The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 14 Terrestrial Ecology and Ornithology

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Contents

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Appendices

14. Terrestrial Ecology and Ornithology

14.1 Introduction

14.1.1 This chapter of **Volume 2** of the Environmental Statement (**ES**) (Doc Ref. Book 6) presents an assessment of the terrestrial ecology and ornithology effects arising from the construction and operation of the Sizewell C power station at the main development site (referred to throughout this volume as "the proposed development"). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

14.1.2 Detailed descriptions of the proposed development site (referred to throughout this volume as the "site"), the proposed development and the different phases of development are provided in **Chapters 1** to **4** of this volume of the **ES (**Doc Ref. Book 6**)**. A description of the anticipated activities for the decommissioning of the Sizewell C power station, including a summary of the types of environmental effects likely to occur is provided in **Chapter 5** of this volume. A glossary of terms and list of abbreviations used in this chapter is provided in **Volume 1, Appendix 1A** of the **ES (**Doc Ref. Book 6**)**.

14.1.3 This assessment has been informed by data from other assessments as following:

- **Volume 2, Chapter 11**: noise and vibration.
- **Volume 2, Chapter 12**: air quality.
- **Volume 2, Chapter 13**: landscape and visual (including lighting).
- **Volume 2, Chapter 15**: amenity and recreation.
- **Volume 2, Chapter 19:** groundwater and surface water.
- **Volume 2, Chapter 20**: coastal geomorphology and hydrodynamics.
- **Volume 2, Chapter 21**: marine water quality and sediments.
- **Volume 2, Chapter 22**: marine ecology.
- **Volume 2, Appendix 2B** lighting management plan for construction and operational sites.

14.1.4 This assessment has been informed by data presented in the following appendices:

- **Appendix 14A1** – Introduction to the Ecological Baseline.

- **Appendix 14A2** – Designated Sites.
- **Appendix 14A3** – Plants and Habitats.
- **Appendix 14A4** – Invertebrates.
- **Appendix 14A5** – Amphibians.
- **Appendix 14A6** – Reptiles.
- **Appendix 14A7** – Ornithology.
- **Appendix 14A8** – Bats.
- **Appendix 14A9** – Terrestrial Mammals.
- **Appendix 14B1** – Plants and Habitats Synthesis Report[1].

14.1.5 A standalone ES was prepared for the Sizewell B relocated facilities works for submission with the hybrid planning application under the Town and Country Planning Act 1990 (East Suffolk Council application ref. DC/19/1637/FUL). Chapter 6 of the Sizewell B relocated facilities ES (refer to **Volume 1, Appendix 2A** of the **ES (**Doc Ref. Book 6**)**) included an assessment of likely significant effects on terrestrial ecology and ornithology and identified mitigation specific to Sizewell B relocated facilities works. However, as the Sizewell B relocated facilities works form part of the Sizewell C Project and consent is sought for these works through the DCO, an assessment of the likely significant effects of these works is set out here, together with an explanation of the implications of relevant project design changes made since the preparation of the Sizewell B relocated facilities **ES** (Doc Ref. Book 6).

14.2 Legislation, policy and guidance

14.2.1 **Volume 1, Appendix 6J** of the **ES** (Doc Ref. Book 6) and describes legislation, policy and guidance of relevance to the assessment of the potential terrestrial ecology and ornithology impacts associated with the Sizewell C Project across all **ES** volumes.

14.2.2 This section provides an overview of the specific legislation, policy and guidance of relevance to the proposed development assessment.

[1] The Plants and Habitats Synthesis Report is a document that draws together a large quantity of evidence that has been used to inform the ecology ES and the Habitat Regulations Assessment (HRA). It presents detailed information concerning a number of identified impact pathways likely to affect plant and habitat features.

a) International

14.2.3 International legislation and policies relating to the terrestrial ecology and ornithology assessment include:

- Convention on Biological Diversity (CBD) (Ref 14.1);
- Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ref 14.2);
- Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (Birds Directive) (Ref 14.3);
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) (Ref 14.4);
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (Ref 14.5); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Ref 14.6).

14.2.4 The requirements of these, as relevant to the terrestrial ecology and ornithology assessment, are set out in **Volume 1, Appendix 6J** of the **ES (**Doc Ref. Book 6**)**.

b) National

14.2.5 National legislation and policies relating to the terrestrial ecology and ornithology assessment include:

- Wildlife and Countryside Act (W&CA) (Ref 14.7);
- Conservation of Habitats and Species Regulations (Habitat Regulations) (Ref 14.8);
- Countryside and Rights of Way (CRoW) Act (Ref 14.9):
- Natural Environment and Rural Communities (NERC) Act (Ref 14.10);
- Hedgerows Regulation (Ref 14.11);
- Protection of Badgers Act (Ref 14.12);
- UK Biodiversity Action Plan BAP (Ref 14.13) (now superseded by the “UK Post-2010 Biodiversity Framework” (Ref 14.14));
- Planning Practice Guidance (Ref 14.15);
- Government’s 25 Year Environment Plan (Ref 14.16);

- National Planning Policy Framework (NPPF) (Ref 14.17); and
- National Policy Statements (NPS) for Energy Infrastructure (Ref 14.18).

14.2.6 The requirements of these, as relevant to the terrestrial ecology and ornithology assessment, are set out in **Appendix 6J** of **Volume 1** of the **ES (**Doc Ref. Book 6**)**.

14.2.7 The overarching NPS for Energy (EN-1) (Ref 14.18) and NPS for Nuclear Power Generation (EN-6) (Ref 14.18) provide the primary policy framework within which the development will be considered. A summary of the relevant planning policy, together with consideration of how the policy has been applied is provided in **Appendix 6J** of **Volume 1** of the **ES** (Doc Ref. Book 6) with requirements specific to this site set out in **Table 14.1** and **Table 14.2.**

Table 14.1: Requirements of the National Policy Statement for Energy (EN-1)

Ref.	NPS topic requirement	How the requirement has been addressed
EN-1 5.2.3	*"A particular effect of air emissions from some energy infrastructure may be eutrophication, which is the excessive enrichment of nutrients in the environment. Eutrophication from air pollution results mainly from emissions of NOx and ammonia. The main emissions from energy infrastructure are from generating stations. Eutrophication can affect plant growth and functioning, altering the competitive balance of species and thereby damaging biodiversity. In aquatic ecosystems it can cause changes to algal composition and lead to algal blooms, which remove oxygen from the water, adversely affecting plants and fish. The effects on ecosystems can be short term or irreversible, and can have a large impact on ecosystem services such as pollination, aesthetic services and water supply."*	The impacts and effects of air emissions have been considered for designated sites, habitats, and plants. This has been detailed in **section 14.6** and **14.7** of this chapter. Furthermore, the **Plants and Habitats Synthesis Report** (**Appendix 14B1**) provides a detailed assessment of the air quality effects the proposed development would have on the terrestrial habitats. This report is provided in **Annex 14A3.3** of **Appendix 14A3 – Plants and Habitats** and has been used to support the assessment.
EN-1 5.2.7	*"The ES should describe… any potential eutrophication impacts."*	As for EN-1 5.2.3 above.
EN-1 5.3.18	*"The applicant should include appropriate mitigation measures as an integral part of the proposed development. In particular, the applicant should demonstrate that:* • *during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;* • *during construction and operation best practice will be followed to*	Primary and tertiary mitigation has been defined within **section 14.4** of this chapter. Secondary mitigation, along with any relevant habitat enhancement measures have been detailed in where relevant in **sections 14.6** to **14.14** of this chapter. The extent to which habitats would be restored during post-operation are described. There would be a level of habitat enhancement within parts of the

Ref.	NPS topic requirement	How the requirement has been addressed
	ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements; • *habitats will, where practicable, be restored after construction works have finished; and* • *opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals."*	site and this described as relevant. In addition, further details relating to construction phase impacts and mitigation are included within the **Code of Construction Practice (CoCP)** (Doc Ref 8.11) with long-term mitigation measures which also discuss management of mitigation being included within the **Outline Landscape and Ecology Management Plan (oLEMP)** (Doc Ref 8.2).

Table 14.2: Requirements of the National Policy Statement for Nuclear Power Generation (EN-6)

Ref.	NPS topic requirement	How the requirement has been addressed
EN-6 3.9.3	"*In carrying out an assessment in accordance with Section 5.3 of EN-1, applicants should also consider the effects of the construction of a new nuclear power station on the groundwater regime and its effects on terrestrial/coastal habitats*."	The **Plants and Habitats Synthesis Report** (**Appendix 14B1**) provides a detailed assessment of the effects the proposed development would have on the groundwater regime (and other impact pathways) and subsequently on the terrestrial habitats. This report is provided in **Annex 14A3.3** of **Appendix 14A3 – Plants and Habitats** and has been used to support the assessment.
EN-6 C.8.52	*"A number of responses expressed concern over the impacts that a new nuclear power station may have on European protected sites which are situated near the site. These concerns include impacts on protected bird populations (including nightjar, woodlark and little tern), water quality, fish and shellfish populations and the effects of cooling water abstraction and discharge. There was a particular concern that the recently designated Outer Thames Estuary Special Protection Area (SPA) should be considered as part of the assessment."*	Designated sites within 20km of the proposed development are detailed within **section 14.6** and **Appendix 14A2 – Designated Sites**, which included the nine European Sites stated within the NPS topic requirement. The effects on specific designated features that would be affected have been set out in the relevant sections within **sections 14.6** to **14.14** of this chapter**,** including bird populations (described and assessed in **section 14.12**). Effects on water quality are assessed in **Chapter 19**, marine water quality in **Chapter 21**, and marine ecology in **Chapter 22** of the **ES (**Doc Ref. Book 6**)**.
EN-6 C.8.60	*"Some responses focused on designated sites including Sizewell Marshes Site of Special Scientific Interest (SSSI) and Leiston-Aldeburgh SSSI, and potential effects on Minsmere-Walberswick Heaths*	Sizewell Marshes SSSI is within the site boundary, Leiston-Aldeburgh SSSI is 0.7km away from the site boundary, and Minsmere to Walberswick Heaths and Marshes SSSI is adjacent to the northern

Ref.	NPS topic requirement	How the requirement has been addressed
	and Marshes SSSI, from which the site boundary includes some land-take. Some responses questioned how direct land take could be mitigated"	site boundary. All have been scoped into the detailed assessment. The only site from which there would be direct land take is Sizewell Marshes SSSI. The loss of reedbed and ditch habitat has been compensated for through the creation of reedbeds and ditches within Aldhurst Farm. Land take would also result in the loss of approximately 0.7ha of fen meadow. A fen meadow strategy which defines two sites (at Benhall and Halesworth) on which good quality, permanent fen meadow would be developed to compensate for the permanent loss of fen meadow habitat from within Sizewell Marshes SSSI, associated with the construction of the main platform and the diversion of the Sizewell Drain. Land take would result in the permanent loss of approximately 2.6ha of wet woodland. A total of 0.7ha of new wet woodland habitats would be created in the north of the site. These mitigation measures are further described under primary mitigation in **section 14.4** of this chapter. **Sections 14.6** to **14.14** of this chapter includes an assessment of the relative designated features for all three SSSIs, along with appropriate secondary mitigation measures to minimise effects.
EN-6 C.8.62	*"As the site boundary also indicates land-take from Sizewell Marshes SSSI, the Appraisal of Sustainability finds that construction and the presence of development are likely to lead to direct loss and fragmentation of habitats within the Sizewell Marshes SSSI. Sizewell Marshes SSSI is an area of grazing marsh with important assemblages of invertebrates and breeding and winter bird populations."*	The land take of reedbed and ditch habitat from Sizewell Marshes SSSI has been compensated for through the creation of reedbeds and ditches within Aldhurst Farm. In addition, a fen meadow strategy has been developed to compensate for the permanent loss of fen meadow habitat from within Sizewell Marshes SSSI. These mitigation measures are further described under primary mitigation in **section 14.4** of this chapter. **Sections 14.6** to **14.14** of this chapter includes an assessment of the designated features of Sizewell Marshes SSSI (e.g. bird assemblages and invertebrate assemblages), along with appropriate secondary mitigation measures to minimise effects.

Ref.	NPS topic requirement	How the requirement has been addressed
EN-6 C.8.63	*"The Appraisal of Sustainability identified the potential for the mitigation of biodiversity effects on sites of UK wide conservation importance (Sizewell Marshes SSSI), including the creation of replacement habitat. The Appraisal of Sustainability notes that developers could avoid or minimise losses and disturbance to protected species through careful site layout, design, routing, location of the development, associated infrastructure, and construction management and timings. The Appraisal of Sustainability finds that there is potential for habitat creation within the wider area in order to replace lost "wet meadows" habitats of the Sizewell Marshes SSSI, but also finds that it may not be possible to fully compensate for losses of this habitat. The applicant will need to develop an ecological mitigation and management plan to minimise the impacts."*	The land take of reedbed and ditch habitat from Sizewell Marshes SSSI has been compensated for through the creation of reedbeds and ditches within Aldhurst Farm. Land take would also result in the loss of approximately 0.7ha of fen meadow. A fen meadow strategy has been developed to identify sites in Suffolk on which good quality, permanent fen meadow would be developed to compensate for the permanent loss of fen meadow habitat from within Sizewell Marshes SSSI, associated with the construction of the main platform and the diversion of the Sizewell Drain. These compensation measures have been described in **section 14.4** of this chapter.

c) Regional

14.2.8 Regional policies relating to the terrestrial ecology and ornithology assessment include:

- Suffolk Nature Strategy (Ref 14.19);
- Suffolk Local Biodiversity Action Plan (BAP) (Ref 14.20); and.
- Suffolk's Priority Species and Habitats list (Ref 14.21).

14.2.9 The requirements of these, as relevant to the terrestrial ecology and ornithology assessment, are set out in **Volume 1, Appendix 6J** of the **ES (**Doc Ref. Book 6**).**

d) Local

14.2.10 Local policies relating to the terrestrial ecology and ornithology assessment include:

- Suffolk Coastal District Council Local Plan Core Strategy and Development Management Polices (Ref 14.22); and
- Suffolk Coastal District Council Final Draft Local Plan (Ref 14.23).

14.2.11 The requirements of these, as relevant to the terrestrial ecology and ornithology assessment, are set out in **Volume 1, Appendix 6J** of the **ES (**Doc Ref. Book 6**)**.

e) Guidance

14.2.12 This assessment has been undertaken in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment (EcIA) (Ref 14.24), in order to provide the determining body with clear and concise information about the likely ecological effects associated with the proposed development. In addition, the following guidance documents were considered during the survey and assessment process.

