and a significant concomitant reduction in potential collision mortality.

5.9.16 Line marking is to be carried out across the following spans in relation to the Loch of Kinnordy SPA[49]/Ramsar qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers S170 to S156; and
- Towers S155 to S148.

5.9.17 With embedded mitigation in place across these spans, it is believed that there would be no significant impact of collision mortality predicted for Loch of Kinnordy SPA/Ramsar[49] Pink-footed geese.

Barrier effects

5.9.18 Many of the flights recorded during the VP watches are of migrating birds and/or birds moving between roost sites. It has been shown that over 85% of goose flights over 5 km from roost sites are at above collision height[87], with foraging birds much more at risk of collision and barrier effects than these migrating birds; the Loch of Kinnordy SPA/Ramsar[49] lies over 5 km from the Proposed Development. Further, few foraging Pink-footed geese were recorded with the only flock recorded to the east of the Proposed Development at Upper Drumgley. Other flocks were noted at Milton of Oglivie to the west of the LOD. As such, there is no prospect of a barrier impact of the Proposed Development on the Loch of Kinnordy SPA/Ramsar[49] population of Pink-footed geese.

5.9.19 With the embedded mitigation and with no prospect of a barrier effect produced by the OHL, it is considered that collision mortality or barrier effects are not predicted for the Loch of Kinnordy SPA/Ramsar[49] Pink-footed goose population, such that site integrity would be affected.

5.9.20 The Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Pink-footed goose at Loch of Kinnordy SPA/Ramsar[49].

Conclusion – site integrity of Loch of Kinnordy SPA/Ramsar

5.9.21 The Loch of Kinnordy SPA/Ramsar[49] population of Greylag geese is described as favourable recovered, with no negative pressures identified. The Pink-footed goose population at Loch of Kinnordy SPA/Ramsar[49], is 'unfavourable declining' however, no negative pressures have been identified for the SPA/Ramsar population.

5.9.22 Given the consideration of the Conservation Objectives for the site against both historical data and survey data collected for the study site, it is concluded that there will be no adverse effect on site integrity with respect to the qualifying features of the Loch of Kinnordy SPA[49] and Ramsar site.

5.10 Loch of Lintrathen SPA and Ramsar site[50]

5.10.1 There are two potential impacts identified for the Loch of Lintrathen SPA/Ramsar[50] qualifying interests identified as having potential connectivity with the Proposed Development:

- barrier effects to the species' movements during the operational phase; and
- collision mortality with OHLs during the operational phase.

5.10.2 The operational phase effects are long-term during the lifespan of the Proposed Development and the potential pathway to impact for both fall under **physical disturbance/mortality & non-physical disturbance** and potential to affect Conservation Objective *Population of the species as a viable component of the site.*

5.10.3 Baseline VP surveys were undertaken over Winter 2023/2024 to determine potential collision risk from the Proposed Development to the qualifying goose species' SPA populations (refer to **Volume 5, Appendix 12.1: Ornithology Technical Report**).

5.10.4 The results of the flight activity watches are summarised in **Table 12.3.10: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Lintrathen SPA/Ramsar** for the Proposed Development that lies within 10 km of the Loch of Lintrathen SPA[50]. The results also pertain to the Loch of Kinnordy SPA/Ramsar[49] (refer to **Section 5.9**).

Table 12.3.10: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Loch of Lintrathen SPA/Ramsar

Designation	Qualifying species	Citation population	Overall Flight Activity		Flights over Proposed Development		Flights at pch[78]		% SPA citation @ pch
			Flights	Number birds	Flights	Number birds	Flights	Number birds	
Loch of Lintrathen SPA[50]/Ramsar	Greylag goose	2,100	1	21	1	21	0	0	0%

Greylag Goose (Conservation Status: Unfavourable declining)

5.10.5 The SPA citation for Loch of Lintrathen[50] is 2,100 Greylag geese. Recent use of the roost site has declined with more recent BTO WeBS counts of just 139 Greylags[57].

Physical disturbance and/or mortality

Conservation Objective: 2a Population of the species as a viable component of the site

Collison mortality

5.10.6 Populations of qualifying goose species at the Loch of Lintrathen SPA/Ramsar[50] may be impacted by collision mortality, and potential barrier effects.

5.10.7 A single flight of 21 birds was recorded during the watches. This flight was not at recorded as being at potential collision height, with no collision risk mortality for Greylag geese predicted from the survey results.

5.10.8 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese. Embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese; and/or
- lie within 5 km of the Loch of Lintrathen SPA/Ramsar[50].

5.10.9 At Loch of Lintrathen SPA/Ramsar[50], those spans considered as high risk, are based on combined flight activity of Greylag and Pink-footed geese in conjunction with Loch of Kinnordy SPA/Ramsar[49] goose flight activity (refer to **Section 5.9**). No part of the Proposed Development lies within 5 km of the Loch of Lintrathen SPA/Ramsar[50].

5.10.10 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Loch of Lintrathen SPA/Ramsar [50] (and Loch of Kinnordy SPA/Ramsar site[49]) qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Spans S170 to S156; and
- Spans S155 to S148.

[78] Flights and number of birds recorded at potential collision height (pch; 10-75 m agl) within the LOD.

5.10.11 With the embedded mitigation, no impact of collision mortality is predicted, and as such the Proposed Development will not result in a long-term reduction in the population or distribution of Loch of Lintrathen SPA/Ramsar[50] Greylag geese.

Barrier Effects

5.10.12 A single flock of 220 Greylag geese was recorded during surveys near the Milton of Ogilvie and 1.5 km east of the Proposed Development. Mitchell (2012)[89] considers that the foraging area and roost usage means that these birds are likely to be from Loch of Lintrathen SPA/Ramsar[50]. Both Greylag goose populations tend to forage in the Strathmore area, to the east of the Proposed Development. As such, no barrier impact of the Proposed Development is expected for the Loch of Lintrathen SPA/Ramsar[50] population of Greylag geese.

5.10.13 With no recorded flights at potential collision height on crossing the Proposed Development and with no prospect of a barrier effect produced by the Proposed Development OHL, it is considered that collision mortality or barrier effects are not predicted for the Loch of Lintrathen SPA/Ramsar[50] Greylag goose population such that site integrity would be affected.

5.10.14 The Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Greylag geese.

Conclusion – site integrity of Loch of Lintrathen SPA/Ramsar

5.10.15 The Loch of Lintrathen SPA/Ramsar[50] population of Greylag geese is 'unfavourable declining' however, no negative pressures have been identified for the SPA/Ramsar population.

5.10.16 Given the consideration of the Conservation Objectives for the site against both historical data and survey data collected for the study site, it is concluded that **there will be no adverse effect on site integrity with respect to the qualifying features of the Loch of Lintrathen SPA[50] and Ramsar site**.

5.11 Montrose Basin SPA and Ramsar site[51]

5.11.1 There are three potential impacts identified for the Montrose Basin SPA[51]/Ramsar qualifying interests with regards to the Proposed Development:

- barrier effects to the species' movements during the operational phase;
- collision mortality with OHLs during the operational phase; and
- loss of foraging habitat during the construction and operational phases of the Proposed Development.

5.11.2 The operational phase effects are long-term during the lifespan of the Proposed Development and the potential pathway to impact for both fall under **physical disturbance/mortality & non-physical disturbance** and potential to affect Conservation Objective 2a *Population of the species as a viable component of the site*.

5.11.3 The potential pathway to impact for loss of foraging habitat falls under **physical damage or loss of habitat** with the potential to affect Conservation Objective 2d *Structure, function and supporting processes of habitats supporting the species* and *Distribution and extent of habitats supporting the species*.

5.11.4 Baseline VP surveys were undertaken over Winter 2023/2024 to determine potential collision risk from the Proposed Development to the qualifying goose species' SPA populations (refer to **Volume 5, Appendix 12.1: Ornithology Technical Report**).

5.11.5 The results of the flight activity watches are summarised in **Table 12.3.11: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Montrose Basin SPA/Ramsar** for the Proposed Development that lies within 10 km of the SPA.

Table 12.3.11: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Montrose Basin SPA/Ramsar

Designation	Qualifying species	Citation population	Overall Flight Activity		Flights over Proposed Development		Flights at pch[79]		% SPA citation @ pch
			Flights	Number birds	Flights	Number birds	Flights	Number birds	
Montrose Basin SPA/Ramsar[51]	Pink-footed goose	21,800	63	6,440	29	3,208	13	794	3.6%
	Greylag goose	1,080	3	18	1	12	0	0	0%

Greylag Goose (Conservation Status: Favourable recovered)

5.11.6 The SPA citation for Greylag geese at Montrose Basin SPA/Ramsar[51] is 1,080 birds, although BTO WeBS[57] counts of 157 across recent years 2018/19-2022/23 show a reduction in numbers. The SPA condition status is 'favourable recovered.' The Icelandic greylag goose population was modelled in Trinder et al. (2010)[48], which concluded a likely reduction in the population of the species due to high levels of shooting in its breeding habitat. The population of the species in 2020 in the UK was considered to be 60,000 individuals (reduced from the estimate of 70,000)[49]. However, the Montrose Basin SPA/Ramsar[51] birds are no longer considered to contain exclusively Icelandic birds, with more British Greylags now wintering in areas in northern Britain: Montrose Basin falls south of the arbitrary line where it is considered that Icelandic birds winter[85].

Physical disturbance and/or mortality

Conservation Objective: 2a Population of the species as a viable component of the site

Collision mortality

5.11.7 Few Greylag geese were recorded, as expected, with only one flight of 12 birds recorded as flying over the Proposed Development. This flight was not at potential collision height, however, with no collision risk mortality for Greylag geese predicted from the survey results (refer **Table 12.3.11: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Montrose Basin SPA/Ramsar**).

5.11.8 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese. Embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese: and/or
- lie within 5 km of the Montrose Basin SPA/Ramsar[51].

5.11.9 At Montrose Basin, those spans considered as high risk, are based on combined flight activity of Greylag and Pink-footed geese. No part of the Proposed Development lies within 5 km of the Montrose Basin SPA/Ramsar[51].

5.11.10 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Montrose Basin SPA/Ramsar[51] qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers S96 to S84;
- Towers S83 to S79;
- Towers S69 to S67; and
- Towers S65 to S57.

5.11.11 With the embedded mitigation, no impact of collision mortality is predicted, and as such the Proposed Development will not result in a long-term reduction in the population or distribution of the Montrose Basin SPA/Ramsar[51] Greylag geese.

[79] Flights and number of birds recorded at potential collision height (pch; 10-75 m agl) within the LOD.

Barrier effects

5.11.12 Foraging Greylag geese were recorded almost exclusively to the east of the Proposed Development during the Winter Goose Foraging Surveys. A single bird only was recorded to the west of the Proposed Development foraging in fields near Brathinch in a flock of 3,700 Pink-footed geese (**Volume 3, Figure 12.5.1** to **12.5.6: Winter Goose Foraging Surveys**). This is in agreement with Mitchell (2012)[89] who points to foraging southwest of the basin, with most flocks remaining close to the roost. It is also likely that the mean foraging distance of Greylag geese here is like that at Loch of Skene, and as such birds will tend to forage within less than 6 km of the SPA/Ramsar.

5.11.13 With no recorded flights at potential collision height on crossing the Proposed Development and with little likelihood of a barrier effect produced by the Proposed Development OHL, it is considered that with the embedded mitigation, no significant impact of collision mortality or barrier effects are predicted for SPA/Ramsar Greylag geese. As such, the Proposed Development is not predicted to result in barrier effects or collision mortality that would affect the population or distribution of the Montrose Basin SPA/Ramsar[51] Greylag goose population, such that site integrity would be affected. As such, the Conservation Objective 2a *'Population of the species as a viable component of the site'* is maintained with respect to Greylag geese.