- Handbook for Phase 1 Habitat survey – a technique for environmental audit (Ref 14.25);
- The National Vegetation Classification (NVC) users' handbook (Ref 14.26);
- Hedgerows Regulations Guidelines (Ref 14.11);
- Procedures for collecting and analysing macro-invertebrate samples (Ref 14.27);
- Joint Nature Conservation Committee (JNCC) guidance on monitoring invertebrates within protected sites (Ref 14.28);
- Natural England's' Surveying terrestrial and freshwater invertebrates for conservation evaluation (Ref 14.29);
- Red Data Book (RDB) of British Invertebrates (Ref 14.30);
- Great crested newt mitigation guidelines (Ref 14.31);
- Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*) (Ref 14.32);
- Technical Information Note 102 – Reptile Mitigation Guidelines (Ref 14.33);
- Froglife Advice Sheet 10 on reptile surveys (Ref 14.34);
- Bird Monitoring Methods: A Manual of Techniques for Key UK Species (Ref 14.35);
- UK Birds of Conservation Concern (BoCC) (Ref 14.36);

- Bat Surveys: Good Practice Guidelines, 2nd edition (Ref 14.37) and 3rd edition (Ref 14.38)[2]; and
- Natural England. Standing advice for local planning authorities who need to assess the impacts of development on badgers (Ref 14.39).

14.3 Methodology

a) Scope of the assessment

14.3.1 The generic EIA methodology that has been applied for the Sizewell C Project is detailed in **Volume 1**, **Chapter 6** of the **ES (**Doc Ref. Book 6**)**. The full method of assessment for terrestrial ecology and ornithology that has been applied for the Sizewell C Project is included in **Appendix 6J** of **Volume 1** of the **ES (**Doc Ref. Book 6**)**.

14.3.2 This section provides specific details of the terrestrial ecology and ornithology methodology applied to the assessment of the proposed development and a summary of the general approach to provide appropriate context for the assessment that follows. The scope of assessment considers the impacts of the construction and operation of the proposed development.

14.3.3 Under the CIEEM guidelines (Ref 14.24) habitats and species considered sufficiently important (in nature conservation terms) to be a material consideration in the planning decision, as well as legally protected and/or controlled species for which there is a potential for a breach of their respective legislation as a result of the proposed development, are considered to be Important Ecological Features (IEFs). Ecological features can be important for a variety of reasons (e.g. quality and extent of designated sites or habitats, habitat/species rarity).

14.3.4 To comply with the CIEEM Guidelines for EcIA (Ref 14.24), this EcIA has identified the IEFs that are of sufficient importance and likely to be sufficiently affected by the proposed development so as to be a material consideration in the planning decision and require a more detailed assessment. The same process also allowed for the identification of those IEFs that are not likely to be significantly affected and so do not require further assessment; that is, they can reasonably be scoped out of the EcIA. Where protected species are present and there is the potential for a breach of the legislation, those species are also considered to be IEFs to be included in the EcIA.

14.3.5 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate. A request for an EIA scoping opinion was initially issued to the Planning Inspectorate in

[2] Note that this guidance was updated in 2016; however, all surveys prior to 2016 were conducted in accordance to the existing guidance at the time of execution.

2014, with an updated request issued in 2019 (see **Appendix 6A** of **Volume 1** of the **ES (**Doc Ref. Book 6**)**).

14.3.6 Comments raised in the EIA scoping opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Appendices 6A** to **6C** of **Volume 1** of the **ES (**Doc Ref. Book 6).

b) Consultation

14.3.7 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory and non-statutory consultees throughout the design and assessment process. A large number of workshops and other meetings have been held since 2013 with ecological consultees, including Natural England, the Environment Agency, Suffolk County Council, East Suffolk Council (formerly Suffolk Coastal District Council), the Royal Society for the Protection of Birds and the Suffolk Wildlife Trust. **Table 14.3** below only summarises a selection of early responses which relate directly to the assessment methodologies. A more wide-ranging consultation table covering the period 2018-2019 is provided in **Appendix 14C8** of this volume**.**

Table 14.3: Summary of consultation responses that have informed the scope and methodology of the terrestrial ecology and ornithology assessment

Consultee	Date	Summary of discussion/ comments
Natural England	29 January 2013	Survey approach and methods for bats (especially barbastelles (*Barbastella barbastellus*)) as required to inform the EIA and European protected species licence(s)
Natural England, Royal Society for the Protection of Birds (RSPB) & Suffolk Wildlife Trust (SWT)	26 September 2014, 3 December 2014 & 9 January 2015	Discussion and site visit (9 January 2015) on the marsh harrier survey methodology and baseline evaluation.
Natural England & RSPB	24 April 2015	NVC mapping was agreed for the main development site. It was agreed that the vegetation and invertebrate communities on the coastal dune are of national value (although this is not reflected in the designation which is a CWS). It was agreed that extensive invertebrate sampling had been carried out although stakeholders thought that all habitats to be potentially affected by the Sizewell C Project directly or indirectly should be surveyed. SZC Co. argued that representative habitats had been surveyed, focussing on those habitats within the Sizewell Marshes SSSI triangle that would be lost.

Consultee	Date	Summary of discussion/ comments
Natural England, RSPB & SWT	24 November 2015	With regards to disturbance effects on birds, the draft assessment and mitigation approach were broadly agreed. There was some uncertainty over appropriateness of the assumed 150m visual buffer especially in the vicinity of the borrow pits and main stockpile. Concerns were expressed over the potential mitigation land to be compromised by noise from the borrow pits. There were concerns about why some historic harrier survey data which appeared to show greater use of by harriers of the Sizewell belts hadn't been used in the assessment. One of the key recommendations (from SWT) was to investigate whether their wetland reserve at Trimley Marshes next to Felixstowe docks, where a pair of marsh harriers forage and could potentially breed, could be used to investigate the relationship between noise and harrier foraging (and breeding) activity, to strengthen the evidence base in the HRA. Concerns were raised with regards to potential impacts on the marsh harrier mitigation area due to use of the field north of Ash Wood. SZC Co. stated that in developing proposals for a borrow pit on this land, SZC Co. would take account of the need to protect the mitigation land from unacceptable levels of noise/disturbance.
Natural England, RSPB & SWT	25 February 2016	SZC Co.'s mock assessment for recreational disturbance effects was largely agreed. It was agreed that sufficient user surveys had been carried out and that upper range (precautionary) baseline estimates should be used in the assessment. There was broad agreement with the baseline evaluation of designated sites. SZC Co.'s view that potential impacts on designated sites can't be discounted at a handful of sites including Westleton heath were broadly accepted. There was consensus that the proposed mitigation approach was sensible.
Natural England, RSPB & SWT	26 June 2016	There was general consensus that a lot of ecological survey work has been carried out using a number of different techniques over many years and that it was therefore likely to be relatively robust. The key area of outstanding work that was acknowledged was on completing the tree roost survey strategy. SZC Co.'s emerging strategy to avoid creating bat corridors through the main development site other than at the SSSI crossing was discussed. It was flagged that connectivity to/from roosts at Upper Abbey Farm need to be considered. It was noted that whilst the focus on barbastelle was appropriate the mitigation strategy needs to accommodate as

Consultee	Date	Summary of discussion/ comments
		much of the bat assemblage as possible. The sizing of any culvert would be key. It was also noted that noise/light disturbance at either end of the culvert and within the Sizewell Belts would need to be mitigated.
Natural England	7 July 2016	SZC Co. agreed to develop proposals for the recreation strategy.
Natural England	27 July 2016	There was agreement on the baseline evaluation of the floristics of the M22 fen meadow communities within the Sizewell Belts and the extent of potential inadequacies in published evidence on tolerances and sensitivities to hydrological change.
SCDC	20 October 2016	With regards to operational emissions assessment for the diesel generators: further work is required to consider the sensitivity of ecological receptors in the vicinity of the site. At this stage it is considered unlikely that there will be any significant effects on ecological receptors.

c) Study area

14.3.8 The study area includes the land within the red line boundary and Zone of Influence (ZoI) (defined below) of the proposed development. Due to the variable sensitivity of terrestrial ecology and ornithology receptors, the study area differed depending on the receptor considered.

14.3.9 The survey area for which baseline data was collected is defined as *“the geographical extent over which a particular field survey activity took place”*. The survey area differed depending on the activity being undertaken.

14.3.10 Ecological features have been considered within areas of the proposed development boundary and their immediate environs, taking into account their legislative protection, conservation status and their status/distribution in the vicinity of the proposed development, as well as desk-study information and previous survey work.

14.3.11 Areas and resources that may be affected by the identified activities arising from the whole lifespan (duration of construction and operation) of the proposed development were considered. These define the ZoI. The ZoI is defined as “*the area over which ecological features may be affected by potential biophysical changes caused by a proposed project and associated activities*” (Ref 14.24).

14.3.12 The ZoI have been developed as species- / species assemblage-appropriate distances from the site boundary that take account of the varying mobility of different taxa.

14.3.13 Full details of the study area, survey area and ZoI are provided in **Appendix 14A1** to **14A9** of this volume.

d) Assessment scenarios

14.3.14 The terrestrial ecology and ornithology assessment has considered two scenarios: construction and operation.

e) Assessment criteria

i. Sensitivity

14.3.15 In line with the EIA methodology used for other technical assessments within this **ES** (Doc Ref. Book 6), ecological features have been assessed according to both their "value" and "sensitivity". Value and sensitivity are assessed separately, as they are to an extent independent of each other.

Table 14.4: EIA criteria for the assessment of ecological value/sensitivity

Importance/ sensitivity	Guidelines
High	**Value:** Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor (e.g. designated features of international/national importance, such as SACs, SPAs, Ramsar sites and SSSIs). **Sensitivity:** Feature/receptor has a very low capacity to accommodate the proposed form of change.
Medium	**Value:** Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness and character of the site/receptor (e.g. designated features of regional or county importance such as County Wildlife Sites (CWSs) and local Biodiversity Action Plan (BAP) species). **Sensitivity:** Feature/receptor has a low capacity to accommodate the proposed form of change.
Low	**Value:** Feature/receptor only possesses characteristics which are locally significant. Feature/receptor not designated or only designated at a district or local level (e.g. Local Nature Reserves (LNRs)). **Sensitivity:** Feature/receptor has some tolerance to accommodate the proposed change.
Very Low	**Value:** Feature/receptor characteristics do not make a significant contribution to local character or distinctiveness. Feature/receptor not designated. **Sensitivity:** Feature/receptor is generally tolerant and can accommodate the proposed change.

14.3.16 The sensitivity of individual IEF within **sections 14.6** to **14.14** of this chapter is where the potential impacts on IEFs are described. Different IEFs may have different levels of sensitivity, depending upon the type of impact being described as well as the predicted duration, extent and magnitude of the impact. The sensitivity of individual IEFs has been qualified, where sufficient information exists. In the absence of detailed information, professional judgement has been used to determine the sensitivity of individual IEFs.

14.3.17 In addition, in line with the CIEEM guidelines (Ref 14.24), the importance of an ecological feature, as determined with reference to legal, policy and/or nature conservation considerations, has been assessed within the following geographical context:

- International and European importance;
- national importance (i.e. England);
- regional importance (i.e. the East of England);
- county importance (i.e. Suffolk); and
- local importance, including assessment with a Suffolk Coastal District context, or within the ZoI of the proposed development.

ii. Magnitude

14.3.18 **Table 14.5** sets out the following thresholds that have been used in the definition of the different scales of magnitude of impact to act as a guide for the assessment.

Table 14.5: Generic guidelines for the assessment of magnitude of impact

Magnitude	Guidelines
High	Large-scale, permanent/irreversible changes over a large area; for example, loss of greater than 30% of designated site/habitat used by an ecological receptor or greater than 30% loss of a species population within the development area (where this can be determined).
Medium	Medium-scale, permanent/irreversible changes; for example, loss of between 5 and 30% of habitat used by an ecological receptor or loss of between 5 and 30% of a species population within the development area (where this can be determined).
Low	Noticeable but small-scale change over a partial area; for example, loss of between 1 and 5% of habitat used by a receptor or loss of a few individuals of a species population.
Very Low	Noticeable, but very small-scale change; for example, less than 1% of habitat used by an ecological receptor.

14.3.19 Where possible, magnitude of impact has been quantified taking account of not only the habitat or species resource within the site but also within the wider area, as appropriate. For example, for bats, consideration has been given to the Core Sustenance Zone (CSZ) for each species, but also habitat quality within the CSZ.

14.3.20 In compliance with the CIEEM guidelines (Ref 14.24) impacts on biodiversity are assessed not only by magnitude, but are also characterised and described as positive/negative together with their extent, duration, reversibility, timing and frequency (figures for percentage loss in **Table 14.5** above are therefore indicative not absolute). **Table 14.6** provides impact criteria used in line with the CIEEM guidelines.

Table 14.6: Criteria for determining the impact on ecological features under CIEEM guidelines (Ref 14.24)

Characteristic	Criteria
Positive or Negative	Positive impact: a change that improves the quality of the environment. Positive impacts may also include halting or slowing an existing decline in the quality of the environment. Negative impact: a change that reduces the quality of the environment.
Extent	The spatial or geographic area over which the impact/effect may occur.
Magnitude	Refers to the size, amount, intensity and volume. It will be quantified if possible and expressed in absolute or relative terms.
Duration	Duration will be defined in relation to ecological characteristics (such as a species' lifecycle), as well as human timeframes. The duration of an activity may differ from the duration of the resulting effect caused by the activity. Effects may be described as short, medium or long-term and permanent or temporary. Where durations of short, medium, long-term and temporary are given in this assessment, they are defined in months/years where possible.
Frequency	The number of times an activity that will impact biodiversity will occur.
Timing	The timing of an activity or change caused by the project may result in an impact if this coincides with critical life-stages or seasons.
Reversibility	Irreversible: an effect from which recovery is not possible within a reasonable timescale or there is no reasonable change of action being taken to reverse it. Reversible: an effect from which spontaneous recovery is possible or which may be counteracted by mitigation.

14.3.21 Impacts can also be defined as being direct or indirect. A direct impact is defined as an impact resulting in the direct interaction of an activity with an environmental or ecological component. An indirect impact is defined as an impact on the environment which is not a direct result of a project or activity, often produced away from or as a result of a complex impact pathway.

iii. Effect definitions

14.3.22 The definitions of effects for terrestrial ecology and ornithology are shown in **Table 14.7** in line with the EIA methodology set out within **Volume 1, Chapter 6** of the **ES** (Doc Ref. Book 6).

Table 14.7: Generic effect definitions

Effect	Description
Major	Effects, both adverse and beneficial, which are likely to be important considerations at a national to regional level because they contribute to achieving national/regional objectives, or, which are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Effects that are likely to be important considerations at a regional and county level.
Minor	Effects that could be important considerations at a local level.
Negligible	An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

14.3.23 Following the classification of an effect as presented in **Table 14.7**, a clear statement is made as to whether the effect is "significant" or "not significant". Under CIEEM guidelines (Ref 14.24) the significance of effect on the IEF(s) has been determined based on the analysis of the factors that characterise the impact (**Table 14.6**). A significant effect is defined as *"an effect that either supports or undermines biodiversity conservation objectives for the IEFs or for biodiversity in general"*.

14.3.24 Using CIEEM guidelines (Ref 14.24) and approach, significant effects are identified with regard to an appropriate geographical scale, using the following terms:

- significant at the international level;
- significant at the national level;
- significant at the regional level;
- significant at the county level;
- significant at the local level; and
- not significant.

14.3.25 To allow a consistent approach across all disciplines, the standard levels of significance defined in the CIEEM guidelines (Ref 14.24) are set out in **Table 14.8**, alongside the equivalent definitions of effect used elsewhere in this **ES** (Doc Ref. Book 6). Therefore, as a deviation from the standard EIA methodology, minor effects identified within this chapter have been classified as significant at a local level.

Table 14.8: Summary and comparison of EIA and CIEEM based measures of significance of ecological effects

Significance following the CIEEM guidelines	Equivalent effect categories and significance definitions following the standard EIA methodology presented within Volume 1, Chapter 6
Significant at the international level	Major (= significant)
Significant at the national level	Major (= significant)
Significant at the regional level	Moderate (= significant)
Significant at the county level	Moderate (= significant)
Significant at the local level	Minor (= not significant)
Not significant	Negligible (= not significant)

f) Assessment methodology

i. Establishing the baseline

Existing baseline

14.3.26 Baseline conditions were determined through a combination of a desk-study and field surveys. Technical data has been assimilated from survey work carried out between 2007 to 2019. A review was also conducted to determine any European and nationally designated sites located within 20km of the proposed development. Through this method, habitat and species of importance were identified and assessed. **Appendices 14A1** to **14A9** contains the detailed methodology and results of this baseline study and so are not replicated here, however a summary has been provided below.

14.3.27 The desk-study exercise comprised the following steps:

- identification of designated sites (statutory and non-statutory) including SPAs, SACs, Ramsar sites, SSSIs and National Nature Reserves (NNRs) within 20km[3], and LNRs and CWSs within 2km[4];

[3] In establishing an appropriate ZoI for European designated sites, reference was made to the HRA Screening Report. This defined 20km as an appropriate distance over which effects upon European sites may manifest themselves and has therefore been similarly adopted as an appropriate ZoI for considering potential effects on SPAs, SAC and Ramsar sites. In addition, on a precautionary basis, and given that SSSIs underpin SACs, SPAs and Ramsar sites, 20km has also been adopted as an appropriate ZoI for considering potential effects on SSSIs.
[4] For non-statutory designated sites, the main effects arising from the proposed development are likely to constitute effects such as land-take, hydrological change, changes in air quality, and disturbance from noise and lighting, which are only likely to affect those sites in close proximity to the site. Therefore, 2km has been established as an appropriate ZoI for non-statutory CWSs.

- review of Suffolk Biodiversity Information Service (SBIS) and the JNCC records;
- a review of the Suffolk BAP (Ref 14.20), Suffolk's Priority Species and Habitats list (Ref 14.21), and Section 41 of the NERC Act (Ref 14.10);
- a review of Sizewell Land Management Reports produced by NGL from 1996 to the present (Ref 14.40)[5]; and
- Species-specific or species group-specific collected or reported data from other projects (e.g. Galloper Wind Farm, Scottish Power) or organisations (e.g. Suffolk Wildlife Trust (SWT), Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO) etc.).

14.3.28 A full account of the desk-study conducted for this EcIA has been provided in **Appendices 14A1** to **14A9**.

14.3.29 A detailed suite of ecological survey work has been undertaken within the proposed development and/or its immediate surrounds (i.e. within the ZoI), conducted by both Wood Group and Arcadis during the period 2007 to 2019. The following surveys have been conducted within the ZoI:

- extended Phase 1 habitat surveys;
- NVC surveys;
- lichen and bryophyte surveys;
- invertebrate surveys;
- amphibian surveys;
- reptile surveys;
- bird surveys (breeding and wintering and species-specific studies such as marsh harrier);
- bat surveys (multiple techniques);
- water vole surveys;
- otter surveys; and
- badger surveys.

[5] Twenty-two separate annual reports are covered under this reference.

Future baseline

14.3.30 The future baseline considered any existing/future development(s) or forecasted changes (e.g. climate change) that would materially alter the baseline conditions during the construction and operation of the proposed development. It also considered what the land use would be in the absence of the proposed development.

ii. Construction

14.3.31 The assessment of effects on terrestrial ecology and ornithology is based on the full construction period and its associated activities rather than specific assessment years.

iii. Operation

14.3.32 The assessment of effects on terrestrial ecology and ornithology is based on the full operation period and its associated activities rather than specific assessment years.

iv. Inter-relationships

14.3.33 A number of inter-relationships and their effects have been considered on the different receptors, where relevant. This has included consideration of:

- noise and vibration;
- air quality;
- landscape and visual (including lighting);
- amenity and recreation;
- groundwater and surface water;
- coastal geomorphology and hydrodynamics; and
- marine water quality and sediments.

g) Assumptions and Limitations

14.3.34 Although every effort was made to undertake a rigorous impact assessment, a number of assumptions and limitations must be acknowledged. The following assumptions have been made in this assessment:

- The impact assessment is based on the prevailing ecological conditions which are not expected to change substantially in the absence of the proposed development; however, consideration of the potential future baseline has been made for each assessment section.

- The invertebrate assessment was based upon surveys undertaken by in 2007, 2009, 2010, 2014, 2015 and 2016. Survey methodology has varied between these surveys, depending on surveyor, details of which can be found in **Appendix 14A4 – Invertebrates (Annex 14A4.3** and **Annex 14A4.4**) of this volume. Between 2007 and 2019, additional surveys were also undertaken across the main development site for other ecological receptors covering the same habitats as those identified during invertebrate surveys. It was established that the baseline habitats considered to be suitable to support an invertebrate assemblage have not altered during this time due to a lack of disturbance to the site overall. This assessment is therefore based on a total of nine years of invertebrate survey data with no change to the baseline habitats on site; hence it was not considered proportional to update the surveys further. The data collected sufficiently enables an accurate assessment of the overall habitat suitability and invertebrate assemblages across all compartments.

- The natterjack toad assessment is based on annual survey data provided by SWT, who record peak natterjack toad tadpole counts, numbers of adults seen, number of spawn strings seen and number of emerging toadlets counted.

- Published reptile survey protocols are usually based on simple counts (of maximum numbers seen during a survey) rather than statistical models, such as Capture-Mark-Recapture (CMR). There are often substantial variations in capture rates due to changes in capture effort, weather and seasonal behavioural changes; this may be particularly true for slow-worms that spend a significant proportion of their time underground and so have limited availability for capture. CMR models also require a minimum number of different individuals to be caught to be valid. Therefore, accurately estimating reptile population size for a given survey area relies to a large degree of professional judgement.

- The assessment of noise impacts on bats using modelling of high frequency noise (rather than 'A-weighted' modelling of noise within the human auditory range) is a relatively new approach. To date there has been insufficient research evidence to determine species-specific auditory ranges for modelling, or to determine whether there are species-specific noise thresholds above which disturbance can be expected to occur.

- The water vole assessment is based on annual survey data provided by SWT and RSPB, who have been monitoring transects within the Sizewell and Minsmere National Key Sites, as part of the National Key Sites Monitoring Programme, since 2001.

- In order to install overhead lines within the footprint of the development to the south-west of the main Sizewell C platform, a 1.42ha corridor of habitat within the Sizewell Marshes SSSI would be temporarily impacted. This area includes 0.9ha of fen meadow, 0.43ha of wet woodland and 0.09ha of ditches. These habitats would be initially impacted to some extent during the installation of the overhead lines but would remain throughout the operational phase. The wet alder woodland under the overhead lines would be coppiced occasionally to provide clearance. Given this, the 0.9ha of fen meadow and 0.43ha of wet woodland in this corridor are not included within permanent loss calculations although they sit within the footprint of permanent operational development.

- Whilst the survey data included as part of this assessment do vary in age, extensive surveys have been carried out to obtain robust, detailed baseline condition data. The habitats and management of the site are essentially unchanged since the earlier surveys were undertaken and additional desk study and further habitat surveys confirm that the baseline as surveyed in the earlier surveys remains appropriate for assessment.

14.4 Environmental design and mitigation

14.4.1 As detailed in **Volume 1, Chapter 6** of the **ES** (Doc Ref. Book 6) a number of primary mitigation measures have been identified through the iterative EIA process and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements or are standard practices that will be implemented as part of the proposed development.

14.4.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. For terrestrial ecology and ornithology, these measures are identified below, with a summary provided on how the measures contribute to the mitigation and management of potentially significant environmental effects.

14.4.3 Primary and tertiary mitigation for off-site development areas, including off-site sports facilities, permanent fen meadow compensation areas at Halesworth and Benhall and temporary marsh harrier land west of Westleton, are set out in **Appendix 14D** of this volume.

a) Environmental design and mitigation for the Sizewell B relocated facilities works during Phase 0

14.4.4 In line with the project programme set out in **Chapter 3** of this volume, it is anticipated that the first phase of the Sizewell B relocated facilities works, which is referred to as 'Phase 0', would be carried out pursuant to the planning permission granted by East Suffolk Council on 13 November 2019 (application ref. DC/19/1637/FUL). The second phase of the Sizewell B relocated facilities works would take place in Phases 1 and 2 in parallel with other DCO works due to take place at this time and would be carried out pursuant to the DCO.

14.4.5 Under the existing planning permission, mitigation measures for terrestrial ecology and ornithology effects that occur as a result of Phase 0 of the Sizewell B relocated facilities works include the following:

- Primary mitigation:
  - Measures embedded within design to reduce land-take, siting facilities and adjusting site boundaries to increase the distance from sensitive ecological receptors, where possible, limiting light spill through the orientation of buildings, keeping areas unlit when not in use, provision of directional lighting and a boundary fence along the western edge of the western access road, and retention of existing vegetation along site perimeter, as far as practicable. The retained perimeter planting would be enhanced with new planting as part of the landscaping proposals. Sustainable Drainage System would be used to minimise surface water run-off and prevent diffuse pollution.
- Tertiary mitigation:
  - Good practice measures would be followed, as set out within the Outline Construction Environmental Management Plan submitted with Sizewell B relocated facilities planning application, to reduce the potential impacts arising from construction disturbance. Pre-construction ecology surveys, tree and building inspections would be undertaken in advance of site clearance works to validate baseline conditions. Site clearance works would be programmed to avoid the bird-nesting season and sensitive periods for bat maternity and hibernation periods, if possible.
  - If required, any groundwater extracted from the proposed outage store basement would be discharged under a suitable Environmental Permit. Prior to excavation of the basement, a temporary sheet-piled wall would be constructed to provide a water-resistant seal. This would allow dewatering of the construction footprint of this building, while limiting the potential for dewatering to cause drawdown within Sizewell Marshes SSSI. A piling risk assessment would be undertaken to manage the risk of introducing new contamination pathways as a result of piling.
- Secondary mitigation:

- Phased vegetation clearance approach, displacement of reptiles and destructive search;
- Tree assessment surveys prior to tree felling under a bat licence granted by Natural England, if required; and
- Management of new habitats provided in Pillbox field, including the installation of refugia/hibernacula for reptiles, and the installation of bat boxes within the wider EDF Energy estate.

14.4.6 Details of these measures are provided in Chapter 6 of the Sizewell B relocated facilities ES (provided at **Appendix 2A** of **Volume 1** of the **ES** (Doc Ref. Book 6)).

14.4.7 It is anticipated that the mitigation measures summarised above would largely be in place or under way by the end of Phase 0. However, in order to allow for this mitigation to be implemented in Phases 1 and 2, if required (or if the works are instead carried out entirely under the DCO – see **Appendix 6A** of **Volume 2** of the **ES** (Doc Ref. Book 6)), these measures have also been incorporated within the DCO.

b) Environmental design and mitigation for the DCO

i. Primary mitigation

14.4.8 Primary mitigation is often referred to as “embedded mitigation” and includes modifications to the location or design to mitigation impacts, these measures become an inherent part of the proposed development. A summary of the primary mitigation that has been incorporated into the design of the proposed development is provided here.

14.4.9 The following measures are included to manage recreational impacts:

- The Rights of Way and Access Strategy for the EDF Energy estate (see **Chapter 15, Appendix 15I** of the **ES** (Doc Ref. Book 6)) has been developed to minimise the displacement of people away from the proposed development area and to nearby European sites to minimise disturbance to ground-nesting bird species and trampling of vegetation. In addition, the strategy outlines a monitoring programme for recreational displacement and identify local mitigation measures, to be agreed with local land managers, which could be introduced to further reduce recreational disturbance.
- SZC Co. would provide recreational facilities for new construction workers both at the onsite temporary accommodation campus and in Leiston to reduce the use of local Public Rights of Way (PRoW) by workers. Campus based workers would not be able to bring dogs to site.

14.4.10 The following measures are included within either the construction layout or the operational design to control impacts:

- Boundary treatments are included within the Construction Masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats. Boundary treatments would also limit the extent of air borne dust pollution.
- A barrier (e.g. sheet piling) would be installed to provide separation from the main platform and Sizewell Marshes SSSI with engineered drainage installed to limit the disturbance to the hydrology and geology of Sizewell Marshes SSSI (see **Chapter 19**: Groundwater and Surface Water of the **ES** (Doc Ref. Book 6)).
- The realignment of the Sizewell Drain and the construction of associated water control features would enable manipulation of the water levels within Sizewell Marshes SSSI, to safeguard retained areas of fen meadow and reedbed habitats (see **Chapter 19** Ground and Surface Water of the **ES** (Doc Ref. Book 6)). Control structures would include passage for eels and other fish (see **Eels Regulations Compliance Assessment**, 2019).
- The SSSI crossing has been designed to be an embankment and culvert. The culvert would be approximately 68m long by 6m high by 3.6m wide (with a cross sectional area of approximately 21.6 m2). The final dimensions would be confirmed as the design progresses and would be of sufficient dimensions to leave the bank and channel of the Leiston Drain intact. The culvert is considered to be of sufficient size to facilitate the passage of fish, bats, otter and water vole through the structure, and a ledge would be installed to enable passage by otter during high flow (complete with fencing to guide otter to the SSSI crossing). Lighting measures on the crossing would be deployed to ensure the culvert is viable for use by bats.
- A detailed lighting strategy would be implemented in accordance with the **Lighting Management Plan** (**Volume 2, Appendix 2B**). The strategy would comply with best practice to minimise impacts on nocturnal species such as bats that may use nearby habitats for roosts or foraging. Guidance within the latest Institution of Lighting Professionals (ILP) Guidance Note (Ref 14.41) would be followed.
- Construction infrastructure would be in place to ensure all surface runoff and foul water is captured and treated and does not enter adjacent designated sites. Ditches, bunds and swales would be constructed to prevent untreated surface water run-off from leaving the site. Oil/petrol interceptors would be incorporated into the drainage design. Where complete infiltration to ground is not feasible, Water Management Zones (WMZs) have been embedded into the design. These systems

would be designed to discharge treated water to the surface water drainage network at greenfield run-off rates. Foul water would be pumped to a central treatment plant, prior to discharge to sea. Run-off would be managed as part of the Construction Drainage Strategy, which would include mitigation measures to manage surface water discharges see **Chapter 19:** Groundwater and Surface Water and **Chapter 22** Marine Ecology and Fisheries of this volume for full details.

- Diesel generator stack heights set as high as practicable under the design envelope for the power station and emissions of nitrogen oxides controlled through primary means.