Physical damage or loss of habitat

Loss of Foraging Habitat

Conservation Objective: 2d Structure, function and supporting processes of habitats supporting the species

5.11.14 There is predicted to be a very small loss of potential goose foraging habitat (less than 1%) of potential goose foraging habitat associated with the Proposed Development, with respect to the available habitat present within 20 km of Montrose Basin SPA[51] with infrastructure including tower bases, access tracks and construction compounds being created. The main land take will be temporary, with construction compounds likely to be present for less than 3 years, as such impacts on foraging habitat will be limited. Small numbers of foraging Greylag geese were recorded within 2 km of the Proposed Development, with two birds present near Little Brechin and a single bird at Brathinch. Mitchell (2012)[89] recorded few feeding records on Greylag geese from 2007 onwards, however, those foraging flocks that were recorded were all to the east of the Proposed Development. As such, the Proposed Development is not predicted to result in impacts on foraging habitat that would affect the population or distribution of Montrose Basin SPA/Ramsar[51] qualifying Greylag geese, such that site integrity would be affected. As such, the Conservation Objective *'Structure, function and supporting processes of habitats supporting the species'* is maintained with respect to Greylag geese.

Pink-footed Goose (Conservation Status: Favourable maintained)

Physical disturbance and/or mortality

Conservation Objective: 2a Population of the species as a viable component of the site

Collison mortality

5.11.15 A total of 63 flights of Pink-footed geese were recorded from the four VPs within 10 km of the Montrose Basin SPA/Ramsar[51] (refer to **Table 12.3.11: Wintering goose and waterfowl flight data from 2023/24 VP surveys for Montrose Basin SPA)**. Of these flights, 29 were over the Proposed Development of which 13, involving 794 birds were recorded as being at potential collision height (pch). This represents approximately 3.6% of the SPA citation of the species of 21,800 Pink-footed geese. Four VPs were used to watch the Proposed Development, with 63 hours of watched time, and as such with an average of 12.6 geese flying over the Proposed Development at pch every hour of watched. This is equivalent to at least 31 Pink-footed geese colliding with the OHL across the non-breeding season, assuming approximately 2,500 hours of available flight time (representing 0.15% of the SPA/Ramsar population). The foraging areas that the geese are using are considered to be at the very west-most extent of the foraging range of Pink-footed geese from Montrose Basin SPA/Ramsar[51], with the likelihood that flight activity would not be a constant across the available flight hours; with collision mortality considerably less than predicted above.

5.11.16 Recently, Wood et al. (2020[80]) modelled the impacts of wind farm and OHL collisions on the UK's overwintering Pink-footed goose population (data obtained by recording the flight patterns of several tagged geese). They estimated that 0.14% of the population would succumb to collision mortality from these infrastructure types. (674 geese from a population of 479,361; an avoidance rate of 99.8% applied). In comparison, it has been estimated that 11% of the UK population are shot each winter; potentially up to 50,000 birds[81]. Their conclusion was that even doubling the number of turbines and powerlines encountered by geese during flights would still have a small effect on predicted mortality, especially relative to other potential impacts. Given that avoidance rates for OHLs, especially line-marked spans, would likely be considerably higher (Heritage Environmental Limited, 2016[65]) it is not considered that the Proposed Development would impact the SPA/Ramsar population of what is a species with a robust population dynamic.

5.11.17 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese. Embedded mitigation, in the form of bird diverters, are proposed across spans that have been identified as either:

- presenting an elevated risk of collision mortality to geese; and/or
- lie within 5 km of the Montrose Basin SPA/Ramsar site[51].

5.11.18 At Montrose Basin, those spans considered as high risk are based on combined flight activity of Greylag and Pink-footed geese. No part of the Proposed Development lies within 5 km of the Montrose Basin SPA/Ramsar site[51].

5.11.19 Following the outlined criteria, line marking is to be carried out across the following spans in relation to the Montrose Basin SPA[51] qualifying features (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers S96 to S84;
- Towers S83 to S79;
- Towers S69 to S67; and
- Towers S65 to S57.

5.11.20 With the embedded mitigation, no impact of collision mortality is predicted, and as such the Proposed Development will not result in a long-term reduction in the population or distribution of the Montrose Basin SPA/Ramsar[51] Pink-footed geese.

Barrier Effects

5.11.21 Foraging Pink-footed geese were recorded to the west of the Proposed Development in relation to Montrose Basin SPA[51]/Ramsar south of Edzell and Balmain (ie birds would have to cross the powerline to reach foraging sites). These areas are also described in Mitchell (2012)[89] as the most westerly of the foraging grounds for the species from the SPA. As described by Mitchell[89], the considerable majority of foraging extends to the south (eg Rossie Moor) and north (ie south of Inverbervie) of the roost site, on farmland close to the basin and beyond any potential interaction with the Proposed Development. As such, sites to the west of the Proposed Development do not represent critical foraging habitat. In addition, these areas also have existing OHLs running north to south, closer to the foraging sites than the Proposed Development (eg foraging sites near the River Esk are over 1 km from the Proposed Development). Hence, barrier effects are not predicted to impact foraging Pink-footed geese from the Montrose basin SPA/Ramsar[51].

5.11.22 With the presence of embedded mitigation in the form of bird diverters and with no prospect of a barrier impact produced by the OHL, it is considered that collision mortality or barrier effects are not predicted for the Montrose Basin SPA[51] Pink-footed geese population, such that site integrity would be affected.

5.11.23 As such, the Proposed Development is not predicted to result in barrier effects or collision mortality that would affect the population or distribution of the Montrose Basin SPA/Ramsar[51] Pink-footed goose population. The Conservation Objective 2a *Population of the species as a viable component of the site* is maintained with respect to Pink-footed geese.

[80] Wood, K.A., Mitchell, C., Griffin, L. & Hilton, G.M., 2020. *Predicting cumulative wind turbine and power line collision mortality for Pink-footed geese using an individual-based model*. Wildfowl & Wetlands Trust Report, Slimbridge. 179pp.
[81] Frederiksen, M., 2002. Indirect estimation of the number of migratory Greylag and Pink-footed geese shot in Britain. Wildfowl, 53, 27–34.

Physical damage or loss of habitat

Loss of Foraging Habitat

Conservation Objective: 2b Distribution of the species within site

5.11.24 Distribution of Pink-footed geese within the Montrose Basin SPA/Ramsar[51] is not predicted to be affected by the Proposed Development. The Conservation Objective *Distribution of the species within site* is maintained.

Conservation Objective: 2d Structure, function and supporting processes of habitats supporting the species

5.11.25 Foraging Pink-footed geese were recorded to the west of the Proposed Development near to the river North Esk, south of Edzell and near Fettercairn. As noted above, these areas, although traditional foraging areas, are unlikely to be critical to the Pink-footed goose SPA/Ramsar population. The land take from the Proposed Development is likely to be very limited in the long-term, with only the tower bases (and a few access tracks) limiting foraging. The foraging sites tend to be greater than 1 km from the Proposed Development, with barrier effects unlikely in part of the landscape that does support other OHLs too.

5.11.26 As such, the Proposed Development is not predicted to result in impacts on foraging habitat that would affect the population or distribution of Montrose Basin SPA/Ramsar[51] qualifying Pink-footed geese, such that site integrity would be affected with the Conservation Objective *Structure, function and supporting processes of habitats supporting the species* maintained with respect to Pink-footed geese.

Conclusion – site integrity of Montrose Basin SPA/Ramsar

5.11.27 The Montrose Basin SPA[51] population of Greylag geese is favourable recovered; however, no negative pressures have been identified for the SPA population. Pink-footed geese remain favourable maintained, although dumping and storage of materials are noted as a potential threat to birds there; SEPA has identified the basin as a Priority Catchment.

5.11.28 Given the consideration of the Conservation Objectives for the site against both historical data and survey data collected for the study site, it is concluded that **there will be no adverse effect on site integrity with respect to the qualifying features of the Montrose Basin SPA[51] and Ramsar site**.

5.12 Loch of Skene SPA[53] and Ramsar site

5.12.1 There are three potential impacts identified for the Loch of Skene SPA[53]/Ramsar qualifying interests with regards to the Proposed Development:

- barrier effects to the species' movements during the operational phase;
- collision mortality with OHLs during the operational phase; and
- loss of foraging habitat during the construction and operational phases of the Proposed Development.

5.12.2 The operational phase effects (collision mortality and barrier effects) are long-term across the lifespan of the Proposed Development and the potential pathway to impact for both fall under **physical disturbance/mortality & non-physical disturbance** and potential to affect Conservation Objective 2a *Population of the species as a viable component of the site*.

5.12.3 The potential pathway to impact for loss of foraging habitat falls under **physical damage or loss of habitat** with the potential to affect Conservation Objective 2d *Structure, function and supporting processes of habitats supporting the species* and 2c *Distribution and extent of habitats supporting the species.*

5.12.4 Baseline VP surveys were undertaken over Winter 2023/2024 to determine potential collision risk from the Proposed Development to the Greylag goose SPA population (refer **Volume 5, Appendix 12.1: Ornithology Technical Report**). The results of the flight activity watches are summarised in **Table 12.3.12: Winter goose and waterfowl flight data from 2023/24 VP surveys for Loch of Skene SPA/Ramsar.** The Proposed Development lies within 10 km of the SPA.

Table 12.3.12: Winter goose and waterfowl flight data from 2023/24 VP surveys for Loch of Skene SPA/Ramsar

Designation	Qualifying species	Citation population	Overall Flight Activity		Flights over Proposed Development		Flights at pch[82]		% SPA citation @ pch
			Flights	Number birds	Flights	Number birds	Flights	Number birds	
Loch of Skene SPA/Ramsar[53]	Greylag goose	5,500	23	352	9	104	3	18	0.3%

Greylag Goose (Conservation Status: Unfavourable declining)

5.12.5 The SPA citation for Greylag geese at Loch of Skene SPA[53] is 5,500 birds[53]. The population has reduced considerably over the last 30 years, with the latest BTO WeBS[57] counts of 43 birds only (2018/19-2022/23). The Icelandic Greylag goose population was modelled in Trinder et al. (2010)[83], which concluded a reduction in the population of the species due to high levels of shooting in its breeding habitat. The population of the species in 2020 in the UK was 60,000 individuals (reduced from 73,355 in 2019)[84]. However, Loch of Skene is no longer considered to contain exclusively Icelandic birds, with more British Greylags now wintering in areas in northern Britain: Loch of Skene falls south of the arbitrary line where it is considered that Icelandic birds spend winter[85].

Physical disturbance and/or mortality

Conservation Objective: 2a Population of the species as a viable component of the site

5.12.6 Of 23 flights of Greylag geese recorded from VPs within 10 km of the Loch of Skene SPA[53], three flights totalling 18 birds were at pch over the Proposed Development (refer to **Table 12.3.12: Winter goose and waterfowl flight data from 2023/24 VP surveys for Loch of Skene SPA**). This represents less than 0.3% of the SPA citation of the species of 5,500 birds (last updated 2018)[53]. No other SPA species were observed in flight across the section.

Collision mortality

5.12.7 Embedded mitigation has been proposed across those spans where flight activity has been identified as presenting an elevated risk of collision mortality to geese and/or where the Proposed Development lies within 5 km of the SPA. To reduce potential collision risk to Loch of Skene SPA/Ramsar Greylag goose populations, embedded mitigation in the form of bird diverters will be installed. At Loch of Skene, those OHL spans considered as high risk, are based on combined flight activity of Greylag and Pink-footed geese; the latter recorded during BTO WeBS[57] counts of the loch with a maximum peak mean of over 30,000 on the loch (2018/19-2022/23). Moreover, flight activity watches recorded over 20,000 of the SSSI citation species Pink-footed geese flying over the Proposed Development across Winter 2023/24.

5.12.8 Marking to 5 km of the roost was informed by Bell (1998)[86] who found that the median foraging distance of Greylag geese from the Loch of Skene was 5.8 km and Patterson (2015)[87] who showed that flights of geese increased with distance from the roost site up to about 5 km from it, but did not vary with distance from the roost over the remainder of the foraging area.