14.4.11 The following habitat approaches have been used either to establish habitats in advance of construction or to create further habitats as part of the proposals:

- Permanent foraging habitat for marsh harriers is being established and enhanced within the northern part of the EDF Energy estate, in advance of construction, to provide alternative habitats if any potential disturbance effects arise during construction which might discourage marsh harriers from foraging over parts of the Minsmere South Levels and Sizewell Marshes SSSI.6
- The majority of the woodland resource within the EDF Energy estate would be retained including the line of mature broadleaved trees on the northern edge of Kenton Hills, known to support features of importance for roosting bat species and also including most of the well-developed hedgerows and mature trees along Bridleway 19, east of Upper Abbey Farm.
- Large areas of habitats for reptiles have been established, in advance of construction, to enable the translocation of reptiles from the site (further detailed in the Reptile Mitigation Strategy **Appendix 14C2** of this volume). This has also created areas of sand-dominated habitat likely to be beneficial to invertebrate species such as those identified in the coastal and woodland ride habitats.
- Alternative roost sites (bat boxes) have been erected in advance of construction within woodland least likely to be directly affected by noise and lighting disturbance, should the proposed development displace roosting bats from woodland more directly exposed to disturbance. In addition, a purpose-built 'bat house' would be constructed (or modifications made to existing buildings) to provide alternative roosting

[6] An additional off-site area for marsh harriers at Westleton is also included within the application. SZC Co. believes this additional area is not required as sufficient optimised habitat would be delivered on the northern part of the EDF Estate. However, the area at Westleton could be improved to provide further marsh harrier foraging during construction, if SZC Co. is directed to do so.

opportunities for bats. Should any roost loss be confirmed, roosts would be replaced at an appropriate ratio, to be agreed with Natural England.

- The establishment of new reedbed and ditches at Aldhurst Farm (completed in 2016) has provided replacement for the land take of these habitats within Sizewell Marshes SSSI. The replacement habitats have established successfully, and mobile aquatic plant and invertebrate species would colonise over time from the adjacent areas of the Sizewell Marshes SSSI. These new habitats also provide nesting and foraging habitat for bird and bat species as well as suitable habitat for water voles and Aldhurst Farm would act as the main receptor site for water voles, which are translocated from the footprint of the main development site. One of the four lagoons at Aldhurst Farm has been fenced to minimise the risk of water vole colonising naturally ahead of translocation.
- A fen meadow strategy has been prepared (**Appendix 14C4** of this volume) which includes two locations in Suffolk at which permanent fen meadow habitat would be developed to compensate for the permanent loss of about 0.7ha of fen meadow habitat from within Sizewell Marshes SSSI, associated with the construction of the main platform and the diversion of the Sizewell Drain.
- An area of 0.7ha of wet woodland would be created within the north of the development, adjacent to the marsh harrier habitat improvement area. This would provide some compensatory habitat for the loss of wet woodland to the development. Opportunities for additional wet woodland creation are covered as part of Additional Mitigation.
- The **oLEMP** (Doc Ref 8.2) outlines management actions to return existing arable land on the EDF Energy estate post-construction to Suffolk Sandlings habitat comprising dry acid grassland and with additional areas of woodland and scrub. In the operational phase of the development, this landscape-scale habitat creation approach would replace existing intensively managed arable farmland with habitats of greater biodiversity value and would increase habitat connectivity. The **oLEMP** (Doc Ref 8.2) includes also long-term management prescriptions and a monitoring programme for habitats created ensuring that these areas deliver the habitats proposed.

14.4.12 The approach to construction of the new sea defences would include:

- A 5m high sacrificial shingle barrier with sandy cap in front of the new main sea defence, used to defend the Sizewell C power station. The role of the sacrificial dune would be to minimise coastal erosion and release sediment to the beach face, which would only be activated during a storm event. It is likely that the dune would occasionally be eroded and require repair in order to maintain its volume.

- A monitoring and mitigation plan for coastal processes effects would be developed to ensure, as far as practicable, the maintenance of the extent of foreshore sediments covering the new sea defences (in accordance with the monitoring and mitigation plans, the scope of which are outlined in **Chapter 20** Coastal Geomorphology of this volume).

ii. Tertiary mitigation

14.4.13 Tertiary mitigation will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral best practices. Tertiary mitigation relevant to terrestrial ecology and ornithology are defined in the **Code of Construction Practice (CoCP)** (Doc Ref 8.11). The **CoCP** (Doc Ref 8.11) has been environmental legislative requirements informed by relevant as well as general requirements and compliance with current standards, construction and operational experience and the EIA process, securing mitigation measures that are not secured by any other means.

14.4.14 The **CoCP** (Doc Ref 8.11) also includes those measures required to manage environmental and ecological impacts, mitigate nuisance to the public and safeguard the environment during the full lifetime of the proposed development, including the enabling works, preliminary works and the main construction phase. Mitigation measures relevant to terrestrial ecology and ornithology included in the **CoCP** (Doc Ref 8.11) are summarised below.

14.4.15 The following general measures are included in the **CoCP** (Doc Ref 8.11):

- The appointment of an Ecological Clerk of Works (ECoW) to manage ecological issues on site, undertaken or supervise ongoing works in relation to protected species, supervise works in sensitive areas and undertake monitoring as required
- Training for construction workers, in the form of tool box talks, on ecological constraints including retained habitats, designated sites and protected species considerations

14.4.16 The **CoCP** (Doc Ref 8.11) also includes a number of other control measures to limit impacts during construction, Those of particular relevance to minimising impacts to ecological receptors include the following:

- Earth bunds with grassing/seeding, including a bund along the length of the southern temporary construction area boundary (5m height), would be used to screen sensitive boundaries from construction activities.
- Control of dust emissions as set out under **Chapter 12: Air Quality**, and **Outline Dust Management Plan** (**Volume 2, Appendix 12A**). A dust management plan would be implemented, including details of

monitoring, mitigation and complaints procedures. Adequate water supply would be made available for dust/particulate matter suppression and house-keeping, and high-risk dust generation activities would be minimised or avoided where practicable during prolonged dry or windy conditions.

- To enable the re-provision and realignment of the overhead lines, the existing woodland vegetation within this corridor would be coppiced to ground level (in accordance with relevant plans) and then bog matting or a similar approach would be used to protect the wet woodland ground surface and coppiced stumps. Appropriate measures would also be used to protect the retained fen meadow habitats under this corridor. The overhead lines would be installed once these protective measures are in place. These works would be overseen by the ECoW, or a suitably qualified ecologist, to ensure impacts to retained habitats are minimised.

- Sand and shingle substrates from the existing surface layers of the Sizewell C frontage will be stockpiled to preserve the seedbank of the coastal vegetation, prior to the construction of the new coastal defences. These substrates will be safeguarded and then incorporated into the final landscaping of the new sea defences and frontage to enable reinstatement of the coastal vegetation including vegetated shingle and sand dune habitats. These works will be overseen by the ECoW, or a suitably qualified ecologist, to ensure appropriate layers, i.e. those likely to include seedbanks, are safeguarded.

- Section 14(1) of the Wildlife and Countryside Act 1981 makes it illegal to plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9 of the Act. There is the potential for non-native species to be introduced during the construction phase. The following measures are specified in the **CoCP** (Doc Ref 8.11):

  - Contractors will be required to undertake a biosecurity risk assessment and implement a management plan to avoid potentially facilitating the spread of non-native species during construction.

  - During construction, mitigation measures will be implemented as necessary to prevent the establishment of invasive plant species. A general strategy will be to establish a viable vegetation cover quickly, before invasive plant species can become established.

  - Any invasive species that colonise an area during construction will be removed and disposed of as required.

  - Any imported soils will be subject to appropriate control processes to ensure they are free of any seeds/roots/stems of any invasive plant covered under the Wildlife and Countryside Act 1981.

14.4.17 The main mechanism used to safeguard protected species is through a suite of mitigation strategies, draft protected species licenses and method statements. These are signposted throughout this chapter as relevant to individual species of species groups and appended to this chapter. The following protected species approaches are summarised both here and in the CoCP (Doc Ref 8.11):

- A draft **Deptford Pink Method Statement (Appendix 14C11** of this volume**)** has been prepared for Deptford Pink (*Dianthus armeria*). If the species is relocated in targeted searches, the collection of both seeds and plants would be undertaken with translocation to a suitable location on the existing sea defence seaward of the Sizewell B power station.
- A **draft Natural England Natterjack Toad Protected Species Licence** (**Appendix 14C7B** of this volume) as well as a **Natterjack Toad Mitigation Strategy** (**Appendix 14C7A** of this volume) has been prepared for the proposed development. Removal of vegetation, ground clearance and the commencement of construction activities have the potential to risk killing or injuring natterjack toads. Amphibian-proof fencing would be installed prior to construction around the footprint of the WMZ in Retsom's Field, to prevent any natterjack toads from entering the construction footprint and would include a trapping out exercise using pitfall buckets. Pre-construction checks of any potential refugia in and alongside Retsom's Field would be required, with any natterjack toads found within the footprint of the proposed WMZ captured and relocated to the retained areas of Retsom's Field. Works would be undertaken outside of the hibernation season (considered to be October to April). Pre-construction checks would be completed by a licensed or accredited ecologist. In addition, a new pond would be created within the retained areas of Retsom's Field as well as the creation of hibernation features which would be suitable for use by natterjack toads.
- A **Great Crested Newt Method Statement** (**Appendix 14C9A** of this volume) has been prepared detailing the approach to be used, including the removal of vegetation and ground clearance in areas where commencement of construction activities have the potential to kill or injure Great Crested Newts during their terrestrial phase (there are no breeding ponds within the site).
- A **Reptile Mitigation Strategy** (**Appendix 14C2** of this volume) has been prepared detailing capture and translocation of reptiles from the footprint of the proposed development to the receptor sites. It also includes measures (installation of reptile-proof fencing, searching refugia and moving individuals outside of the development footprint into receptor site) to avoid incidental mortality associated with construction work phase. Active management of receptor sites is ongoing and would

ensure these features are maintained and enhanced, so that the receptor sites have adequate carrying capacity to receive translocated reptiles. The locations of the receptor sites were selected to maximise connectivity with the wider landscape using existing ecological features and corridors.

- An **Otter Method Statement** (**Appendix 14C10** of this volume) has been prepared detailing the approach to be used, including the removal of vegetation and ground clearance in areas where commencement of construction activities have the potential to damage or destroy otter holts. Pre-construction surveys would be required to provide up-to-date information as to whether any holts are present within the construction footprint or in the ZoI. A European Protected Species Licence application and Method Statement may be required to permit works that would otherwise disturb, injure or kill otter, and/or damage or restrict access to their holts, should an active holt be identified. If required, a detailed mitigation strategy for otter would be provided in a method statement, based on Natural England's standing advice and guidance in relation to otter and mitigation for development projects (Ref 14.42) and Highways Agency's design Manual for Roads and Bridges (Ref 14.43). If any holts would be impacted by the works, it may be necessary to create artificial holt(s) to mitigate for their loss.

- A **Water Vole Mitigation Strategy** (**Appendix 14C6A** of this volume) has been prepared detailing the approach to be used, including the removal of vegetation and ground clearance in areas where construction activities have the potential to damage or destroy water vole burrows. A Natural England licence application and method statement would be required to permit works that would otherwise disturb water vole or destroy their burrows. The approach involves trapping out water voles from the footprint of the site within Sizewell Marshes SSSI and releasing them into a receptor area at Aldhurst Farm. As soon as water vole have been removed from the area of the proposed SSSI crossing and the Sizewell Drain realignment footprint, their habitat would be rendered unsuitable for re-colonisation by an initial destructive search of burrows (using hand-tools), followed by clearing ditches, removing vegetation, and scraping banks. Further details in relation to the approach to be adopted for water voles has been presented in the **Draft Water Vole Protected Species Licence** (**Appendix 14C6B** of this volume).

- A confidential **Badger Mitigation Strategy - Confidential** (**Appendix 14C3** of this volume) has been provided as part of this **ES** (Doc Ref. Book 6). Pre-construction surveys would be required to provide up-to-date information on the badger setts within the site and its ZoI. A Natural England licence application and method statement would be required to permit works that would otherwise kill or injure a badger; damage, destroy or obstruct a sett; or disturb a badger in a sett; and would be appended to the method statement. A confidential draft **Badger Licence** is included at **Appendix 14C3B** of this volume. Mitigation would require: the construction of artificial setts to compensate for the loss of any main setts; excluding badgers from any setts due to be lost; suitable stand-off zones around retained setts to avoid damage to those setts or disturbance to badgers using them; provision of alternative foraging habitat (marsh harrier and reptile mitigation areas would provide better foraging habitat for badgers); and pre-, during- and post-construction monitoring of badgers.

- A **Bat Mitigation Strategy** (**Appendix 14C1A** of this volume) has been provided as part of this **ES** (Doc Ref. Book 6) as well as a draft Bat Method Statement (**Appendix 14C1B** of this volume). Tree inspections to determine evidence of use as roosts would be undertaken sufficiently in advance of tree-felling to enable any licence application(s) to be submitted to Natural England, if these are required. A final inspection of these trees would be undertaken as close to the timing of felling as possible to take into account the regular roost switching behaviour displayed by tree-roosting bat species. Should bats (or evidence of use by bats) be identified, the mitigation strategies laid out in any licence application(s) would be implemented (for example, the fitting of exclusion devices and/or soft-felling). The following approaches would be used:

  – To mitigate for the confirmed and potential loss of tree roosts, replacement roosts would be installed on retained trees in suitable locations within the site boundary and within the wider EDF Energy estate. This provision would primarily take the form of a variety of bat boxes which would be used to support different species. However, the transfer of potential roost features, bark replacement and veteranisation of retained trees would be considered where appropriate. This is in addition to that already provided for barbastelle and detailed under primary mitigation.

  – Mitigation of roosts within buildings, particularly maternity and/or hibernation roosts that may be functionally lost would require more substantial mitigation. This may require more robust hibernation bat boxes, the improvement of retained locations that have the potential to support roosts of this nature and/or the provision of a new maternity or hibernation specific bat building, probably in the Lower Abbey Farm area.

  – Where habitat features would be retained within the site during construction, measures to ensure the protection of these features would be implemented (appropriate to the habitat concerned).

- Removal of vegetation, ground clearance and the commencement of construction activities have the potential to risk killing or injuring hedgehogs, either in summer or "day" nests or winter hibernation nests (hibernation occurs between November to April). Ground clearance works would generally be undertaken outside of the hibernation period. Prior to ground clearance, an inspection for hedgehog nests would be undertaken by a suitably experienced ECoW prior to the removal of vegetation; this is likely to be undertaken in parallel with removal of reptiles from the construction footprint.

- Removal of vegetation, ground clearance and the commencement of construction activities have the potential to risk killing or injuring nesting birds, and to damage or destroy nests, including those of ground-nesting species, should works be undertaken during the breeding bird season. Birds and their nests are protected under the Wildlife and Countryside Act (W&CA) (Ref 14.7) and the removal of scrub and trees and ground clearance works would generally be undertaken outside of the breeding bird season. Where it is not possible to undertake these works outside of the breeding bird season, an inspection for nests would be undertaken by a suitably experienced ECoW prior to the removal of vegetation. If nesting birds are identified during this process, works in the vicinity of the nest (estimated to be a 10m standoff or greater, depending upon species) would cease until the young have fledged.

- Barn owl (*Tyto alba*) boxes would be installed within the reptile receptor areas to provide additional nesting/roosting opportunities for the local barn owl population.

- When the Sizewell Drain is realigned, the section to be infilled would be subject to a fish and invertebrate rescue, relocating stranded individuals across to the new realigned drain or undisturbed sections of the Sizewell Drain.

14.5 Ecological receptor baseline, assessment, mitigation and monitoring

a) Sizewell B relocated facilities effects in Phase 0

14.5.1 An assessment of the effects on terrestrial ecology and ornithology that would occur due to Sizewell B relocated facilities works during Phase 0 is presented in Chapter 6 of the Sizewell B relocated facilities ES (that ES is provided in full at **Volume 1, Appendix 2A**). The following sensitive receptors were scoped into the assessment:

- Sizewell Marshes SSSI;

- Coronation Wood;

- Reptile assemblage;
- Bat assemblage; and
- Bird assemblage using the Sizewell Marshes SSSI.

14.5.2 The assessment considered the potential for likely significant effects on the above receptors due to habitat loss and fragmentation, incidental mortality, changes in water quality, hydrology and hydrogeology and construction disturbance, as relevant. Whilst a moderate adverse effect was identified due to the removal of Coronation Wood, it was considered that over time, with the establishment of replacement planting, this effect would reduce to minor adverse. Therefore, with mitigation in place, as set out in **section 14.4(a)** of this chapter, no likely significant effects on the ecological receptors were identified.

14.5.3 The conclusions of the Sizewell B relocated facilities ES are considered to remain valid. However, it is noted that the small amount of land-take from Sizewell Marshes SSSI associated with the footpath between the proposed outage car park at Pillbox Field and the Coronation Wood development area would no longer occur, as the footpath has now been excluded from project proposals.

14.5.4 An assessment of the likely significant effects of the Sizewell B relocated facilities works that would occur concurrently with Phases 1 and 2 of construction and once the Sizewell C Project is operational is provided in the main development site assessment below.

b) Main development site effects under the DCO

14.5.5 Subsequent sections of this chapter present the following information for each receptor topic[7]:

- **Baseline:** a description of the baseline environmental characteristics within the footprint of the proposed development and in the surrounding area, with a clear definition of the IEFs taken forward for detailed assessment.
- **Assessment:** brings together the information to consider the specific impacts likely to be experienced by the IEFs within the relevant ZoI of the proposed development, for construction and operation, and presents the terrestrial ecology and ornithology assessment. Using the criteria set out within the CIEEM guidelines (Ref 14.24), the sensitivity of the IEFs, and all the potential impacts related to each IEF have been characterised. Please note when discussion impacts associated with

[7] Receptor topics are: Designated Sites; Plants and Habitats; Invertebrates; Amphibians; Reptiles; Ornithology; Bats; and Terrestrial Mammals.

"habitat loss" and "land take", this has been assessed in full under construction, including temporary and permanent habitat lost.

- Mitigation and monitoring:
  - describes the proposed secondary mitigation[8] measures for the terrestrial ecology and ornithology assessment within, and in the vicinity of, the proposed development.
  - describes any required monitoring regimes, including monitoring of specific receptors/resources, or monitoring the effectiveness of a mitigation measure. The requirements, scope, frequency and duration of a given monitoring regime are set out, as far as possible.
- **Residual Effects:** the resulting, residual effects following consideration of the proposed mitigation.

14.5.6 Baseline information, an assessment of the effects of and a summary of the additional mitigation and monitoring measures for off-site development areas, including the off-site sports facilities at Leiston, the two fen meadow sites and the potential marsh harrier habitat improvement area at Westleton, are set out in **Appendix 14D** of this volume. As detailed in **Appendix 14D** of this volume, no potential for significant effects associated with the construction and operation of the off-site sports facilities and the marsh harrier improvement area at Westleton have been identified. For the two fen meadow compensation areas, with mitigation in place in the form of an appropriate construction method statement and operational management plan, no likely significant effects associated with the construction and operation of these sites have been identified.

14.6 Designated sites

a) Baseline

14.6.1 A baseline for designated sites is set out in **Appendix 14A2 – Designated Sites** of this volume detailing each site and the interest features that each support.

14.6.2 Within the baseline **Appendix 14A2 – Designated Sites** of this volume, a number of designated sites were considered unlikely to be significantly affected by the proposed development and have been scoped out of the detailed assessment. Thirteen SSSIs are not considered further as they are designated solely for their geological interest and no potential impact

[8] Where other mitigation is required to reduce or eliminate a significant effect, this is referred to as secondary mitigation. Secondary mitigation measures have not been incorporated into the design of the proposed development and would therefore not appear on any development plans. As a rule, secondary mitigation measures have been proposed where a significant effect or potential contravention of legislation is predicted to occur.

pathways have been identified. In addition, a further eight SSSIs (Cransford Meadow, Gromford Meadow, Iken Wood, Titsal Wood and Shadingfield, Potton Hall Fields, Chippenhall Green, Sotterley Park and Sutton and Hollesley Heaths) have been scoped out of detailed assessment, as no obvious impact pathways were identified.

14.6.3 For habitats that are qualifying features these are included in the plants and habitats section of **Volume 2, Chapter 14** of the **ES** (Doc Ref. Book 6). The only faunal qualifying features are birds, this is also discussed further within **Volume 2, Chapter 14** of the **ES** (Doc Ref. Book 6). Marine designations and qualifying feature are included within **Volume 2, Chapter 22** of the **ES** (Doc Ref. Book 6). Full details of all international designations are presented in the HRA Screening Report.

14.6.4 The following designated sites are identified for consideration within the **ES** (Doc Ref. Book 6):

- **Four SPAs:** Outer Thames Estuary; Alde-Ore Estuary SPA, Minsmere to Walberswick; and the Sandlings.
- **Three SACs:** Minsmere to Walberswick Heaths and Marshes; Alde-Ore and Butley Estuaries; and Orfordness to Shingle Street. Southern North Sea SAC was also scoped in for assessment but this is a marine SAC and will be considered within the marine assessment in **ES** (Doc Ref. Book 6) Chapter 22 and the Habitats Regulations Assessment.
- **Two Ramsar sites:** Minsmere to Walberswick; and Alde-Ore Estuary.
- **Eight SSSIs:** The Alde-Ore Estuary; Blaxhall Heath; Leiston to Aldeburgh; Minsmere to Walberswick Heaths and Marshes; Sandlings Forest; Sizewell Marshes; Snape Warren; and Tunstall Common.
- **Five CWSs:** Sizewell Levels and Associated Areas; Southern Minsmere Levels, Suffolk Shingle Beaches; Sizewell Rigs; and Leiston Common.

14.6.5 The implications for each designated site are assessed in the following sections. The approach taken is that the cited features of the designated sites are assessed under the appropriate section in this chapter. For example, potential effects on plant and habitat features are considered in the plants and habitats section, whilst potential effects on terrestrial ornithology features are considered in the terrestrial ornithology section.

14.6.6 The in-combination effects arising on designated sites from individual elements of the proposed development acting together are discussed below. Cumulative effects arising from the proposed development and the associated development elements of the Sizewell C Project, together with other development proposals acting in combination with the Sizewell C

Project on designated sites, are discussed in **Volume 10: Cumulative and Transboundary** of the **ES** (Doc Ref. Book 6).

14.7 Plants and habitats

a) Current baseline

14.7.1 A detailed description of the plants and habitat baseline of the site is provided in **Appendix 14A3 – Plants and Habitats** of this volume; however, a summary of the plants and habitats baseline conditions is provided in the following sections. Where a plant or habitat of conservation concern is identified, this is stated, and the conservation status is provided along with the appropriate legislation.

14.7.2 In addition to the plants and habitats baseline (**Appendix 14A3 – Plants and Habitats)** of this volume**,** a **Plants and Habitats Synthesis Report** (**Appendix 14B1**) of this volume has been produced which provides further detail on the evidence base underpinning the impact assessment. The focus on plants and habitats is because a significant proportion of the key ecological impacts arising from the proposed development reflect losses or changes to these ecological features.

14.7.3 Full details of the designated sites within the ZoI (defined in **section 14.3c)** of this chapter) of the site have been provided in **Appendix 14A2 – Designated Sites** of this volume, with a short summary below:

14.7.4 To the north of the site, the Minsmere to Walberswick Heaths and Marshes SAC supports wetland, heathland and coastal vegetation of international importance under the CIEEM guidelines (Ref 14.24) and of high importance under the EIA-specific methodology.

14.7.5 To the south of the site, the Alde, Ore and Butley Estuaries SAC, Alde-Ore Estuary SPA, Alde-Ore Estuary Ramsar site and Alde-Ore Estuary SSSI support coastal and wetland habitat whilst the extensive shingle spit of the Orfordness to Shingle Street SAC supports a large expanse of vegetated shingle. The Sandlings SPA supports a mosaic of heath, acid grassland and conifer plantation, with vegetated shingle present at Thorpeness. These designated sites are considered to be of international or national importance under the CIEEM guidelines (Ref 14.24) and of high importance under the EIA-specific methodology.

14.7.6 Other habitats of national importance, including the wetland habitats within Sizewell Marshes SSSI, which includes wet woodland, reedbed and fen meadow lie partially within and adjacent to the site.

14.7.7 Detailed survey work and an ecohydrological assessment of the fen meadow vegetation present within Sizewell Marshes SSSI has shown that there is a strong relationship between the most diverse areas of fen meadow and wet ground conditions, low fertility and a neutral-to-basic pH. This has enabled four grades of fen meadow to be identified, with Grades 1 and 2 supporting the greatest number of rich-fen plant species and comprising approximately 60% of the fen meadow resource within Sizewell Marshes SSSI. Full details of the ecohydrological assessment are presented within the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume). This assessment was undertaken primarily to inform mitigation rather than valuation as fen meadow habitats are assessed under the valuation for Sizewell Marshes SSSI.

14.7.8 Fen meadow Grades 1 and 2 support two types of plant species assemblages that are particularly vulnerable to changes in the annual hydrological regime, these being:

- groups of low-growing plant species; and
- plant species associated with low-nutrient and/or high lime content conditions.

14.7.9 Other habitat types within the site include dune and shingle vegetation of the coastal frontage which form part of the Suffolk Shingle Beaches CWS. Habitats of county importance within the site boundary include mixed and broadleaved woodland and acid grassland forming the Sizewell Levels and Associated Areas CWS and Leiston Common CWS.

14.7.10 Both the Sizewell Marshes SSSI and the Suffolk Shingle Beaches CWS are considered to be of national importance under the CIEEM guidelines (Ref 14.24) and of high importance under the EIA-specific methodology. The Sizewell Levels and Associated Areas CWS and Leiston Common CWS are considered to be of county importance under the CIEEM guidelines (Ref 14.24) and of medium importance under the EIA-specific methodology.

14.7.11 **Figures 14A2.1** to **Figure 14A2.3** (**Annex 14A2.1**) show the location of designated sites in relation to the site.

14.7.12 Many of the habitat types present are listed as priority habitats in the Suffolk BAP (Ref 14.20) and are also habitats of principal importance for the conservation of biodiversity under the NERC Act (Ref 14.10).

14.7.13 Desk-study records have identified the presence of the plant Deptford Pink protected under Schedule 8 of the W&CA (Ref 14.7) located on the sandy soil of the sea defence in front of the site. Deptford Pink is considered to be of county importance under the CIEEM guidelines (Ref 14.24) and of medium importance under the EIA-specific methodology.

14.7.14 Survey work has identified that the largest component of the site is arable farmland habitat, of little intrinsic botanical diversity, although the sandy margins of the fields did support two uncommon arable weeds, Corn Spurrey

(*Spergula arvensis*) and Shepherd's Cress (*Teesdalia nudicaulis*). However, away from the arable fields, a diverse range of habitats is present, including broadleaved woodland, conifer plantation, acid grassland, dune grassland, vegetated shingle and wetland (including fen meadow, wet woodland, ditches and reedbed). Within the site boundary, broadleaved woodland and acid grassland are considered to be of County importance under the CIEEM guidelines (Ref 14.24) and of Medium importance under the EIA-specific methodology.

14.7.15 New reedbed and ditch habitat was created in 2015, located adjacent to the development site at Aldhurst Farm, primarily to compensate for the anticipated losses of these habitats from the SSSI associated with the SSSI Crossing and the western edge of the new Sizewell C platform.

14.7.16 **Figure 14A3.1** (**Annex 14A3.1**) presents the Phase 1 habitat map for the site, whilst **Figure 14A3.2** (**Annex 14A3.1**) presents detailed habitat mapping undertaken using the NVC user handbook methodology (Ref 14.26).

14.7.17 Following a review of the plants and habitats baseline within the ZoI, **Table 14.9** lists the plant and habitats IEFs which have been carried forward into the detailed assessment. A detailed justification for these features is also found within **Appendix 14A2 – Designated Sites** and **Appendix 14A3 – Plants and Habitats** of this volume.