[82] Flights and number of birds recorded at potential collision height (pch; 10-75 m agl) within the LOD.
[83] Trinder, M., Mitchell, C., Swann, B. & Urquhart, C., 2010. *Status and population viability of Icelandic Greylag Geese Anser anser in Scotland*. Wildfowl, Volume 60, Pages 64-84. [Online] Available at: https://wildfowl.wwt.org.uk/index.php/wildfowl/article/view/1224 [Accessed: 18 March 2025].
[84] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, S. & Noble, D., 2020. *APEP 4 - Population estimates of birds in Great Britain and the United Kingdom*. British Birds, Volume 113. [Online] Available at: https://www.bto.org/our-science/publications/peer-reviewed-papers/apep-4-population-estimates-birds-great-britain-and [Accessed: 18 March 2025.
[85] Brides, K., Wood, K.A., Auhage, S.N.V., Sigfússon, A. & Mitchell, C., 2021. *Status and distribution of Icelandic-breeding geese: results of the 2020 international census*. Wildfowl & Wetlands Trust Re-port, Slimbridge. 19pp.
[86] Bell, M.V., 1998. *Feeding behaviour of wintering Pink-footed and Greylag Geese in north-east Scotland*. Wildfowl, Volume 39. [Online] Available at: https://wildfowl.wwt.org.uk/index.php/wildfowl/article/view/787 [Accessed: 18 March 2025].
[87] Patterson, I.J., 2015. *Goose flight activity in relation to distance from SPAs in Scotland, including an analysis of flight height distribution, including an analysis of flight height distribution*. Scottish Natural Heritage Commissioned Report No. 735. [Online] Available at: https://www.nature.scot/sites/default/files/2017-07/Publication%202015%20-%20SNH%20Commissioned%20Report%20735%20-%20Goose%20flight%20activity%20in%20relation%20to%20distance%20from%20SPAs%20in%20Scotland%2C%20including%20an%20analysis%20of%20flight%20height%20distribution.pdf [Accessed: 18 March 2025].

5.12.9 Following the outlined criteria, line marking, as part of the embedded mitigation, is to be carried out across the following spans in relation to the Loch of Skene SPA/Ramsar[53] (also refer to **Table 12.3.13: Bird flight diverter line marking** in **Annex 12.3.1: Bird Flight Diverter Line Marking** of this Shadow HRA):

- Towers N49 to N4

5.12.10 Given that only 18 Greylag geese were recorded crossing the Proposed Development at a height considered as pch (0.3 % of the SPA citation) across over 100 hours of observations, it is predicted that collision risk would be immaterial to the SPA population.

5.12.11 Watches were carried out from eight VPs for the Loch of Skene SPA/Ramsar area[53], with 42 separate watches recorded and 103 hours of watch time (a rate of approximately 0.18 Greylags were recorded per hour of watch at pch). The period September to March provides 2,525 hours of potential available flying time (including an assumption that some flights occurred during periods of darkness). As such, approximately 890 Greylag geese would cross the Proposed Development at collision risk height every season. Given avoidance levels of at least 99.8%, between one and two geese would be expected to collide with the Proposed Development each year. With reference to the SPA population of 5,500 birds, this is significantly less than 0.1% of the citation Greylag population. Hence, with embedded mitigation further reducing the likelihood of collision, mortality is predicted to be very low relative to the cited SPA population. As such the Proposed Development is not predicted to result in a long-term reduction in the population or distribution of the qualifying species of the SPA/Ramsar as a result of collision mortality.

Barrier effects

5.12.12 Barrier effects have been reported when new infrastructure interrupts traditional migration routes or foraging corridors for birds, mainly in relation to wind farms[88]. The Proposed Development OHL lies within a landscape of existing OHLs in the area where suitable foraging habitat is present, such that the works will not introduce a new feature into an area without OHLs. This means that the wintering goose population is likely to be habituated to the presence of OHLs. Indeed, the foraging sites where Greylag geese (and Pink-footed geese) were recorded near Loch of Skene included areas at Leuchar Moss and Echt, where birds were recorded foraging under OHLs. Therefore, despite several existing OHLs in the local area, birds continue to move between feeding areas and the SPA in the presence of this infrastructure. Any potential localised avoidance by birds of the Proposed Development OHL, requiring flights over or around the Proposed Development, is unlikely to entail an additional energetic requirement. The main foraging sites for Greylags are to the south of Echt, at approximately 1 km from the Proposed Development and surrounded by existing OHLs and at Kemnay (refer to **Volume 3, Figure 12.5.1 – 12.5.6: Winter Goose Foraging Surveys**). Birds using these sites are likely to remain unaffected by the presence of a new OHL given the distances involved and that flights are likely to remain above pch across the Proposed Development. Given the presence of over 500 km^2 of foraging habitat within 20 km of the Loch of Skene SPA/Ramsar roost[53], should any barrier effect become present due to the development, the available surrounding habitat is likely to accommodate the foraging needs of the species. As such, the Proposed Development is not predicted to result in barrier effects that would affect the population or distribution of the Loch of Skene SPA[53] Greylag goose population.

5.12.13 With the embedded mitigation and with no prospect of a barrier effect produced by the Proposed Development OHL, it is considered that collision mortality or barrier effects are not predicted for the Greylag goose population such that site integrity would be affected with, the Conservation Objective 2a *Population of the species as a viable component of the site'* maintained.

Physical damage or loss of habitat

Loss of Foraging Habitat

5.12.14 There is predicted to be a very small loss of potential goose foraging habitat associated with the Proposed Development, with infrastructure including tower bases, access tracks and construction compounds being created. The main land take will be temporary, with construction compounds likely to be present for less than 3 years, as such impacts on foraging habitat are likely to be limited. In addition, the land take for the Proposed Development is likely to be less than 1% of the potential foraging habitat available that lies within 20 km of the Loch of Skene SPA[53] (estimated as over 500 km^2 of foraging habitat including agricultural land). Foraging grounds of Greylag geese do lie within 2 km of the Proposed Development, notably to the

[88] Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., Bullman, R., Desholm, M., 2009. *Barriers to movement: impacts of wind farms on migrating birds.* ICES Journal of Marine Science, Volume 66, Issue 4, Pages 746–753. [Online] Available at: https://doi.org/10.1093/icesjms/fsp031 [Accessed: 18 March 2025].

southwest of the loch, south of Echt, however preferred and available foraging sites change across time due to different crop rotations etc. For example, Bell (1998)[86] and Mitchell (2012)[89] noted significant foraging of geese to the north of the loch (where current survey records only Pink-footed geese) with relatively few geese recorded to the southwest of the loch. Birds were also noted foraging to the south of the loch and up to the northwest near Kemnay in the present study, as did Bell[86], at sites beyond 2 km from the Proposed Development. As such, the habitats supporting the SPA population of Greylag geese are likely to remain unaffected by the Proposed Development. Indeed, NatureScot's appraisal of possible loss of foraging habitats from allocations in the Aberdeenshire Local Development Plan (LDP) concluded that there was no LSE of those proposals, which affected 12% of the 1 km squares where geese had been recorded as foraging. The Proposed Development is therefore not predicted to result in impacts on foraging habitat that would affect the population or distribution of Loch of Skene SPA[53] qualifying Greylag geese, such that site integrity would be affected with the Conservation Objective 2d *Structure, function and supporting processes of habitats supporting the species* maintained.

Conclusion – site integrity of Loch of Skene SPA/Ramsar

5.12.15 The Loch of Skene SPA[53] population of Greylag geese is 'unfavourable declining'; however, no negative pressures have been identified for the SPA population. Given the consideration of the Conservation Objectives for the site against both historical data and survey data collected for the study site, it is concluded that **there will be no adverse effect on site integrity with respect to the qualifying features of the Loch of Skene SPA[53] and Ramsar site**.

5.13 In Combination Effects

SACs

5.13.1 No projects included within the assessment of in-combination effects for SACs recorded stand-alone residual effects in isolation with regards to the qualifying features of the SACs considered in this HRA[31] (refer above to **Table 12.3.7: In-combination projects with reference to the Proposed Development and the Identified SACs and Ramsar sites**).

5.13.2 Data were drawn from the HRA of the Alyth to Tealing upgrade project[90] and from the HRA of the Cossans Solar and BESS to provide information with regards to the potential impacts of these projects on SAC qualifying features as outlined below.

5.13.3 Projects considered for inclusion to determine in-combination effects for the identified SACs were assessed with regards to their connectivity to the catchments of the riverine SACs, and their distance via watercourse from the Proposed Development. As such, two projects were identified for further consideration of in-combination effects:

- the Alyth to Tealing OHL Upgrade project, on the basis that it oversails the Dean Water; although this project is over 15 km from the Proposed Development via the watercourse, it intersects directly with the SAC and is directly downstream of the Proposed Development; and
- the Cossans Solar and BESS project, as it is within 0.2 km of the Dean Water (part of the River Tay SAC).

5.13.4 The remaining projects either: had no connectivity to any of the identified SACs; connectivity to an SAC was via an extensive length of non-designated watercourse or indirect via an estuary; or, connectivity to an SAC and/or the Proposed Development was over a length of watercourse distance greater than 20 km. The Alyth to Tealing OHL Upgrade project is therefore considered to be the only project with potential to have similar impacts on the European sites as those identified for the Proposed Development, ie it is considered to have similar impact pathways that may affect the conservation objectives noted within the SAC assessment above and at a geographic location with the potential to do so.

5.13.5 The Alyth to Tealing OHL Upgrade project will oversail the River Tay SAC. Information in the HRA of the project indicated that there were LSE and so further assessment was required. The report noted similar impact pathways as have been considered in the assessment regarding the Proposed Development, specifically the potential for disturbance to otter as a result of construction activities. Similar mitigation measures are proposed, including pre-construction otter survey and engagement of

[89] Mitchell, C., 2012. *Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland: A report by the Wildfowl & Wetlands Trust, as part of a programme of work jointly funded by WWT and Scottish Natural Heritage*. [Online] Available at: https://www.bto.org/sites/default/files/mitchel_2012_mapping_distirbution_feeding_pinkfooted_and_greylag_geese_scotland_wwtsnh_report.pdf [Accessed: 18 March 2025].

[90] SSEN Transmission. 2024. LT383 Alyth to Tealing Overhead Line (OHL) 400kV Upgrade: Appendix 7.4 – Statement to inform Habitats Regulations Appraisal. [Online] Available at: https://www.energyconsents.scot/ApplicationDetails.aspx?cr=ECU00005167 [Accessed July 2025]

the licensing mechanism as required. The report concluded that with this mitigation in place, there would be no adverse effect on the integrity of the River Tay SAC.

5.13.6 The Cossans Solar and BESS project is within proximity of the River Tay SAC, to the north of the Dean Water, and the site boundary of the project overlaps with the Proposed Development. Information in the HRA of the project indicated that there were LSE on the qualifying features, and so further assessment was undertaken. The report noted similar impact pathways as have been considered in the assessment regarding the Proposed Development, specifically the potential for disturbance to otter as a result of construction activities. In addition, habitat degradation and disturbance with regards to designated fish species was considered in the Cossans HRA, resulting from pollution associated with construction activities. Similar mitigation measures are proposed, including an ECoW, pollution prevention measures, and specific protocols regarding construction activities and otter, with engagement of the licensing mechanism as required. The report concluded that with this mitigation in place, there would be no adverse effect on the integrity of the River Tay SAC.

5.13.7 Neither the Proposed Development, nor the Alyth to Tealing OHL Upgrade project and the Cossans Solar and BESS project, will result in an adverse effect on the site integrity with respect to otter and the conservation objectives of the River Tay SAC. Given the distance between the Proposed Development and the Alyth to Tealing OHL Upgrade project (over 15 km via the watercourse), and the limited habitat potential recorded within proximity of the Proposed Development and the Cossans Solar and BESS project, and with appropriate construction mitigation measures in place at each site to avoid or mitigate any construction disturbance or habitat degradation, it is assessed that there is no prospect of adverse effects of the Proposed Development in-combination with the identified project on the otter population of the River Tay SAC, and therefore no in-combination adverse effect on the conservation objectives and site integrity.

SPAs and Ramsar sites

5.13.8 No projects (wind farms and OHLs) included that lie within core foraging range of the qualifying species of the identified SPAs and Ramsar sites recorded any level of stand-alone residual effects in isolation with regards to SPA qualifying features/Ramsar features identified in this assessment (refer to **Table 12.3.7: In-combination wind farm and OHL Projects with reference to Proposed Development and SPAs**). Data were drawn from EIARs, Non-Technical Summaries (NTS) and information available on the internet to provide information with regards to the potential impacts of these projects on SPA qualifying features (Greylag and Pink-footed geese). These are outlined below with respect to the SPAs and Ramsar sites assessed in this appendix.