Table 14.9: Plant and habitat IEF taken forward for detailed assessment

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
Designated Sites			
Minsmere to Walberswick Heaths and Marshes SAC, and Ramsar site.	International and National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation, hydrological change, and changes arising from emissions to air.	IEF Scoped in
Alde, Ore and Butley Estuary SAC, Alde-Ore Estuary SPA and Ramsar site	International and National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation and changes arising from emissions to air.	IEF Scoped in
Orfordness to Shingle Street SAC.	International and National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as	IEF Scoped in

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
		recreation pressure causing trampling of vegetation and changes arising from emissions to air.	
Alde-Ore Estuary SSSI	National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation and changes arising from emissions to air.	IEF Scoped in
Blaxhall Heath, Sandlings Forest, Snape Warren, and Tunstall Common SSSIs	National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation and changes arising from emissions to air.	IEF Scoped in
Leiston to Aldeburgh SSSI	National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation and changes arising from emissions to air.	IEF Scoped in
Minsmere to Walberswick Heaths and Marshes SSSI.	National/High	There will be no direct habitat loss from this receptor, which supports plant and habitat assemblages of international importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation, hydrological change, and changes arising from emissions to air.	IEF Scoped in
Sizewell Marshes SSSI.	National/High	There will be direct habitat loss from this receptor, which supports plant and habitat assemblages of national importance. Potential impact pathways exist such as recreation pressure causing trampling of vegetation, hydrological change, and changes arising from emissions to air.	IEF Scoped in
Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS.	County/Medium	There will be direct habitat loss from this receptor, which supports plant and habitat assemblages of country importance. Other potential impact pathways exist such as changes arising from emissions to air.	IEF Scoped in
Suffolk Shingle Beaches CWS.	National/High	There will be direct habitat loss from this receptor, which supports plant and habitat assemblages of national importance.	IEF Scoped in
Leiston Common CWS	County/Medium	There will be no direct habitat loss from this receptor. No potential impact pathways	IEF

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
		identified and therefore this feature has been scoped out of the **ES** (Doc Ref. Book 6)	Scoped out
Habitats within and adjacent to the site			
Broadleaved and mixed Woodland.	County/Medium	There would be direct habitat loss from this habitat type. Broadleaved woodland is listed on both Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20).	IEF Scoped in
Wet Woodland (Within Sizewell Marshes SSSI).	National/High	Wet woodland within Sizewell Marshes SSSI would be subject to direct habitat loss. This habitat is listed in the SSSI citation (although is not a designated interest feature) and is a nationally scarce habitat listed on Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20). This impact is considered within the Sizewell Marshes SSSI receptor as a whole.	IEF Scoped in
Acid grassland.	County/Medium	There will be direct habitat loss from this habitat type, albeit temporary. Acid grassland is both a Section 41 NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20) priority habitat, is of limited in extent within the Suffolk Sandlings, and contributes towards the qualifying features of both Leiston Common, the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS.	IEF Scoped in
Rush pasture and Fen Meadow (within Minsmere to Walberswick and Sizewell Marshes SSSIs).	National/High	Fen meadow within Sizewell Marshes SSSI would be subject to direct habitat loss. This habitat is listed in the citation for both SSSIs. This habitat is nationally scarce, and listed on both Section 41 of the NERC Act ((Ref 14.10) and the Suffolk BAP (Ref 14.20). This impact is considered within the Sizewell Marshes SSSI receptor as a whole.	IEF Scoped in
Reedbed Meadow (within Sizewell marshes SSSI).	National/High	Reedbed within Sizewell Marshes SSSI would be subject to direct habitat loss. This nationally scarce habitat is listed on both Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20). This impact is considered within the Sizewell Marshes SSSI receptor and a whole.	IEF Scoped in
Eutrophic Standing Open Water (Ditches within Sizewell Marshes SSSI).	National/High	There will be direct loss of this habitat type. This nationally scarce habitat listed on both Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20). This impact is considered within the Sizewell Marshes SSSI receptor as a whole.	IEF Scoped in
Shingle and Sand Dune Vegetation	National/High	There will be no direct habitat loss from this receptor. This nationally scarce habitat is listed	IEF

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
(within Minsmere to Walberswick SSSI/SAC).		on both Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20), and supports a nationally rare plant assemblage.	Scoped in
Shingle and Sand Dune Vegetation (within Suffolk Shingle Beaches CWS).	National/High	There will be direct habitat loss from this habitat within this designation. This is a nationally scarce habitat listed on both Section 41 of the NERC Act (Ref 14.10) and the Suffolk BAP (Ref 14.20), and supports nationally rare plant assemblage.	IEF Scoped in
Plants			
Deptford Pink.	County/Medium	Nationally scarce plant protected under the W&CA (Ref 14.7). The location where this plant has been identified will be subject to severe disturbance and habitat supporting plant will be lost.	IEF Scoped in

14.7.18 The IEFs taken forward for detailed assessment are:

- IEF: The Minsmere European Site (comprised Minsmere to Walberswick Heaths and Marshes SAC and Ramsar site).
- IEF: Alde, Ore and Butley Estuary SAC, SPA, Ramsar site and SSSI.
- IEF: Orfordness to Shingle Street SAC and SSSI.
- IEF: Minsmere to Walberswick Heaths and Marshes SSSI.
- IEF: SSSIs underpinning the Sandlings SPA (Blaxhall Heath, Sandlings Forest, Snape Warren, Tunstall Forest and Leiston to Aldeburgh SSSI).
- IEF: Sizewell Marshes SSSI.
- IEF: Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS.
- IEF: Suffolk Shingle Beaches CWS.
- IEF: Broadleaved and mixed woodland within the site boundary.
- IEF: Acid grassland within the site boundary.
- IEF: Deptford Pink.

14.7.19 The **Shadow HRA Report (Book 5, Report 5.10)** also includes an assessment of those plants and habitats which form the interest features of European designated sites listed above (comprising SACs and Ramsar sites). The HRA identified no adverse effects which would affect the integrity of European sites in respect of the plant and habitat interest features.

b) Future baseline

14.7.20 In the absence of the construction and operation of the proposed development, it is anticipated that the habitats would remain largely in their current form, at least in the medium term, with a few exceptions. The overall effects of climate change on habitat types and component plant species are uncertain. The impacts that climate change may have on habitat types have been summarised on report cards produced by the Living with Environmental Change Network (Ref 14.44). This suggests that:

> *"Almost all of the scenarios indicate the UK will have a climate that is within the limits of the Temperate zone until at least the 2080s….the climate projections resulting from the high carbon emissions scenarios for beyond the 2080s where the increase in temperature will give the UK a climate that is similar to a current day climate south of the Temperate biome. If these high carbon emissions scenarios are realised the vegetation of the UK is likely to change dramatically and sometimes in currently unpredictable ways.*
>
> *Evidence is beginning to show that many semi-natural plant communities are relatively resilient to climate change and especially temperature increase. Major stress on some plant communities will occur where summer precipitation decreases and temperature increases. Lowland Heath, Lowland Fen, some Lowland Calcareous Grassland communities and Lowland Beech and Yew Woodland are the most likely to be affected in the south and east of the UK. If precipitation becomes more seasonal e.g. wetter winters and drier summers this may have more impact on vegetation than if precipitation changes throughout the year in the same way".*

14.7.21 In the medium to long-term, with increasing summer temperatures and reduced rainfall the sandy soils of the EDF Energy estate would be less suitable for trees and woodland and for arable crop production. Vegetation may shift towards heathland and summer parched grassland communities. Reduced precipitation is likely to lead to a reduction in water available for the wetland habitats of Sizewell Marshes SSSI and there may be a shift from fen meadow towards grassland communities.

c) Assessment

i. Construction

14.7.22 During the construction phase of works, the main impact pathways would be associated with:

- alteration of coastal processes;
- direct land take resulting in habitat loss and fragmentation;
- incidental loss of plant species;
- disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users);
- changes in water quality;
- alteration of local hydrology (including water chemistry) and hydrogeology; and
- changes in air quality.

14.7.23 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in a non-significant effect. The impact pathways that have been scoped out of this assessment, along with the rationale for scoping them out, are detailed below.

14.7.24 During both construction and operation, an **Outline Drainage Strategy** (**Appendix 2A** of this volume) would be implemented to manage surface water discharges from the site. Ditches, bunds and swales would be constructed to prevent untreated surface water run-off from leaving the site. Oil/petrol interceptors would be incorporated into the drainage design. Where complete infiltration to ground is not feasible, WMZs have been embedded into the design. These systems would be designed to discharge treated water to the surface water drainage network at greenfield run-off rates. Foul water would be pumped to a central treatment plant, prior to discharge to sea. This would prevent the contamination of surface waters with sewage effluent during construction. Impacts of changing water quality on plants and habitats have therefore been scoped out of detailed assessment.

14.7.25 The hydrological modelling work which is used in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that any potential hydrological effects on the terrestrial environment would be limited to areas less than 1km from the site. Therefore, any potential hydrological effects would be restricted to the Minsmere European Site and the Minsmere to Walberswick Heaths and Marshes SSSI (hereafter known as the Minsmere SSSI) and Sizewell Marshes SSSI. Hydrological effects (water quality, hydrology and hydrogeology) on other statutory sites have therefore been scoped out of the detailed assessment. **Chapter 19 Groundwater and Surface Water** of this volume provides further information and details on the hydrological assessments undertaken and consideration of ecological receptors.

14.7.26 The air quality dispersal modelling work which is used in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that the likely ZoI for potential air quality effects is limited, with the majority of emissions and deposition occurring within 1km radius of the point of source. Therefore, any potential air quality effects would be restricted to the Minsmere European Site, Minsmere to Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI. Air quality effects on other statutory sites have therefore been scoped out of the detailed assessment. **Chapter 12 Air Quality** of this volume provides further information and details on the air quality assessment undertaken and consideration of ecological receptors.

14.7.27 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by each IEF are identified and detailed within the subsequent sections.

IEF: Minsmere European Site

14.7.28 During construction, the potential impacts experienced by the plant and habitat features of this site could include:

- alteration of coastal processes;
- disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users);
- alteration of local hydrology (including water chemistry) and hydrogeology; and
- changes in air quality.

14.7.29 The characterisations of the above impacts are described in detail below.

Alteration of coastal processes

14.7.30 This impact refers to changes in coastal processes and sediment transport that may result from construction and operation of marine infrastructure associated with the proposed development, which could then in turn affect terrestrial habitats. For example, any infrastructure which reduces sediment transport could accelerate the rate of coastal erosion and loss of terrestrial habitats, such as dune vegetation. The habitat qualifying features located within the Minsmere European Site are already subject to natural change due to coastal processes and would be sensitive to any changes (in addition to natural variation) in coastal processes caused by the new marine infrastructure introduced at the proposed development.

14.7.31 Modelling work within the British Energy Estuarine Marine Studies (BEEMS) Report TR311 (summarised in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that the construction of the Beach Landing Facility (BLF) and the Hard Coastal Defence Feature (HCDF) are the only elements of marine infrastructure likely to affect coastal processes and thereby indirectly affect terrestrial habitat. The terrestrial piles of the BLF would be installed from a terrestrial piling machine. Although the method for marine piling has yet to be determined, it is likely to be using a cantilever method from the HCDF (no effects on coastal geomorphology) or from a jack-up barge. As the effects of constructing the intertidal sections of the BLF jetty would be localised, superficial and short-lived, they would be expected to have no significant effect on the shoreline.

14.7.32 The HCDF would be terrestrial, set well back from the coast and landward of the present 5m above Ordnance datum (ODN) dune/barrier. As the HCDF would be constructed terrestrially, there would be no impacts on coastal processes during the construction phase.

14.7.33 As discussed in **section 14.4** of this chapter, and detailed in **Volume 2: Chapter 22: Marine ecology**, a 5m sacrificial dune would be constructed in front of the main sea defence. Once constructed, the sacrificial dunes' primary function is to minimise coastal erosion and release sediment to the beach face, which would only be activated during a storm event.

14.7.34 For the above reasons, the construction of the BLF and the HCDF is considered unlikely to lead to substantive changes to coastal processes and therefore no significant effects (over and above any natural change) on the Minsmere European Site are envisaged. Overall the impact of the BLF would be of a low magnitude. This would, therefore, have a **minor adverse** effect, which is considered to be **not significant**.

Disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users)

14.7.35 During the construction of the proposed development, patterns of recreational usage in the Sizewell area may alter as a result of the displacement of existing recreational users, particularly walkers (with dogs and without). A detailed Recreation Evidence Base has been produced with a summary outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume).

14.7.36 An increased number of visitors to an area can increase the physical trampling of habitat types such as heath and vegetated shingle, leading to the loss of component plant species and the replacement of these habitat types with bare un-vegetated substrate. An increase in dog-walking can also lead to a localised build-up of nutrients, due to dog faeces and urine, causing localised enrichment which will favour vigorous fast-growing plants. This could cause slower-growing plant species to be out-competed, thus leading to an overall loss in plant species diversity. The **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) concludes that any trampling effects are likely to be reversible with vegetation recovering once the trampling pressure is removed. Nutrient enrichment from dog waste may take longer to reverse. The duration of additional trampling and enrichment from dog waste is likely for the period over which recreational users may be displaced, the estimated 10-year construction period for the proposed development.

14.7.37 The Minsmere European Site is considered vulnerable to trampling of shingle vegetation (**Appendix 14A2 – Designated Sites** of this volume) and the area is likely to be currently impacted. A substantial increase in trampling of vegetation and nutrient enrichment, arising from recreational displacement, would constitute an adverse effect, the significance depending on the extent of habitat affected. The extent of any potential effect is likely to vary depending upon the location of access points. For example, an effect is more likely from car park locations that are close to sensitive habitats (such as at Walberswick and Dunwich, where these is direct access to the beach and its sensitive shingle and dune habitat).

14.7.38 The Recreational Evidence Base (**Book 5**, **Report 5.10: Shadow HRA Report**) concludes that the Sizewell area receives approximately 500,000 recreational visits a year, with most visitors arriving by car. Of the respondents questioned, 29% indicated that they would avoid the Sizewell area during the construction of the proposed development and seek other locations in which to undertake recreation. The results for the visitor survey at Minsmere were comparable. An alternate location would be one at which recreational users could park their cars and undertake similar recreational activities at that location.

14.7.39 The majority (96%) of these alternative car-parking locations fall within a 16km study zone established for the Recreational Disturbance Evidence Base (**Book 5**, **Report 5.10: Shadow HRA Report**), with a concentration of car-park locations falling within the boundaries of the following European designated sites:

- the Minsmere European Site;
- Sandlings SPA; and

- Alde-Ore Estuary European site, including the Orfordness to Shingle Street SAC.

14.7.40 This potential displacement of recreational users has to be considered in the context of the large number of recreational visits already made to the Minsmere European Site. **Table 14B1-5** presented in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) and the Habitat Regulations Assessment, which indicates that the car-park locations that give access to the Minsmere European Site already together receive an estimated 1,969,428 recreational visits per year, and that any increase due to recreation users displaced from the Sizewell area would be small (estimated to be an approximate additional 20,000 recreational visits per annum). In addition, this pressure would be diffuse and spread across a large number of potential car-park access points for example perhaps 20% visiting the RSPB Minsmere Reserve (where dog walking is not permitted) and 80% visiting the outer areas of the reserve where dog walking is permitted.

14.7.41 In addition to the displacement of existing recreational users, evidence presented in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) estimates that the influx of new construction workers would generate an additional 60,000 recreational visit per annum, of which 8,000 may be within the Minsmere European Site.

14.7.42 There is no automatic correlation between an increase in the number of recreational visits and the potential for the qualifying features of European Sites to be detrimentally affected. To an extent it depends upon the behaviour of visitors and the pattern of recreation usage.

14.7.43 It is envisaged that on large, managed sites with a well-defined path network, and where people are easily observed, such as within the core of the RSPB Minsmere reserve then new recreational users are likely to keep to existing path networks and thus would be unlikely to lead to an increase in trampling or nutrient enrichment of sensitive vegetation. In the outer parts of the RSPB Minsmere reserve however, which have a less well-defined path network, it is however possible that visitors may be more likely to access areas away from the path network and this part of the RSPB Minsmere Reserve might therefore be impacted by a marginal increase in vegetation trampling.

14.7.44 The displacement of recreational users is likely to last for the duration of the construction phase although as people establish new patterns of behaviour and access alternate sites, the changes could become permanent for a proportion of users. Once construction activities have ceased, a substantial proportion of displaced users would likely reuse the Sizewell area and be joined by new users.

14.7.45 As indicated in **section 14.4** of this chapter, primary mitigation would aim to minimise the need for both construction workers and existing recreational users at Sizewell to access the Minsmere European Site for recreational purposes.

14.7.46 SZC Co. has developed a Recreation and Amenity Strategy presented in **Chapter 15, Amenity and Recreation** for the EDF Energy estate and this is included with the wider application. The strategy would allow Kenton Hills and its associated car park to remain open during construction and would be extended and improved to provide additional parking spaces and a more welcoming environment for users and dog walkers in particular. In addition, alternate recreational provision (including dog-walking) has been created close to Leiston in the southern part of the Aldhurst Farm habitat compensation area, access links for walkers and cyclists between Leiston and the coast would be improved, and additional car parking spaces would be provided at Kenton Hills car park.