5.13.9 Projects chosen for inclusion to determine in-combination effects for the identified SPAs and Ramsar sites were confined to wind farms and to OHL developments. These project types are considered as having the potential to have similar impacts on these European Sites as those identified for the Proposed Development, ie they were considered to have similar impact pathways to affect the Conservation Objectives noted within the SPA assessments above and at a spatial capacity to have the potential to do so.

5.13.10 The Firth of Tay and Eden Estuary SPA and Ramsar site has a number of Projects including wind farms, substation developments and OHLs within 15 km core foraging range of qualifying goose species. Information on predicted effects from the Lochelbank Wind Farm were not available, although the RSPB did suggest that there is '*risk to large number of geese*', however it is not known whether any flight activity was recorded at potential collision height. The wind farm at Govals concluded that there would not be a significant effect of the Project (in EIA terms) given that the majority of flights were above potential collision height. The Projects at Emmock substation, including tie-ins, coincide spatially with the Proposed Development reported in this HRA. Flight activity and foraging activity would not be significantly impacted by these Projects and as such no significant residual effects are present. Therefore, no substantial collision mortality is predicted to arise from these developments and there is predicted to be no prospect of an adverse effect of the Proposed Development in-combination with the identified Projects on goose populations and site integrity is predicted to be maintained for the Firth of Tay and Eden Estuary SPA.

5.13.11 A total of six wind farms with 34 turbines are present within 15 km of the Loch of Kinnordy SPA and Ramsar site. Govals, Frawney and Ark Hill Wind Farms lie to the east of the SPA, with 23 turbines between them. Of these, baseline surveys at Govals Wind Farm recorded at least 2,378 Pink-footed geese in flight. However, it was concluded that there would not be a significant effect of the project given that the majority of flights were above potential collision height. The other wind farms did not record substantial goose flight activity. Those developments to the west of the SPA, including Tullymurdoch Wind Farm, recorded some flight activity, but due to their siting away from foraging grounds and migratory pathways, no additional impact was predicted. As such, there is no expectation of substantial mortality to goose populations arising from the Proposed

Development in-combination with these wind farms, and site integrity is predicted to be maintained for the Loch of Kinnordy SPA.

5.13.12 Four wind farm developments are present within 15 km of the Loch of Lintrathen SPA and Ramsar site. Three of these are operational (27 turbines in total) with Green burn (Drumfork; 11 turbines) under construction. These developments lie over 15 km from the Proposed Development. All these wind farms recorded low flight activity and relatively small numbers of geese. The wind farms, lying to the west of the loch do not present regular commuting or migratory pathways for either goose species. Where information was available, no significant residual significance was recorded (ie collision risk mortality was not considered to have an impact on Greylag geese). As such, there is no expectation of substantial mortality to the Greylag goose population arising from the Proposed Development in-combination with these wind farms, and site integrity is predicted to be maintained for the Loch of Lintrathen SPA.

5.13.13 Only a single wind farm of more than three turbines is present within 15 km of Montrose Basin SPA and Ramsar site. No information regarding impacts on ornithology of Tullo Wind Farm was available, however. The presence of a single eight turbine development over 12 km from Montrose Basin SPA is considered unlikely to provide a significant effect on the SPA goose populations: as discussed above, the majority of goose foraging occurs within 5 km of Montrose Basin SPA given traditional foraging grounds close to the roost site, suggesting that limited foraging-related flight activity is present across Tullo Wind Farm. As such, there is no expectation of substantial mortality to goose populations arising from the Proposed Development in-combination with Tullo Wind Farm, and site integrity is predicted to be maintained for Montrose Basin SPA.

5.13.14 The Loch of Skene SPA and Ramsar site has two large (greater than three-turbine) wind farms present within 15 km of the SPA (ie within core foraging range of the qualifying features). No information could be found regarding the operational Meikle Carewe Wind Farm. The Hill of Fare Wind Farm, approximately 800 m to the east of the Proposed Development recorded very limited Greylag goose flight activity, with a collision risk estimate of one bird killed every 114 years. As such, there is no expectation of a substantial mortality to the Greylag goose populations arising from the Proposed Development in-combination with these wind farms, and site integrity is predicted to be maintained for the Loch of Skene SPA.

5.13.15 In-combination effects on the Outer Firth of Forth and St. Andrews Bay Complex SPA[36] were not assessed given that no Red-breasted Merganser were recorded during surveys and that no suitable foraging habitat for the species lies within at least 2 km of the Proposed Development. As such, there is no prospect of any in-combination impacts and site integrity is predicted to be maintained on the Outer Firth of Forth and St. Andrews Bay Complex SPA.

5.13.16 Given the stand-alone assessment of the Proposed Development with regards to the identified SPAs reported previously in this Shadow HRA, it is considered that in combination with the developments identified in **Table 12.3.6: In-combination wind farm and OHL Projects with reference to Proposed Development and SPAs and Ramsar sites**, and as summarised above, there will be no adverse effects on the qualifying features of any of the identified SPA and Ramsar sites (the latter coincident to and having the same qualifying features of the SPAs in all cases) [47], produced by construction and operation of the Proposed Development. Consequently, it is predicted that **there will be no effect on the integrity of the SPAs/Ramsar sites as a result of in combination effects.**

5.14 Conclusion

5.14.1 The above outlines field survey work and desk studies carried out with regard to the Proposed Development.

5.14.2 NBN[56] data and North East Scotland Biological Records Centre (NESBReC) data were obtained with respect to the ecological features of the SACs. Desk study records were obtained from the BTO for WeBS[57] survey data for the SPAs and Ramsar sites.

5.14.3 Survey work was carried out in 2023 and 2024 with respect to the ecological features of the SACs. Detailed ornithological survey work was carried out across the Autumn/Winter and Spring periods of 2023/2024 for which qualifying interests of the SPAs and Ramsar sites had been identified.

5.14.4 This Shadow HRA screening has demonstrated that, in the absence of mitigation, the Proposed Development had LSEs on the qualifying features of a number of European Sites[7]. These were five SPAs (all five of which are also designated as Ramsar sites): the Firth of Tay and Eden Estuary SPA/Ramsar[47], Loch of Kinnordy SPA/Ramsar[49], Loch of Lintrathen SPA/Ramsar[50], Montrose Basin SPA/Ramsar[51] and the Loch of Skene SPA/Ramsar[53]; and three SACs: River Tay SAC[42], River South Esk SAC[43] and the River Dee SAC[45].

5.14.5 It was concluded there were no LSE on the qualifying features of the Firth of Tay and Eden Estuary SAC[39], Garron Point SAC[44], Red Moss of Netherley SAC[46] and Fowlsheugh SPA[52].

5.14.6 Where LSEs existed detailed information including results of field studies undertaken on behalf of the Applicant, to inform the competent authority's Appropriate Assessment, is recorded in this Shadow HRA and the other chapters and supporting information of the EIAR. It was found, on the basis of objective evidence, that none of the relevant Conservation Objectives of any of the SPAs/Ramsars and SACs are undermined by the Proposed Development once mitigation measures (both embedded and additional) have been considered and therefore there will be no adverse effects from the Proposed Development on the integrity of any of the identified European Sites[7]. This is true both in-isolation and in-combination with other developments. As such, there is no requirement in this assessment to consider a Stage 3: Derogation case.

5.14.7 In carrying out its own Appropriate Assessment, and as appropriate taking the opinion of the general public, the competent authority must consult with NatureScot. Having done so, the conclusion of this Shadow HRA is that Scottish Ministers can ascertain either that there are no likely significant effects on qualifying features of European Sites, or where such effects have been reported upon in this Shadow HRA, there is no reasonable scientific doubt as to the absence of adverse effects on site integrity of the qualifying features assessed. In terms of Regulation 63(5) of the Habitats Regulations, Scottish Ministers may be satisfied that they can grant the Section 37 Consent and deemed planning permission sought, subject to appropriate mitigation measures.

ANNEX 12.3.1: BIRD FLIGHT DIVERTER LINE MARKING

Table 12.3.13: Bird flight diverter line marking

Final Structure name		Marking with Bird Flight Diverters	SPA/Ramsar the qualifying features of which triggered marking
South span	North span	Rationale[91]	
Gantry2-Emmock	S206	Adjacent span	Firth of Tay and Eden Estuary SPA
S206	S205	Flight activity	Firth of Tay and Eden Estuary SPA
S205	S204	Flight activity	Firth of Tay and Eden Estuary SPA
S204	S203	Adjacent span	Firth of Tay and Eden Estuary SPA
S202	S201	Adjacent span	Firth of Tay and Eden Estuary SPA
S201	S200	Flight activity	Firth of Tay and Eden Estuary SPA
S200	S199	Flight activity	Firth of Tay and Eden Estuary SPA
S199	S198	Flight activity	Firth of Tay and Eden Estuary SPA
S198	S197	Adjacent span	Firth of Tay and Eden Estuary SPA
S170	S169	Adjacent span	Loch of Kinnordy SPA
S169	S168	Flight activity	Loch of Kinnordy SPA
S168	S167	Flight activity	Loch of Kinnordy SPA
S167	S166	Flight activity	Loch of Kinnordy SPA
S166	S165	Flight activity	Loch of Kinnordy SPA
S165	S164	Flight activity	Loch of Kinnordy SPA
S164	S163	Flight activity	Loch of Kinnordy SPA
S163	S162	Flight activity	Loch of Kinnordy SPA
S162	S161	Flight activity	Loch of Kinnordy SPA
S161	S160	Flight activity	Loch of Kinnordy SPA
S160	S159	Flight activity	Loch of Kinnordy SPA
S159	S158	Adjacent span	Loch of Kinnordy SPA
S158	S157	Adjacent span	Loch of Kinnordy SPA
S157	S156	Flight activity	Loch of Kinnordy SPA
S155	S154	Adjacent span	Loch of Kinnordy SPA
S154	S153	Flight activity	Loch of Kinnordy SPA
S153	S152	Flight activity	Loch of Kinnordy SPA
S152	S151	Flight activity	Loch of Kinnordy SPA
S151	S150	Flight activity	Loch of Kinnordy SPA
S150	S149	Flight activity	Loch of Kinnordy SPA
S149	S148	Adjacent span	Loch of Kinnordy SPA
S143	S142	River South Esk	Watercourse
S131	S130	Noran Water	Watercourse
S106	S105	Cruick Water	Watercourse
S100	S99	Cruick Water	Watercourse

[91] OHL span marked between the identified towers – the rationale includes spans where high levels of flight activity of SPA species (and nesting Schedule 1 species not identified here) have been identified with the span adjacent to these areas also marked; within 5 km of a SPA; or whether the span oversails a waterway.

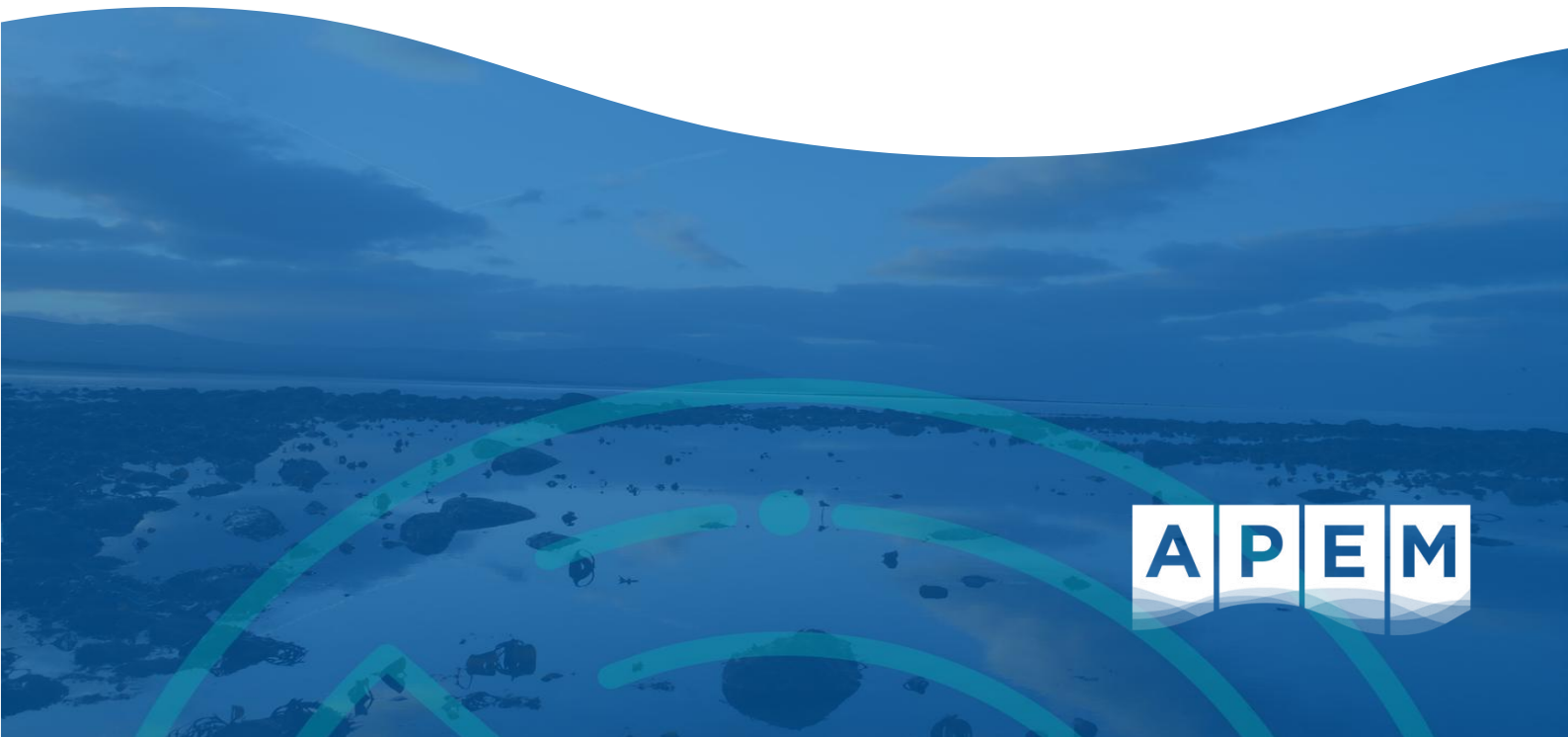
Final Structure name		Marking with Bird Flight Diverters	SPA/Ramsar the qualifying features of which triggered marking
South span	North span	Rationale[91]	
S96	S95	Adjacent span	Montrose Basin SPA
S95	S94	Flight activity	Montrose Basin SPA
S94	S93	Flight activity	Montrose Basin SPA
S93	S92	Flight activity	Montrose Basin SPA
S92	S91	Flight activity	Montrose Basin SPA
S91	S90	Flight activity	Montrose Basin SPA
S90	S89	Flight activity	Montrose Basin SPA
S89	S88	Flight activity	Montrose Basin SPA
S88	S87	Flight activity	Montrose Basin SPA
S87	S86	Flight activity	Montrose Basin SPA
S86	S85	Flight activity	Montrose Basin SPA
S85	S84	Adjacent span	Montrose Basin SPA
S83	S82	Adjacent span	Montrose Basin SPA
S82	S81	Flight activity	Montrose Basin SPA
S81	S80	Flight activity	Montrose Basin SPA
S80	S79	Flight activity	Montrose Basin SPA
S69	S68	Flight activity	Montrose Basin SPA
S68	S67	Flight activity	Montrose Basin SPA
S65	S64	Adjacent span	Montrose Basin SPA
S64	S63	Flight activity	Montrose Basin SPA
S63	S62	Flight activity	Montrose Basin SPA
S62	S61	Flight activity	Montrose Basin SPA
S61	S60	Flight activity	Montrose Basin SPA
S60	S59	Flight activity	Montrose Basin SPA
S59	S58	Flight activity	Montrose Basin SPA
S58	S57	Adjacent span	Montrose Basin SPA
S23	S22	Bervie Water	Watercourse
S12	S11	Carron Water	Watercourse
N4	N6	SPA	Loch of Skene SPA
N6	N7	SPA	Loch of Skene SPA
N7	N8	SPA	Loch of Skene SPA
N8	N9	SPA	Loch of Skene SPA
N9	N10	SPA	Loch of Skene SPA
N10	N11	Flight activity/SPA	Loch of Skene SPA
N11	N12	Flight activity/SPA	Loch of Skene SPA
N12	N13	Flight activity/SPA	Loch of Skene SPA
N13	N14	Flight activity/SPA	Loch of Skene SPA
N14	N15	Flight activity/SPA	Loch of Skene SPA
N15	N16	Flight activity/SPA	Loch of Skene SPA
N16	N17	Flight activity/SPA	Loch of Skene SPA

Final Structure name		Marking with Bird Flight Diverters	SPA/Ramsar the qualifying features of which triggered marking
South span	North span	Rationale[91]	
N17	N18	Flight activity/SPA	Loch of Skene SPA
N18	N19	Flight activity/SPA	Loch of Skene SPA
N19	N20	Flight activity/SPA	Loch of Skene SPA
N20	N21	Flight activity/SPA	Loch of Skene SPA
N21	N22	Flight activity/SPA	Loch of Skene SPA
N22	N23	Flight activity/SPA	Loch of Skene SPA
N23	N24	Flight activity/SPA	Loch of Skene SPA
N24	N25	Flight activity/SPA	Loch of Skene SPA
N25	N26	Flight activity/SPA	Loch of Skene SPA
N26	N27	Flight activity/SPA	Loch of Skene SPA
N27	N28	Flight activity/SPA	Loch of Skene SPA
N28	N29	Flight activity/SPA	Loch of Skene SPA
N29	N30	Flight activity/SPA	Loch of Skene SPA
N30	N31	Flight activity/SPA	Loch of Skene SPA
N31	N32	Flight activity/SPA	Loch of Skene SPA
N32	N33	Flight activity/SPA	Loch of Skene SPA
N33	N34	Flight activity/SPA	Loch of Skene SPA
N34	N35	Flight activity/SPA	Loch of Skene SPA
N35	N36	Flight activity/SPA	Loch of Skene SPA
N36	N37	Flight activity/SPA	Loch of Skene SPA
N37	N38	Flight activity/SPA	Loch of Skene SPA
N38	N39	Flight activity/SPA	Loch of Skene SPA
N39	N40	Flight activity/SPA	Loch of Skene SPA
N40	N41	Flight activity/SPA	Loch of Skene SPA
N41	N42	Flight activity/SPA	Loch of Skene SPA
N42	N43	Flight activity/SPA	Loch of Skene SPA
N43	N44	Flight activity/SPA	Loch of Skene SPA
N44	N45	Flight	Loch of Skene SPA
N45	N46	SPA	Loch of Skene SPA
N46	N47	SPA	Loch of Skene SPA
N47	N48	SPA	Loch of Skene SPA
N48	N49	Adjacent span	Loch of Skene SPA
N61	N62	River Dee	Watercourse

ANNEX 12.3.2: ELECTROMAGNETIC FIELD EFFECTS ON FISH AND FRESHWATER PEARL MUSSEL

Scottish and Southern Electricity Networks – Transmission

Kintore to Tealing 400 kV OHL Connection: Electromagnetic field effects on fish and freshwater pearl mussel



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Contents

Summary

Background

Scottish and Southern Electricity Networks – Transmission (hereafter, SSEN Transmission) is proposing to construct a new 400 kV overhead line (OHL) in the northeast of Scotland. The OHL project, known as the Kintore to Tealing 400 kV OHL connection (hereafter referred to as the Proposed Development), would involve the construction of approximately 119.04 km of new OHL in total. As part of SSEN Transmission's public consultation for alignment options for Proposed Development the potential for electromagnetic field (EMF) effects on fish were raised by fisheries stakeholders.

This report delivers the results and interpretation of a study commissioned by SSEN Transmission which had the following aims: (1) provide a review of the sensitivity of Scottish native freshwater fish (resident and migratory) and freshwater pearl mussel (FWPM) to deleterious behavioural impacts from EMFs generated by high voltage (up to 400 kV) overhead lines; and (2) provide a technical interpretation of the information gleaned from the review in the context of the Proposed Development. The focus of the study was on high conservation value fish species and FWPM, but all fish species were initially considered.

To deliver the aims of the project we undertook the following: (1) a data gathering and GIS mapping exercise to ascertain the route and the design criteria for the OHL; (2) a review of the primary and secondary literature to ascertain the state of the art in anthropogenic EMF effects on fish and FWPM from OHLs; (3) a high level risk assessment of the likely impacts from the Proposed Development on the fish and FWPM present and (4) recommendations for mitigation of those impacts, where possible.

Key location and design criteria of the Proposed Development relevant to anthropogenic EMFs

The key location and design criteria for the cable route and the means to transmit electricity, in relation to the fish and FWPM are as follows:

Location:

1. The Proposed Development is in northeast Scotland and makes 83 watercourse crossings;
2. Eels, salmonid fish and lampreys were identified as key fish species that may be susceptible to EMFs from the OHL;
3. The Proposed Development crosses the following sites which are designated for aquatic features relevant to this study:

a) River Tay Special Area of Conservation (SAC) – Primary feature - Atlantic salmon; Qualifying Features: Sea lamprey (*Petromyzon marinus*), Brook lamprey (*Lampetra planeri*), River lamprey (*Lampetra fluviatilis*);
b) River South-Esk SAC: Primary Features: FWPM and Atlantic salmon;
c) River Dee SAC – Primary Features: FWPM and Atlantic salmon.

Main findings

The literature available to assess the of EMFs generated by high voltage OHLs on resident and migratory fish species and FWPM found on the Proposed Development was non-existent. The reason for such a paucity of research on OHL EMFs is also unknown but likely reflects the perceived negligible impact and thus a lack of a driver for applied research.

The literature for fish taxa which utilise EMFs for migration was scarce, but a consensus is broadly that fish with magnetite deposits can utilise naturally occurring EMFs for migration which makes them potentially vulnerable to EMF effects from OHLs. These fish taxa include migratory salmonid fish, eels and lamprey species which are present along the Kintore to Tealing 400kV OHL. The primary literature for EMF sensitivity in native resident freshwater fish such as pike (*Esox lucius*) and perch (*Perca fluviatilis*) was also very scarce.

Primary literature specifically for anthropogenic effects of subsea power cable generated EMFs in marine environments did exist (although again, not expansive) and was useful for contextualisation of the risks from OHLs. Contextualisation was also gained from Environmental Impact Assessment (EIA) chapters from renewable energy projects where impacts from subsea cable EMFs are assessed routinely.

The main findings from the literature review, for potentially susceptible fish species were as follows:

1. EMFs from OHLs and how they interact with the environment is not an active area for research. There is no available primary literature on OHL EMFs and fish or FWPM;
2. Eels (*Anguillidae*) and salmonids (*Salmonidae*) can detect EMFs in the range of those generated by OHLs and use these adaptations for migration;
3. Lamprey species are likely to be electroreceptive to EMFs but this is a tentative conclusion based on limited studies;
4. Adaptations as identified in (2) above include magnetoreception based on the magnetite particle – magnetite is a biogenic iron rich particle which is widely believed to aid migration in birds and fish;
5. Anthropogenic EMFs will interfere with magnetoreception in eels and salmonids where conductors are laid underwater; and

6. Literature on EMF effects on FWPM is non-existent but some studies exist for marine molluscs (blue mussel) and decapods.