14.7.47 For these reasons, the impact due to the displacement of recreation users is considered to be of low magnitude**.** The overall trampling of vegetation and nutrient enrichment from dog waste would have a **minor adverse** effect, which is considered to be **not significant**.

Alteration of local hydrology and hydrogeology

14.7.48 This impact pathway refers to any changes in the hydrological conditions during construction, for both groundwater and surface water, which could impact the habitat types present within and adjacent to the Minsmere European Site.

14.7.49 The elements of the proposed development likely to cause hydrological change within the Minsmere European Site during construction are:

- loss of part of Sizewell Marshes SSSI to accommodate the main platform;
- installing a reinforced concrete cut-off wall allowing the main platform area to be dewatered;
- potential breach of cut off wall following completion of construction;
- realignment of the Sizewell Drain; and
- construction of the SSSI crossing over the Leiston Drain between Goose Hill and the main platform.

14.7.50 Any significant changes in hydrological conditions to both groundwater and surface water (by making conditions wetter or drier) could potentially alter the plant composition of the habitat types present, leading to a loss of individual species that require specific conditions. For example, increased inundation by surface water could smother plants preventing growth and setting of seed by species not adapted to periodic inundation. Changes in water quality could potentially alter plant species composition and distribution.

14.7.51 The Minsmere European Site supports sensitive wetland habitats that require careful manipulation and control of water levels to support the full range of flora and fauna present on the site. Changes to the nature and structure of habitats could influence the range of species supported; for example, wetter conditions could promote more extensive growth of Rush (Juncus species) species making the ground less suitable for some wading birds to nest or feed (though other species may be advantaged).

14.7.52 Anything other than relatively small changes to the underlying hydrological regime of the Minsmere European Site as a direct result of the proposed development would be likely to constitute an adverse effect. The extent, magnitude and duration of any such effect would depend upon the scale of change to the underlying hydrological regime and could potentially result in a permanent non-reversible effect.

14.7.53 A technical note on the potential hydrological impacts on the Minsmere European Site/SSSI (Ref 14.45) the conceptualisation report (**Volume 2, Appendix 19E: Surface Water Conceptualisation model**) (summarised in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) identifies two water catchments in the vicinity of the site: those areas that drain north and east into the Leiston Drain including Sizewell Marshes SSSI, and those areas that drain south and east into the Minsmere New Cut (see **Figure 14B1-1** in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume).

14.7.54 The Minsmere Sluice is the main control structure governing the flow and water level regimes of the Minsmere New Cut, Leiston Drain and Scott's Hall Drains. The sluice is divided into two chambers, each with its own gravity-outlet culvert. The northern chamber receives flows from the Minsmere New Cut, while the southern chamber receives flows from Leiston Drain and Scott's Hall Drains.

14.7.55 There is the theoretical possibility that if the flows within the Leiston Drain are increased, as a result of the construction of the proposed development to the south, this would cause excessive back flooding of the Scott's Hall Drain. This back flooding could then result in increased inundation of the RSPB Minsmere Reserve preventing control of water levels. Further details surrounding monitoring of waterbodies associated with the project are detailed in **Chapter 19 Groundwater and Surface Water** and the **Monitoring and Response Strategy** (**Appendix 19F** of this volume).

14.7.56 The Leiston Drain drainage system provides a relatively small hydrological input to the study area and supplies approximately 14% of the total contributing catchment of the Minsmere Sluice. As part of the construction phase, the Sizewell Drain (a tributary of the Leiston Drain) would be diverted, parallel to the base of the main platform slope. At its northern extent, it would discharge to the Leiston Drain upstream of the proposed SSSI crossing. In addition, changes to water level management may be required for the Sizewell Marshes SSSI adjacent to the construction site. New water level control structures would be installed and the operation of existing operational structures would potentially be revised. The design of the structures would consider the interfaces with other drains and ditches and aim to ensure the existing water balance of the surrounding wetlands is maintained. The enhanced water level control within the Sizewell Marshes SSSI would allow for fine tuning of the management regime over time. Further details on water control measures are included in **Chapter 19, Groundwater and Surface Water** of this volume.

14.7.57 There is a potential risk that a greater volume of discharge down the Leiston Drain may be required to ensure the Sizewell Marshes SSSI water levels behind the water management structures are maintained. If the increased discharge flows are sufficient to reduce available capacity in the southern chamber of the Minsmere Sluice this could cause back flooding within the Scott's Hall Drain. The back flooding could lead to adverse impacts on Minsmere European Site/SSSI. As outlined in **section 14.4** of this chapter, primary mitigation measures are embedded in the design to manage surface water discharges from the proposed development adequately during the construction phases that could potentially affect the flow regime of the systems.

14.7.58 The primary mitigation measures in **section 14.4** of this chapter, combined with the proposed Sizewell Drain realignment, largely isolate the proposed development from the surrounding areas. The mitigation measures also ensure that any flows discharged to an existing surface water receptor would have passed through water quality treatment measures and would be discharged at greenfield rates. Therefore, it is anticipated that the proposed development should create no significant effect on the flow regime or water quality of the existing surface water receptors.

14.7.59 Changes to the percentage of hardened surfaces (the temporary accommodation campus) within the catchment of the Internal Drainage Board (IDB) Drain No. 7 can also influence the flow regime within the lower reaches of the Leiston Drain. However, effects caused by the proposed development are anticipated to be of minor significance due to the following mitigation measures that have been embedded in the design of the temporary accommodation campus facility.

14.7.60 During the construction phase, WMZs would ensure runoff from the vicinity of the Campus are returned to groundwater at greenfield runoff rates. Oil/petrol interceptors would be incorporated into the drainage design.

14.7.61 An operational phase drainage system would be implemented, including Sustainable Drainage Systems (SuDS) measures to intercept water, sediment and contaminants.

14.7.62 Based upon modelling results, presented in **Chapter 19 Groundwater and Surface Water** and the **Monitoring and Response Strategy** (**Appendix 19F** of this volume) it is concluded that the construction of the proposed development should not lead to any significant effects on the flow regime of the Sizewell Drain, Leiston Drain, IDB Drain No. 7 through a variety of mechanisms. The proposed water management structures would also allow for manipulation of the water levels and flows and thus levels/flows within the Leiston Drain could be reduced as and when required to allow for the Scott's Hall Drain to discharge efficiently when required. This coupled with the fact that the relatively small contribution from Leiston Drain to the overall flow at Minsmere Sluice, limited effects on the flow regime of the southern chamber of the Minsmere Sluice are anticipated and thus no significant effect is predicted for the Scott's Hall Drain and associated drainage network.

14.7.63 The Environmental Appraisal of the SSSI crossing options (Ref 14.46) (summarised in **Appendix 14B1 – Plants and Habitat Synthesis Report** of this volume), details a modelling exercise that was undertaken to assess the predicted changes in water levels as a result of constructing the crossing. This modelling predicted only a very small, highly localised effect, such that during construction there would be a temporary 2cm reduction in water levels to the east of the crossing and a 1cm reduction to the west. This effect would rapidly diminish over distance, not being apparent beyond a radius of 90m. During the operational phase, water levels would stabilise, and long-term changes are predicted to be less than a 1cm increase in levels to the west of the crossing (i.e. up-gradient), with a corresponding reduction to the east, with no change apparent 60m from the SSSI crossing on both sides.

14.7.64 A hydrological model for the proposed development has been developed using the Finite Element Subsurface Flow (FEFLOW[9]) model (outlined in the **Appendix 14B1 – Plants and Habitat Synthesis Report** of this volume). The model creates a synthetic hydrological baseline against which construction scenarios can be modelled.

14.7.65 Detailed modelling (outlined and presented within **Appendix 14B1 – Plants and Habitats Synthesis Report** of this volume) indicates that during construction there may potentially be groundwater drawdown of less than 13cm for a very localised part of the Minsmere to Walberswick Heaths and Marshes SAC and SSSI, at the southern tip of the Minsmere South Levels just to the north of the main platform and a short section either side of the Leiston Drain. Whilst the construction phase activities are anticipated to take place between 9-12 years, the potential drawdown effects of groundwater

[9] FEFLOW is a computer model for simulating groundwater flow.

are anticipated to be temporary and would only occur for a short-duration over the course of the construction phase. Further clarity on the spatial distribution of the drawdown is provided within the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) and **Chapter 19 Groundwater and Surface Water** showing the maximum drawdown contours in both the peat and crag deposits. Measurement indicates that less than 0.6ha would be directly affected, which represents 0.04% of the Minsmere European Site/SSSI total area of 1256.57ha.

14.7.66 Drawdown would be short-term and reversible once the dewatering operations have concluded. It is considered that such a minor change in groundwater levels would unlikely cause a significant change to the composition or structure of the vegetation present. Importantly, other than the small (0.6ha) localised area of groundwater drawdown within the Minsmere European Site/SSSI, modelling does not indicate any other impacts on this designated site.

14.7.67 Considering the modelling results and evidence presented above, the extent of hydrological change (if any) is considered to be highly localised and the impact of a change in local hydrological regime on the Minsmere European Site is considered to be of low magnitude. This would result in a **negligible adverse** effect, which is considered to be **not significant**.

14.7.68 Modelling work (see **Chapter 19: Groundwater and Surface Water**) predicts no change in the hydro chemical signature of each component of ground water and surface water and no significant changes to water chemistry are envisaged.

Changes in air quality

14.7.69 This impact pathway refers to any changes to air quality because of the emission and/or deposition of dust and other airborne pollutants.

14.7.70 The deposition of airborne emissions can affect plants and habitats in several ways. Dust deposition can cover the surface of leaves and other vegetation preventing plants from photosynthesising, whilst deposition of other pollutants can cause a localised alteration in the nutrient status and pH of soil which, if large enough, can alter the plant communities present.

14.7.71 The construction elements likely to cause changes in air quality are:

- Construction works likely to generate dust including:
  - Demolition works and on-site crushing and screening of aggregate.
  - Earthworks, including soil stripping, stockpiling and excavation.
  - On-site concrete batching.

– The movement of Heavy Goods Vehicles (HGV) and other vehicle movements on site.

Dust generation

14.7.72 Dust takes the form of finer particles that remain in suspension in the air, and coarser particles that settle to ground (Ref 14.47). Deposition to ground can occur for all dust size fractions, but typically soiling and smothering effects are associated with size fractions between 10–30 microns (µm) in diameter (denoted PM_{10} to PM_{30}). Particulates larger than PM_{30} do not typically remain airborne for more than a few tens of metres from the point of generation and those below PM_{10} are readily re-entrained into the atmosphere. Potential impacts on vegetation include physical effects such as smothering of leaves causing reduced photosynthesis, respiration, and transpiration; filming of static watercourses, and increase in sedimentation and contaminant build-up, leading to changes in water chemistry or soil chemistry (for example change in acidity).

14.7.73 A dust deposition rate of 0.5g/m^2/day (see **Volume 2, Chapter 12: air quality**) was agreed with consultees as the threshold level, with significant ecological effects from deposited dust predicted to occur above this threshold. The Institute of Air Quality Management (IAQM), indicates:

> *"For locations with a statutory designation,…consideration should be given as to whether the particular site is sensitive to dust and this will depend on why it has been designated…The level of dust deposition likely to lead to a change in vegetation is very high (over 1g/m^2/day) and the likelihood of a significant effect is therefore very low except on the sites with the highest dust release close to sensitive habitats."*

14.7.74 For the purposes of this assessment, the lower ecological dust-deposition value (0.5g/m^2/day) has been adopted to represent the level below which insignificant effects on vegetation are expected; whilst the upper value (1g/m^2/day) is assumed to represent the level above which a change in vegetation may occur as a result of dust deposition.

14.7.75 Baseline monitoring of background levels of dust at various locations within the footprint of the site (Ref 14.48) indicate that existing dust levels within the Minsmere European Site are currently well below the threshold of 0.5g/m^2/day with a mean of 19mg/m^2/day.

14.7.76 The extent of any dust-related impacts is likely to occur over a relatively small area, with deposition likely to occur close (10s of meters) from the point of origin. Dust generation would likely continue for the duration of the construction phase. The impacts of dust are likely to be reversible.

14.7.77 The three Annex 1 habitats supported by the Minsmere European Site (dry heaths, annual vegetation of drift lines, and perennial vegetation of stony banks) have developed on a nutrient-poor substrate typically acidic in nature. These three habitat types are considered sensitive to dust deposition, if the quantify of dust is enough to smother the leaves of vegetation and sufficient to alter the pH locally.

14.7.78 Both the lowland heath and perennial vegetation of stony banks Annex 1 habitat types are present within the coastal vegetation, just to the north of the site. Lichen and bryophyte surveys (Ref 14.49, Ref 14.50) (species considered particularly vulnerable to dust deposition) have established that the species assemblage present is composed of relatively widespread and common species with no species thought to be of high sensitivity to dust deposition. The annual vegetation of drift lines is no longer present in Unit 113 of the Minsmere to Walberswick Heaths and Marshes SSSI (which underlies the Minsmere European Site), adjacent to the site (**Appendix 14B1 – Plants and Habitat Synthesis Report**) and consequently effects on this Annex 1 habitat type are unlikely.

14.7.79 As indicated in **section 14.4** of this chapter, primary mitigation would include the development of a dust management plan outlining a range of measures that would ensure dust generation is kept to a minimum and within the threshold limits of $0.5g/m^2/day$. If monitoring indicates exceedance of this threshold, then additional mitigation measures would be adopted.

14.7.80 Overall, the impact of dust deposition on the Minsmere European Site would have a **negligible adverse** effect, which is considered to be **not significant**.

Combustion emissions from diesel generators

14.7.81 Air quality dispersal modelling (outlined in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) and detailed in **Chapter 12 Air Quality** of this volume) has considered the following emissions from the emergency diesel generators for both initial commissioning (during construction) and then routine operation (testing) scenarios:

- oxides of nitrogen (NO_x);
- SO_2;
- nitrogen deposition; and
- acid deposition.

14.7.82 NO_x and SO_2 refer to the gaseous element of emissions whilst nutrient nitrogen and acid deposition refer to the small proportion of the gaseous emissions that are precipitated (often in rain) and fall to the ground as a solid.

14.7.83 The Environment Agency's Risk Assessment guidance screening criteria for significance of emissions for both European and National sites (Ref 14.51) defines total pollutant emission as being insignificant where the predicted Process Contributions (PCs[10]) are:

- PC <1% of the Critical Level, or the PEC<70% of Critical Level for long-term releases; and
- PC <10% of the Critical Level for short-term releases.

14.7.84 For all other nature conservation sites (i.e. CWS), the same guidance states that an assessment needs to determine whether the installation would result in "significant pollution" i.e. where Critical Levels are exceeded. In these cases, if the long- and short-term PC is less than 100% of the relevant standard, it is considered to be **not significant**.

14.7.85 As with Critical Levels of atmospheric pollutants, the Environment Agency and Natural England agree that PCs of less than 1% of the Critical Load[11] (Ref 14.51) for pollutant deposition (nitrogen and acid) can be considered to be insignificant, and that PCs greater than 1% have the potential to be significant, depending upon the context.