Conclusions

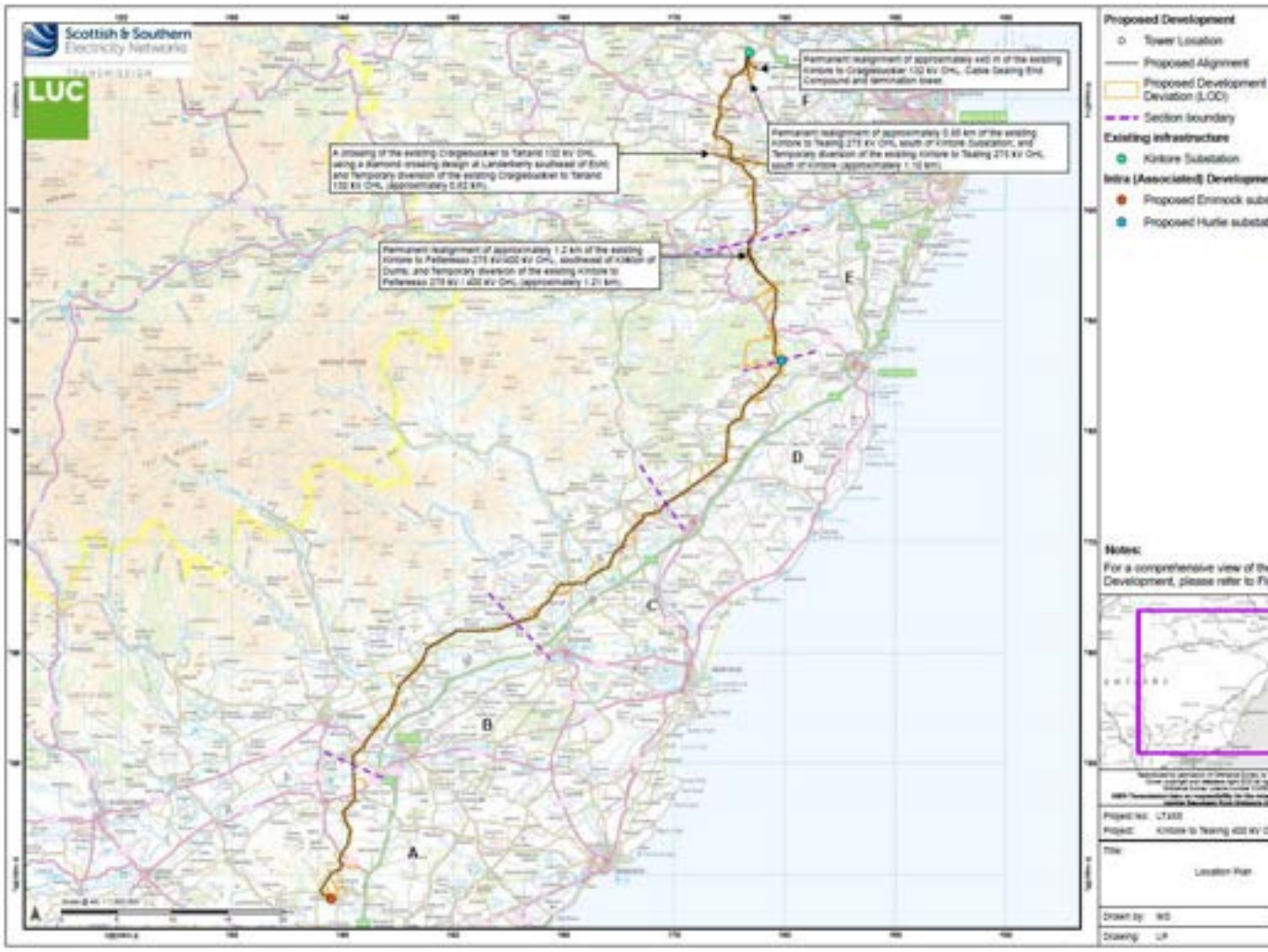
The Proposed Development comprises overhead line and the conductors have a ground clearance of nine metres. In conclusion, given the rapidly dissipating nature of the EMF from high voltage OHLs, the low potential for freshwater to generate induced electric fields from EMFs and the natural background EMF experienced by fish, we conclude that EMFs from the high voltage OHLs in the Proposed Development will have a negligible impact on the fish and FWPM receptors.

Recommendations

- EMF effects on fish and FWPM should not be included in the scope of the Environmental Impact Assessment (EIA) for this development.

1. Introduction

Scottish and Southern Electricity Networks Transmission (hereafter, SSEN Transmission) is proposing to construct a new 400 kV overhead line (OHL) in the northeast of Scotland



. The OHL project, known as the Kintore to Tealing 400 kV OHL connection (hereafter referred to as the Proposed Development), would involve the construction of approximately 119.04 km of new OHL in total and a substantial number of associated built structures, including some sections of existing OHL being realigned, diverted or reconductored. SSEN Transmission have (at the time of writing) completed the Environmental Impact Assessment (EIA) scoping exercise and a public consultation for the Proposed Development.

The new OHL line will increase capacity for electricity transmission the north of Scotland including delivering electricity generated from offshore and onshore wind farms. The SSEN

Transmission OHL designers have reviewed the options and designs and are confident that overhead lines on steel lattice towers located at appropriate intervals represents the best value (SSEN Transmission, 2024). Crucially, conductors will not be buried and will be a minimum of 9m above any land or surface water. Please refer to **Volume 1, Chapter 2: Established Need for the Proposed Development** for more details on Project Need.

1.1 Aims

This report delivers the results and interpretation of a study commissioned by SSEN Transmission which had the following aims:

(1) provide a review of the sensitivity of Scottish native freshwater fish (resident and migratory) and freshwater pearl mussel (*Margaritifera margaritifera*; FWPM) to deleterious behavioural impacts from electromagnetic fields (EMFs) generated by high voltage (up to 400 kV) OHLs; and
(2) provide a technical interpretation of the information gleaned from the review in the context of the Proposed Development, in northeast Scotland. All fish species were initially considered before selecting the highest value and most potentially sensitive species local to the Proposed Development.

The primary focus of this study is the effect of EMFs generated from high voltage OHLs on high conservation value fish (i.e. salmonid fish, eels and lampreys) and FWPM found in the fresh (surface) waters underneath the conductors on the OHL. Freshwater fish with no conservation value that are present in the vicinity of the Proposed Development (e.g. pike, *Esox lucuis* and perch, *Perca fluviatilis*) are scoped into this study but were not a priority.

To deliver the aims of the project we undertook the following:

(1) a data gathering and GIS mapping exercise to ascertain where and how the route and the design criteria for the OHL will be operating;
(2) a review of the primary and secondary literature to understand potential anthropogenic EMF effects on fish and FWPM from high voltage OHLs;
(3) a high-level risk assessment of the likely impacts from the Proposed Development on the fish species and FWPM present along the conductors and,
(4) recommendations for mitigation of those impacts, where possible.

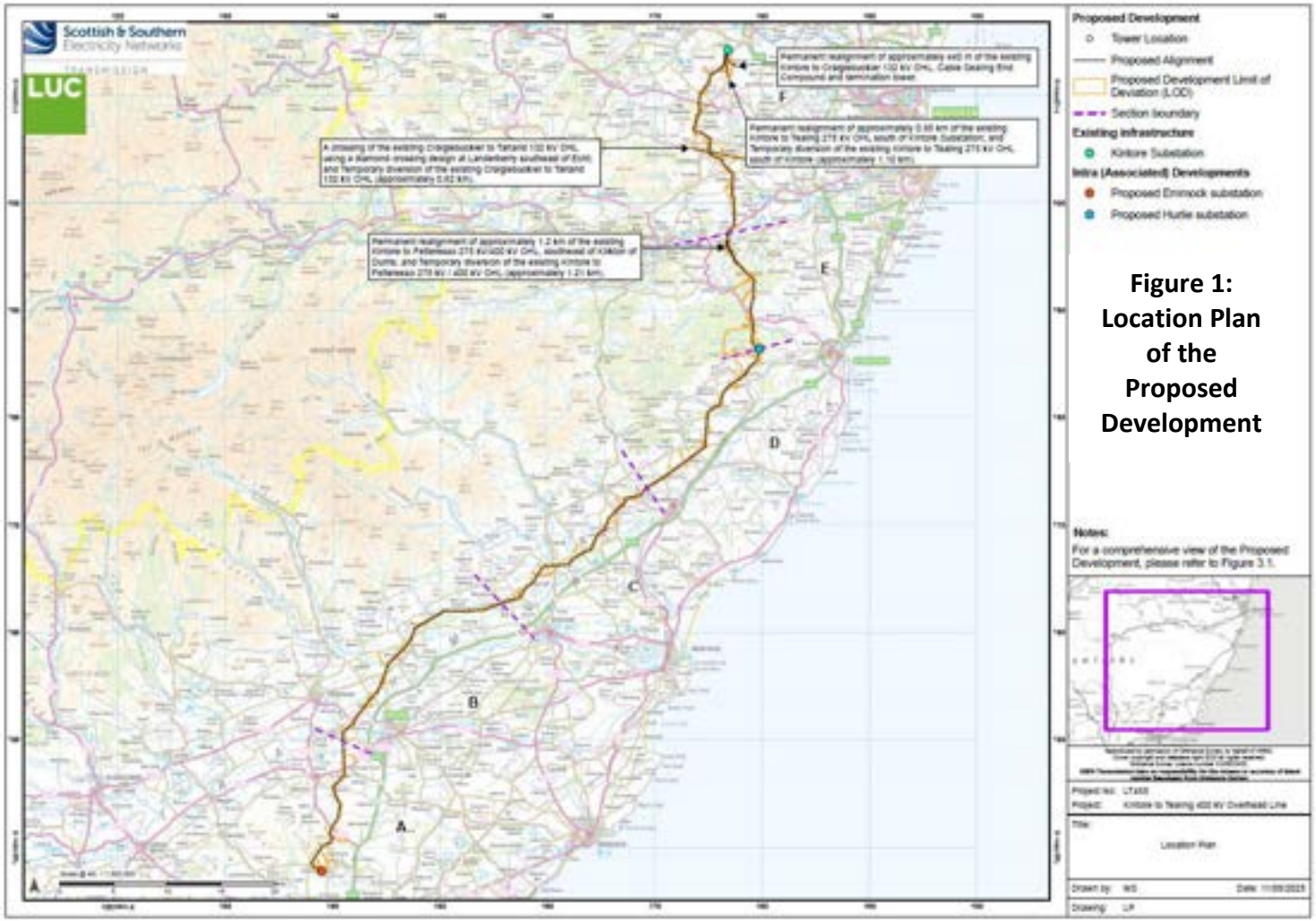


Figure 1: Location Plan of the Proposed Development

1.2 Overview of design criteria

The electricity transmission network in the UK is increasing its capacity for transporting large amounts of high-voltage electricity and a key driver of this increase in capacity is the increased need to transmit electricity generated by offshore marine renewable energy (MRE) sources. The Proposed Development is being constructed in response to this need[1]. Please refer to **Volume 1, Chapter 2: Established Need for the Proposed Development** for more details on Project Need.

The following is proposed by SSEN Transmission for construction of the Proposed Development. A detailed description of the Proposed Development is outlined in **Volume 1, Chapter 3: Project Description.**

- There will be 300 lattice towers (Figure 2) installed as part of the Kintore to Tealing 400 kV OHL works;
- The Proposed Alignment will be approximately 105.2 km long;
- The electricity is transmitted at 50 hertz, in 3 phases as alternating current (AC);
- Steel lattice towers will support 6 conductor bundles which make up the circuits for the OHL (three wires per bundle on six cross-arms (three on each side) and an earth wire between the peaks;
- The average height for each tower suite is approximately 57 m;
- The height of the towers and the conductor span lengths depends on altitude, weather and topography; and
- Crucially, the lowest conductor bundle would not be lower than nine metres above any land or surface water and will not be buried.

[1] The onshore part of the delivery of MRE in north-east Scotland, generated from the North Sea.

Figure 2 Indicative picture of the proposed lattice tower design for the 400 kV Kintore to Tealing upgrade.

1.3 Electromagnetic and electric fields and interactions with aquatic animals

Electric and magnetic fields are generated naturally by both the Earth (geological) and biogenically (within organisms)[2]. The term electromagnetic field (EMF) necessarily incorporates both electric field and magnetic field fundamental physics[3]. Whilst detailed discussion on EMF physics is out with the scope of this study, it is useful to consider one key concept – anthropogenic EMFs generated using electricity conductors. Anthropogenic EMFs are typically produced when electricity flows in a conductor. The most common anthropogenic generators of EMFs are the transmission of electricity through wires and conductors, electricity substations and electrical appliances. Electricity supply conductors and wires which transmit electricity through their networks (including the UK National Grid) generate EMFs when in operation. In a conductive medium such as seawater, currents running through a cable also generate electric fields in the sea water – the converse is true for freshwater which is less conductive (see Figure 3). For the purposes of this report all future

[2] In terms of magnetic fields, the Earth's magnetic field is the most significant magnetic field that exists in nature. The Earth's magnetic field is generated by a flow of charged particles in the liquid iron core of the planet.

[3] EMF comprises both the electrical (E) fields, measured in volts per metre (V/m), and the magnetic (B) fields, measured in (micro)tesla (µT) or milligauss (mG) (1 µT = 10 mG).

reference to EMFs will relate specifically to anthropogenic EMF sources (unless otherwise stated).

As fish swim past live AC conductors, they experience the anthropogenic EMF by swimming through it (the B Field). The EMF may then induce and electric field in the fish (or organism). Natural EMF and electric field (EF) stimuli are widely agreed to have resulted in adaptations in numerous animal taxa, that utilise the EMFs and induced EFs as cues for migration. Note that EMFs cannot be shielded from the environment but also that electric fields can be (Figure 3).

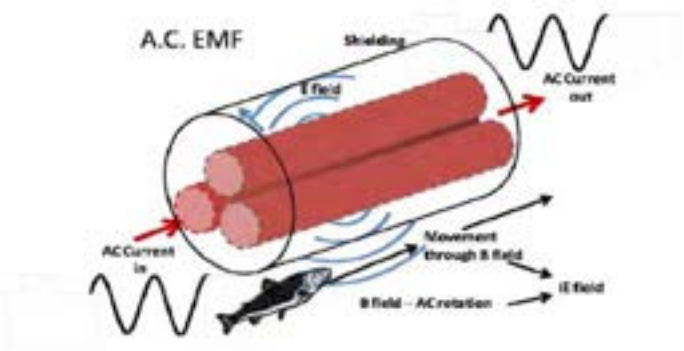


Figure 3 The electric and electromagnetic fields associated with a cable transmitting AC electricity, as experienced by a fish in sea water (adapted from Gill *et al*., 2010). A.C. = alternating current.

When electricity is transmitted through a cable, EMFs and EFs are generated. In the context of anthropogenic EMFs experienced by animal taxa, EMFs and EFs emanate outwards from the cable in a predictable way in both air and water (see Figure 3) and thus have a pathway to animal receptors. Whilst anthropogenic EFs from conductors can be shielded from the environment using conductive materials, EFs cannot be shielded, enter the environment and interact with organisms, including humans. Many animal taxa, including fish, birds and mammals have evolved abilities to detect and respond to natural magnetic fields, most notably as an aid in migrations (Gill *et al*. 2010) and anthropogenic EMFs from anthropogenic sources can impact the behaviours of animals utilising natural magnetic fields.

1.4 Electromagnetic fields generated by high voltage (up to 400 kV) overhead electricity conductors

High voltage alternating current OHLs generate electromagnetic fields that behave predictably in air. The EMF from OHLs emanates outward and perpendicular to the transmission wire and is strongest next to the cable with a negative and exponential decrease as distance from the wire increases. This relationship is described visually in the graph presented in Figure 4. Strict guidelines exist for exposure limits to humans[4] from anthropogenic EMF from power distribution but exposure limit guidelines for wildlife and the environment are not standardised or implemented routinely (but see Discussion for further exploration of future goals in EMF research).

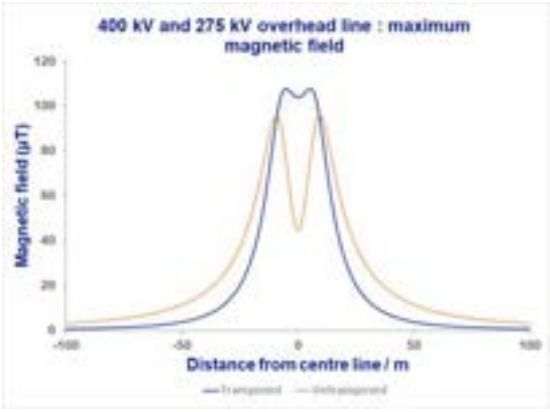


Figure 4 Graph showing EMF field dissipation as distance increases from OHL wires in 275 kV and 400 kV scenarios[5][6].

[4] The International Commission on Non-Ionizing Radiation Protection (ICNIRP).

[5] www.EMFS.info

[6] Transposition is the aligning of the different phases of power on alternating sides of the lattice tower. The design criteria for the transposition of phases in the conductors on each side of the towers will (minimally) affect the EMF strength at ground and surface water level under the OHLs.

Anthropogenic EMFs are a source of energy (non-ionising radiation) and are thus treated as environmental pollutant[7]. Although the Proposed Development intersects a large area, the rapid dissipation of the EMFs in air and the narrow and linear physical structure and orientation of the conductors mean that the potential zone of effect is relatively small and leads us to classify this as a point source of pollution (energy). In addition, this energy is not diluted by natural processes because once in operation, the electricity (current) in the OHL will be flowing constantly and thus generating EMFs locally, in the zone of effect for the operational life cycle of the project.

On the Proposed Development, the minimum OHL conductor height above any surface water of nine metres means that at the land and surface water directly underneath the conductors may experience EMF field strengths of between 50 and 100 micro-Tesla (µT)[5]. The accepted background magnetic field strength generated by the earth[8] and experienced by humans and other organisms in the UK is around 50 µT on average (30-70 µT range) (although this figure will vary according to latitude)[5].

When considering the principles of the "Source, Pathway, Receptor" model for assessing potential impacts of OHL EMFs on fish and FWPM along the Proposed Development, the EMF (as the pollutant) will reach the fish and FWPM receptors via the air and the EMFs produced will penetrate surface waters below. The impact of the EMFs from OHLs on fish and FWPM is therefore worthy of elucidation and is the aim of this study.

[7] Pollutant – the introduction of substances or energy into the environment resulting in deleterious effects to humans, human activities, or other living components of the environment. In this case EMFs as non-ionizing radiation.

[8] Generated by the molten metallic core of the earth.

2. Methods

2.1 Data sources for literature review

2.1.1 Literature searches for effects of EMFs from OHLs on fish and macroinvertebrates

We utilised Boolean searches on the Google Scholar bibliographic database for reviewing the publicly available primary (peer reviewed) and secondary literature (simultaneously) on the impact of OHL EMFs on fish and macroinvertebrates. Our primary combinations of terms and operators were as follows:

(1) Electromagnetic+Field+Fish+Overhead+Line;

(2) Electromagnetic+Field+Invertebrate+Overhead+Line.

The scope of the primary literature review for this study necessarily included literature on MRE infrastructure and its EMF effects on marine fish and invertebrates because our prior knowledge of the subject meant that we expected a comparatively replete (but not extensive) literature on EMF effects in MRE settings and a sparse (to non-existent) literature on EMF effects from OHLs in fresh surface waters. We limited our review of the primary literature for MRE and EMF effects to the five most recent review papers in the primary literature. Our search terms and operators for MRE and associated EMFs was as follows:

(1) Electromagnetic+Field+Cable+Sea+Fish.

Primary literature specifically on electroreception in fish was sourced from references within the review articles themselves.

2.2 Geographic information system (GIS) mapping

We mapped the Proposed Development in QGIS (Version 3.34 – Prizren) In addition, to ascertain the number of times the Proposed Development intersected a surface flowing water body we overlaid the OS Open Rivers WatercourseLink[9] shapefile and the Proposed

[9] https://api.os.uk/downloads/v1/products/OpenRivers/downloads?area=GB&format=ESRI%C2%AE+Shapefile&redirect

Development shapefile provided to us by SSEN Transmission[10] and used the 'Intersect' tool to generate a data table of route crossings and locations.

2.3 Identifying key fish species in surface waters along the Proposed Development

Taking into account the results from Section 2.2 above, we additionally used expert opinion, searches of the Nature Biodiversity Network (NBN) Atlas and searches of the conservation designations relevant to fish and FWPM using the Nature Scot SiteLINK service, to develop a list of fish taxa that were known to be present along the Proposed Development. We then further refined the list of fish taxa most relevant for scoping into an assessment of EMF effects from OHLs based on their conservation value, electroreceptive ability[11], migratory behaviours and value as an exploited fishery resource. FWPM were not subject to this process and were scoped into this assessment as required by SSEN Transmission.

[10] Provided to APEM from SSEN and indicated the Proposed Development.

[11] Ability to detect and utilise electric and magnetic fields as behavioural cues in, for example, migration.

3. Results

3.1 River crossings, conservation designations and key fish species found along the Proposed Development

The Proposed Development is based in a terrestrial setting and will interact only with fresh surface waters. The Proposed Development makes 83 watercourse crossings and intersects the following sites which are designated for aquatic features relevant to this study:

1. River Tay Special Area of Conservation (SAC) – Primary feature - Atlantic salmon; Qualifying Features: Sea lamprey (*Petromyzon marinus*), Brook lamprey (*Lampetra planeri*), River lamprey (*Lampetra fluviatilis*);
2. River South-Esk SAC: Primary Features: FWPM and Atlantic salmon;
3. River Dee SAC – Primary Features: FWPM and Atlantic salmon.

Searches of the NBN Atlas revealed seventeen species of freshwater fish which are recorded as local to the Proposed Development (maximum search radius of 10 km using the point at which the Proposed Development crosses the three SAC rivers as centre points) – these species are presented in Table 1 and include those designated in the SACs listed above. FWPM location data are not publicly available at a useful level of granularity. However, the SAC designation in the River South Esk and River Dee SAC sites was satisfactory confirmation of presence along the Proposed Development.

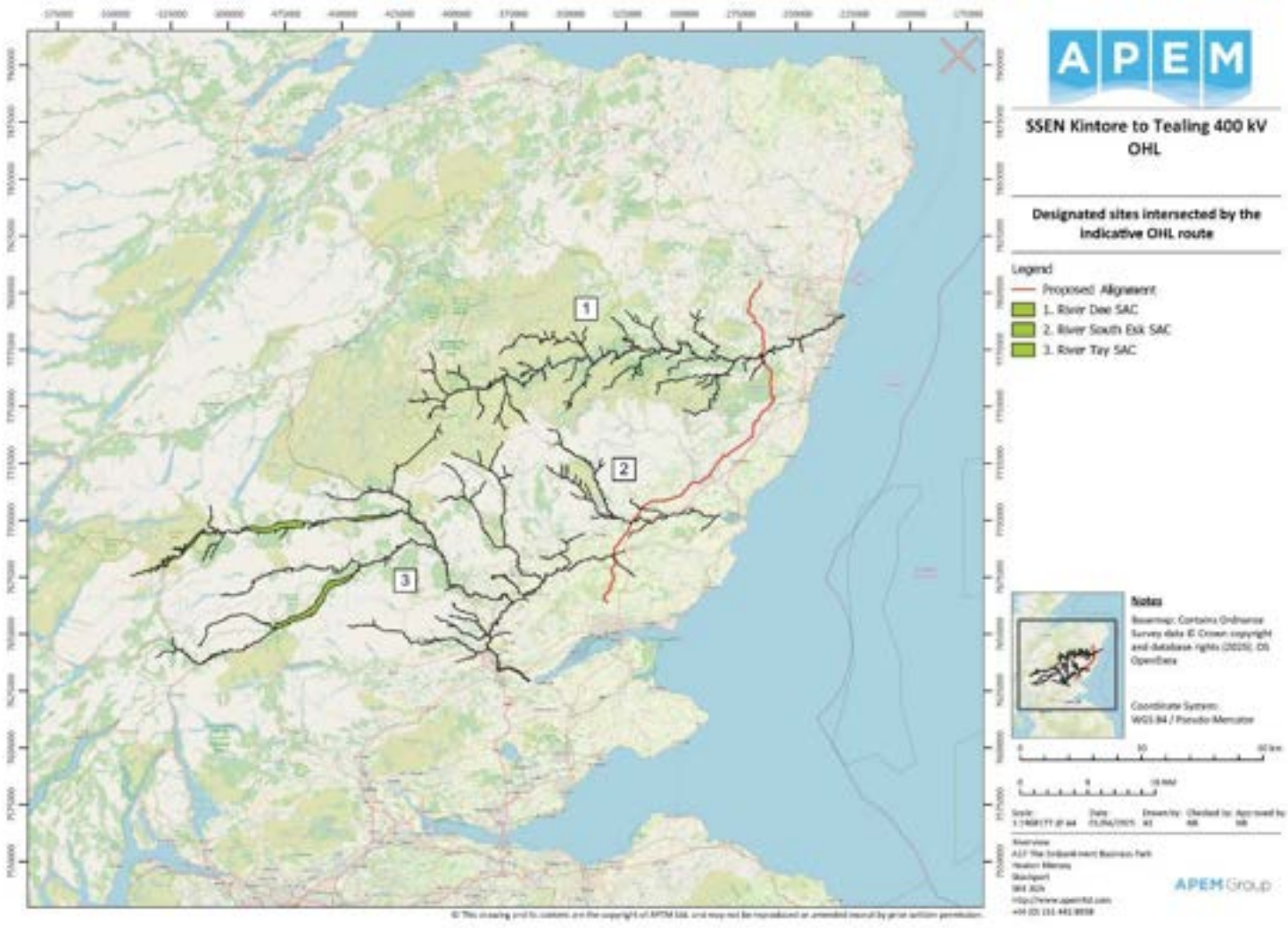


Figure 5: The Proposed Development and its intersection with the River Tay SAC (3), the River South Esk SAC (2) and the River Dee SAC (1).

Table 1 Fish species found along the Proposed Development and noted ability for electroreception (NBN Atlas, 2025). U=Unknown.

Common Name	Species	Electroreceptive?	Migratory
Atlantic salmon	*Salmo salar*	Y	Y
Brown/Sea trout	*Salmo trutta*	Y	Y
Arctic charr	*Salvelinus alpinus*	N	N
European eel	*Anguilla anguilla*	Y	Y
Pike	*Esox lucius*	N	N
Perch	*Perca fluviatilis*	N	N
Minnow	*Phoxinus phoxinus*	N	N
Three-spined stickleback	*Gasterosteus aculeatus*	N	N
Rainbow trout	*Oncorhynchus mykiss*	Y	N (n/a)*
Stone loach	*Barbatula barbatula*	N	N
River lamprey	*Lampetra fluviatilis*	Y	Y
Brook lamprey	*Lampetra planeri*	Y	N
Sea lamprey	*Petromyzon marinus*	Y	Y
Roach	*Rutilus rutilus*	U	N
Grayling	*Thymallus thymallus*	U	N (n/a)*
Flounder	*Platichthys flesus*	U	Y

**non-applicable as non-native*

Of those fish species listed in Table 1, there is a range of conservation value associated with each. Rainbow trout and grayling are non-native species. Arctic char are a salmonid fish but are not considered further because they typically inhabit deep glacial lakes and make non-diadromous small migrations to wave-washed shallow gravels to spawn.

Priority species of conservation concern are as presented in Table 2.

Table 2 High conservation value fish species found along the cable route.

Native Fish Species	Key Legislation	Fishery resource
Atlantic Salmon	EU Habitats Directive	Y
Brown/Sea Trout	Biodiversity Action Plan (BAP) Priority Species (2007)	Y
European Eel	Critically endangered on the IUCN Red List of Threatened Species;	N
Lamprey spp.	EU Habitats Directive	N

After considering each fish species' conservation value, migratory behaviour, electroreception ability and value as an exploited fishery resource, those fish species listed in Table 2 were the focus of our study in the context of assessing impacts from the Proposed

Development remainder of the fish species in Table 1 were not assessed any further in this study.

3.2 Literature Review

Fish sensitivity to electric and electromagnetic fields

The utilisation of natural electric and magnetic fields by fish is widely accepted as an aid to migration in fish (for review see Verhelst *et al*. 2025; Krylov *et al*., 2014) and is based on two different mechanisms (Mouritsen, 2018; Nyqvist *et al*., 2020):

1) induction-based magnetoreception, the action of an animal through the geomagnetic field of the earth which induces currents in the electro-sensory system, which can subsequently be used as a directional cue for navigation;

2) magnetite-based magnetoreception, in which chains of ferromagnetic magnetite inside an organism align themselves when in a magnetic field (Kirschvink *et al*., 2001).

Whilst there are still significant knowledge gaps on how bony fish[12] utilise electroreception the ability to detect EMFs within the range of those experienced along the Proposed Development is highly likely.

The freshwater eel (*A. anguilla*) is an electroreceptive species that uses electromagnetic fields from the earth's core for navigation. The exact mechanism for this is unknown but it is likely to be magnetite[13] deposits in the lateral line. Salmonid fish (including *S. salar*, *S. trutta*) also utilise magnetite for electroreception which aids in large migrations over the continental shelf and into offshore waters. Lamprey species (family: Petromyzontidae) utilise electroreception but the physiological mechanisms underpinning this ability are still unclear (Ronan, 1988; Bodznick and Preston, 1983; Chung-Davidson *et al*., 2004).

[12] Bony fish – Osteichthyes: A vertebrate clade within the Teleostei which contains all fish with a bony skeleton including eels and salmons.

[13] Magnetite is produced biogenically and laid down in various hard structures and soft tissues in numerous animal taxa.

EMF effects from OHLs on FWPM

Our bibliographic searches of the primary and secondary literature for the impact of EMFs from OHLs on FWPM yielded no results. This was an expected outcome. There are a very small number of examples of EMF effects in invertebrate animal taxa but these of limited use in identifying potential impacts from EMFs on FWPM. Data presented by Harsanyi *et al*. (2022) reported growth impacts from chronic high-level exposure to EMFs in two decapod species. Albert *et al*. (2022) presented findings on the impacts of elevated (beyond background levels) EMFs of the feeding of blue mussels (*Mytilus edulis*) but found no evidence of behaviour change. In contrast to fish therefore, literature assessing EMF effects on invertebrates was very sparse and inconclusive.

EMF effects on fish and invertebrate taxa from susbsea conductors in marine renewable infrastructure

In order to deliver a useful review and gain traction of EMF effects on fish and invertebrates more widely, our bibliographic searches for review articles on EMF effects from subsea conductors used in the MRE industry yielded more results. Our search of primary review articles on the topic of EMF effects showed the potential for MRE EMFs to be deleterious to fish and invertebrates through behaviour modification in taxa that are electroreceptive. In addition, the MRE industry is rapidly expanding to meet the distribution demands for power generated through offshore MRE projects (for review see Copping *et al*., 2021). The number of subsea conductors from MRE installations has rapidly in recent years with an expected 193 gigawatts (GW) produced by MRE in Europe by 2040 increasing from 12 GW in 2020 (ECA, 2023). This rapid increase in subsea cable infrastructure is widely regarded as a burgeoning problem for many fish taxa because habitat on migration routes will be frequently interested by conductors and MRE infrastructure. The risk has been highlighted as a serious cause for concern for many fish taxa including eels and salmonids which both undertake significant inter-continental migrations as diadromous fish[14].

[14] Including: eels (*A. anguilla*) which are catadromous and migrate as adults from freshwaters to spawn in the Sargasso sea; and Atlantic salmon (*S. salar*) and the migratoty from of trout (*S. trutta*) which are anadromous and migrate from freshwaters to marine waters as juveniles.

4. Discussion

As expected, the primary literature did not yield any specific research articles on the effects of EMFs from high voltage OHLs on the taxa of interest in this study. This was an expected result and indicates that this is not an active area for research. For example, a research article which presented a review of the results of a recent workshop on EMF effects on electrosensitive taxa (Pophoff *et al*., 2023) did not mention OHL EMFs specifically and this attests to this position. The drivers for a lack of active research are unknown but likely mean that industry experts and academics regard OHLs of least concern to electrosensitive aquatic taxa. The presence of a relatively expansive (but by no means exhaustive) literature on EMFs from MRE infrastructure also attests to a lack of concern over OHL EMFs because the fish and FWPM receptors of interest in this study feature heavily in that literature (for example see Gill *et al*., 2020). In their review of MRE infrastructure on diadromous fish, Verhelst *et al*. (2025) briefly mention concern over points where conductors are brought onshore from marine environments and risks to migratory eels and salmonids – however, this was the most specific reference to terrestrial energy infrastructure in the context of aquatic taxa, in literature reviewed in this study.

We prioritised fish taxa that are of both conservation concern and electroreceptive in our assessment of the literature. Firstly, this was important because the literature on non-migratory or non-electroreceptive fish taxa was very sparse to non-existent. Second, the links between electroreception and migration in the high conservation value species makes (e.g. *A. Anguilla*) and salmonids (e.g. *S. salar*) especially vulnerable to deleterious behavioural impacts from anthropogenic EMFs. This was well contextualised by the consensus point between articles from the MRE literature that the burgeoning offshore MRE industry is a cause for concern, especially in the context of a high (and growing) number of subsea MRE conductors intersecting key continental shelf migration routes. A second and linked consensus point in the literature was that industry and academia must prioritise the total anthropogenic EMF experienced by migratory animal taxa whilst at sea and it is ill advised to view, for example, MRE infrastructure in the North Sea as a series of isolated point sources of anthropogenic EMF.

As part of this study, we also reviewed the EMF chapters from the Environmental Impact Assessments (EIAs) for a small number of MRE infrastructure developments (subsea conductors). Whilst an in-depth discussion of these is out with the scope of this study, the EIAs for these developments typically categorised EMF impacts on diadromous fish (i.e. eels (*A. anguilla*) and salmonid fish (*S. salar* and *S. trutta*) relevant to this study) as minor in the sea. Given the conductivity of seawater and the large volumes of water passing over the conductors, this conclusion is interesting. A key design criterion for the Proposed Development is the suspension of conductors above fresh surface waters and that they will not be buried (or in the water). Conversely, in the marine environment, subsea conductors

present an obstacle and point source of pollution for electrosensitive animal taxa. However, spatially, animals do have options to move away from the cable in three dimensions in the sea. However, in a river, the space to move around a cable, if it were submerged would be significantly less, a fact compounded by the linear space that rivers present to fish, especially those on migrations to and from spawning grounds.

The mobile parasitic (glochidia) stage of FWPM is dependent on salmonid parr[15] for successful recruitment of juveniles. Thus, FWPM would be indirectly affected by any deleterious EMF impacts on salmonid fish from OHLs, should they arise. As a sessile invertebrate, FWPM will experience EMFs from OHLs differently to fish taxa. However, we found no substantial evidence from the primary literature of potential deleterious effects from OHL EMFS on FWPM as the most relevant studies were marine.

4.1 Conclusions

As a potentially deleterious pollutant (as a form of energy), anthropogenic EMFs from high-voltage OHLs will have a pathway to rivers below and to resident and migratory fish and FWPM receptors. The primary and secondary literature provide insufficient studies to rule out anthropogenic EMF effects from the Proposed Development. However, given the rapidly dissipating nature of the EMF from high voltage OHLs (exponentially negative with distance), the low potential for freshwater to generate induced electric fields from EMFs and the natural background EMF experienced by fish being comparable to maximal EMF values from OHLs, we conclude that EMFs from high voltage OHLs will have a negligible impact on the fish and FWPM receptors.

4.2 Recommendations

Based on the results and interpretation presented in this study, we recommend the following:

- Whilst recent guidance from the Scottish Environmental Protection Agency (SEPA) on the siting of towers around watercourses (according to width) will have little impact on EMF penetration into surface waters (as they still necessarily cross watercourses),

[15] Juvenile salmonid fish greater than 1 year old, having spent their first winter in their natal river as fry.

a position statement from the Environment Agency (EA) sets out new guidance on buried cable routes over and under watercourses and is worthy of note[16];

- EMF effects on fish and FWPM should not be included in the scope of the Environmental Impact Assessment (EIA) for the Proposed Development;

[16] EA position – Precautionary principle. No anthropogenic EMFs should be detectable after the installation of underground conductors in the wetted perimeter of inland freshwater bodies in England and Wales. This guidance is not currently (March 2025) publicly available.

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