Oxides of nitrogen

14.7.86 NO_x has been modelled for both annual emissions (construction and operation) and daily emissions (operation only) and a summary presented in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume). For both annual average NO_x and daily NO_x, the ZoI is restricted to a relatively small area of the southern part of the Minsmere European Site and the northern portion of Sizewell Marshes SSSI with the majority of emissions being within a 1km radius of the emission source (the diesel generator stacks). Approximately 35.6ha of the Minsmere European Site lies within 1km of the emission source and therefore, emissions of NO_x may potentially affect approximately 3% of the Minsmere European Site area (1,256.57ha total).

14.7.87 The modelling indicates that the worst-case impacts are predicted to occur at Minsmere and Sizewell Levels (part of the Sizewell Marshes SSSI) which are both predicted to experience annual NO_x concentrations that cannot be screened out as insignificant during the commissioning phase. The site experiencing the greatest impacts is Minsmere, with a Predicted

[10] Process contribution is the level of a pollutant emission arising from the proposed development.
[11] Critical Load is the estimated threshold above which damage to vegetation may occur, but this is not tested empirically as for Critical Levels.

Environmental Concentration (PEC)[12] of 74% of the Critical Level during the Commissioning period and Sizewell Levels at 70%.

14.7.88 The habitat types present within the Minsmere European Site which could be impacted are as follows:

- coastal or flood plain grazing marsh;
- reed bed; and
- vegetated shingle and sand dune.

14.7.89 Of these habitat types, the Air Pollution Information System (Ref 14.47), indicates vegetated shingle is considered the most sensitive to increases in nitrogen levels. However, the PEC (background pollutant levels combined with the PC) show that exceedance of the annual Critical Level is unlikely, so no significant effect is envisaged. However, given that Critical Levels are defined as "*concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as plants, ecosystems or materials, may occur according to present knowledge*", it is not considered that the PEC would have an adverse effect as no exceedance is predicted. Additionally, when taking into consideration the background NO_x concentration at this site, the PEC show that exceedance of the annual Critical Level is unlikely.

14.7.90 Overall, the impact of NO_x emissions on the Minsmere European Site would have a **minor adverse** effect, which is considered to be **not significant**.

Sulphur dioxide

14.7.91 As for NO_x, the ZoI for SO_2 is restricted to a relatively small area of the southern part of Minsmere European Site and the northern portion of Sizewell Marshes SSSI.

14.7.92 The air quality dispersal modelling (summarised in **Appendix 14B1 – Plants and Habitat Synthesis Report** of this volume) indicates that, during commissioning, the Minsmere European Site is predicted to experience SO_2 PCs of 0.5µg/m^3, affecting the same habitat types as identified for NO_x. Importantly, as for NO_x, it is unlikely that an exceedance of the Critical Level would occur, with a PEC of less than 45% of the Critical Level (below the Environment Agency screening criteria of 70% for annual average impacts).

14.7.93 As described above under NO_x, the lichen and bryophyte surveys (Ref 14.49, Ref 14.50) identify assemblages of species which are not particularly sensitivity to SO_2 emissions.

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[12] PEC is background levels of a pollutant combined with the Process Contribution (PC) to give a predicted environmental contribution (PEC)

14.7.94 Overall, the impact of SO_2 emissions on the Minsmere European Site would have a **minor adverse** effect, which is considered to be **not significant**.

Nutrient nitrogen deposition

14.7.95 As indicated above nutrient nitrogen is the portion of emissions that are precipitated to the ground. The air quality dispersal modelling (summarised in the **Appendix 14B1 – Plants and Habitat Synthesis Report** of this volume) modelled both nutrient nitrogen deposition (from NO_x emissions) and acid deposition (from SO_2 emissions). The Air Pollutant Information System website (Ref 14.47) indicates that deposition of nitrogen can lead to an increase in nutrient levels, promoting the growth of coarse grass species and leading to the loss of low-growing plant species such as lichens and bryophytes and those plant species indicative of low nutrient levels.

14.7.96 Air Pollutant Information System also indicates that, except for annual vegetation of drift lines, other habitat features of the Minsmere European Site (dry heaths and perennial vegetation of stony banks) are sensitive to an increase in nutrient nitrogen. The Site Improvement Plan for the Minsmere European Site (Ref 14.52) highlights nutrient deposition as being a potential issue to be addressed within the period 2015-2020 with the production of a nitrogen plan.

14.7.97 For each habitat type, Air Pollutant Information System sets out two Critical Load thresholds, a lower one for lower plants (lichens and bryophytes) and an upper one for higher plants. The air dispersal modelling, using the data from Air Pollutant Information System, indicates that the average existing background deposition rates of nutrient nitrogen onto habitat receptors tend to be in excess of the lower end of the Critical Load range and, in some cases, exceed the higher end of the Critical Load range. This indicates that deposition of nutrient nitrogen is already impacting the natural environment and is reflected by the lichen and bryophyte communities present which do not include species sensitive to nutrient nitrogen deposition.

14.7.98 The modelling indicates that during commissioning, three of the four habitat types within the Minsmere European Site (the coastal dune habitat, the dry heath, and the fen/swamp) would experience increases in nitrogen deposition of more than 1%. However, all three of the receptor habitats are already receiving background nitrogen inputs above the lower value of the relevant Critical Load range. Therefore, whilst the PC represents more than 1% of the Critical Load for these habitat features, it is unlikely that this would lead to significant changes in plant species composition or to noticeable damage to the constituent plants.

14.7.99 The air dispersal modelling also indicates that the ZoI of nutrient nitrogen deposition is likely to be relatively small, with the majority of deposition being within a 1km radius of the emission source (the diesel generator stacks).

Approximately 35.6ha of the Minsmere European Site lies within 1km of the emission source; therefore, deposition of nutrient nitrogen may potentially affect approximately 3% of the Minsmere European Site area (1256.57ha total). This would result in an overall low magnitude of impact.

14.7.100 Despite the background deposition rates of nutrient nitrogen exceeding the Critical Load threshold, the Natural England Condition Assessment of the SSSI underpinning the Minsmere European Site (which divides the site into 120 separate management units) indicates that most of the site is in favourable condition, with 54% of units being “favourable” and 40.5% being “unfavourable but recovering”. Nutrient nitrogen is not identified as a reason for units not being in favourable condition.

14.7.101 Overall, the impact of nutrient nitrogen deposition on the Minsmere European Site would have a **minor adverse** effect, which is considered to be **not significant**.

Acid deposition

14.7.102 As for nutrient nitrogen, the Air Pollutant Information System website (Ref 14.47) indicates that some habitat features within the Minsmere European Site are sensitive to acid deposition which can alter soil chemistry leading to an increase in the availability of aluminium ions causing toxicity to plant species, in particular lichens and bryophytes. However, the air dispersal modelling (Ref 14.47) indicates that the majority of habitat features within the Minsmere European Site are already exposed to background levels of acid deposition above the Critical Load threshold.

14.7.103 The highest predicted increase from PC occurs during the commissioning phase and would result in a 21% increase within the grazing marsh of the Minsmere European Site. However, as background acid deposition already significantly exceeds the Critical Load, this increase would be expected to have only a small impact. Furthermore, grazing marsh is not a particularly sensitive habitat to acid deposition, as the soils are likely to be well-buffered. In addition, as indicated above under nutrient nitrogen deposition, the ZoI is relatively small (potentially only 3% of the Minsmere European Site would be directly affected). This change has been calculated for the closest part of the Minsmere European Site to the diesel generators (and therefore represents the worst case); the PCs over the rest of the site would be below this value. In addition, the condition assessment for Minsmere to Walberswick Heaths and Marshes SSSI underpinning the Minsmere European Site designation does not identify acid deposition as a reason for unfavourable condition.

14.7.104 Overall, the impact of acid deposition on the Minsmere European Site would have a **minor adverse** effect, which is considered to be **not significant.**

IEF: Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI

14.7.105 During construction, the potential impact pathway experienced by the plant and habitats of the Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI would be associated with disturbance effects on habitats (comprising trampling and other effects due to potential displacement of recreational users from the Sizewell area). The characterisation of this impact is described in detail below.

Disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users)

14.7.106 The qualifying features of the Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI include the following habitat types: mudflats; sandflats and Atlantic salt meadows (saltmarsh) and vegetated shingle habitat. Other than vegetated shingle, these habitat types are difficult to access, and only exposed for short periods at low tide. It is, therefore, considered unlikely that an increase in recreation users would have a significant effect on these intertidal habitat types.

14.7.107 As outlined for the Minsmere European Site above, an increased number of visitors to an area can increase the physical trampling of vegetated shingle, and an increase in dog-walking can also lead to a localised build-up of nutrients, due to dog faeces and urine. Information presented in the baseline **Appendix 14A2 – Designated Sites** indicate that the Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI is considered vulnerable to trampling of shingle vegetation, and existing levels of recreational activity has been implicated as causing damage. Of the Annex 1 habitats, the main area of shingle vegetation within the Alde, Ore Estuary is along the Orfordness to Shingle Street shingle spit, discussed under IEF the Orfordness to Shingle Street SAC.

14.7.108 **Table 14B1-5** of the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) indicates that the car park locations that give access to the Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI already receive an estimated 580,000 recreational visits per year, and that any increase due to recreational users displaced from the site would be small (estimated to be an additional 29,000 recreation visits per annum). In addition, this total increase in pressure would be diffuse and spread across a large number of potential car-park access points.

14.7.109 In addition to the displacement of existing recreational users, the Recreational Evidence Base (**Book 5**, **Report 5.10: Shadow HRA Report**) estimates that the influx of new construction workers would generate an additional 60,000 recreational visits per annum, of which 7,000 may be to Aldeburgh where it is possible to access the Alde, Ore and Butley Estuary.

14.7.110 As indicated in **section 14.4** of this chapter and discussed under the Minsmere European Site, primary mitigation would aim to minimise the requirement for both construction workers and existing recreational users from Sizewell to access the Alde, Ore, and Butley estuary site for recreation.

14.7.111 For the reasons outlined above, the potential magnitude of impact due to the displacement of recreational users is considered to be low, and, overall, trampling of vegetation and nutrient enrichment of vegetation due to dog waste would have a have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Orfordness to Shingle Street SAC and SSSI

14.7.112 During construction, the potential impact pathway experienced by the plant and habitats of the Orfordness to Shingle Street SAC and SSSI would be associated with disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users). The characterisation of this impact is described in detail below.

Disturbance effects on habitats (comprising trampling effects and nutrient enrichment due to displacement of recreational users)

14.7.113 The main area where sensitive shingle vegetation is present is along the Orfordness to Shingle Street shingle spit and the main access point to Orfordness is by boat from Orford. Once on the spit, access is carefully controlled by the National Trust, with access to sensitive shingle vegetation prevented by fencing and signage. It is possible to access the spit by walking from Aldeburgh, but it is envisaged most people would access the town beach rather than undertake a return walk of approximately 12km to access the shingle spit. In addition, clear fencing and signage from the National Trust indicate access is prohibited from this direction.

14.7.114 For the reasons given above, the potential magnitude of impact due to the displacement of recreation users to this site is considered to be low and, overall, trampling of vegetation and nutrient enrichment of vegetation due to dog waste would a have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Minsmere to Walberswick Heaths and Marshes SSSI

14.7.115 During construction, the key potential impact pathways experienced by the plant and habitat features of this IEF would be the same as outlined for the Minsmere European Site.

14.7.116 These impact pathways have already been discussed in detail under the Minsmere European Site and the evidence base is not repeated here. It has been concluded that none of these are likely to result a significant effect.

IEF: the SSSIs underpinning the Sandlings SPA

14.7.117 The Sandlings SPA supports acid grassland and heath habitats, together with areas of non-native conifer plantation, whilst the Leiston to Aldeburgh SSSI also supports vegetated coastal shingle at Thorpeness.

14.7.118 During construction, the key potential impact pathways experienced by the plant and habitats of this IEF would be associated with disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users). The characterisation of this impact is described in detail below.

Disturbance effects on habitats (comprising trampling effects and nutrient enrichment due to displacement of recreational users)

14.7.119 As outlined for the Minsmere European Site above, an increase in the number of visitors to an area can increase the physical trampling of heath and acid grassland vegetation, and an increase in dog-walking can also lead to a localised build-up of nutrients, due to dog faeces and urine. Information presented in the baseline **Appendix 14A2 – Designated Sites** of this volume indicate that the Sandlings SPA (including the underpinning SSSIs) is considered vulnerable to public access and disturbance. Although this is primarily associated with dogs off the lead disturbing ground-nesting birds, trampling of acid grassland, heath and vegetated shingle could also occur.

14.7.120 **Table 14B1-5** in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) indicates that the car park locations that give access to the Sandlings SPA and underpinning SSSIs already receive an estimated 630,000 recreational visits per year, and that any increase due to recreational users displaced from the site would be small (estimated to be an additional 43,000 recreational visits per annum). In addition, this pressure would be diffuse and spread across a large number of potential car park access points.

14.7.121 As indicated in **section 14.4** of this chapter, and discussed under the Minsmere European Site, primary mitigation would aim to minimise the requirement for both construction workers and existing recreational users from the Sizewell area to access the Sandlings SPA and component SSSIs for recreational purposes.

14.7.122 For this reason, the potential magnitude of impact due to the displacement of recreation users is considered to be low and, overall, trampling of vegetation and nutrient enrichment of vegetation due to dog waste would have a have a **minor adverse** effect, which is considered to be **not significant.**

IEF: Sizewell Marshes SSSI

14.7.123 During construction, the main potential impact pathways experienced by the plant and habitat features of the Sizewell Marshes SSSI would be associated with:

- direct land take resulting in habitat loss and fragmentation;
- disturbance effects on habitats (comprising trampling effects due to displacement of recreational users);
- alteration of local hydrology (including water chemistry) and hydrogeology; and
- changes in air quality.

14.7.124 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss and fragmentation

14.7.125 Building the main platform, realigning the Sizewell Drain, constructing the SSSI crossing and facilitating the national grid works. Approximately 2.9ha of habitat would be temporarily lost and restored following the construction phase, however approximately 7.03ha of permanent land take would occur from the SSSI. The 2.9ha of temporary loss includes habitats that would be impacted temporarily during the construction phase and those where replacement habitat is proposed within the site. Temporarily impacted areas are located within the corridor which will be used to install overhead powerlines. This area includes 0.9ha of fen meadow and 0.43ha of wet woodland. The wet woodland would be coppiced to enable the cable to be laid out, prior to lifting and the fen meadow would be protected from damage using appropriate methods for spreading the weight of plant in wet ground. These habitats would be retained throughout the operational phase, with occasional coppicing of the wet woodland under the overhead lines to ensure the lines are not impacted by the tree canopy.

14.7.126 Details of the botanical composition of the habitat types affected are presented in **Appendix 14A3 – Plants and Habitats** of this volume.

Table 14.10: Land take from Sizewell Marshes SSSI required to accommodate the proposed development

Development Item	Habitat Feature	Extent of temporary land take from habitat type (ha)	Extent of permanent land take from habitat type (ha)
Sizewell Marshes SSSI Land Take	Fen Meadow	0.90*	0.70
	Wet woodland	1.13*	2.63

Development Item	Habitat Feature	Extent of temporary land take from habitat type (ha)	Extent of permanent land take from habitat type (ha)
(*to accommodate:* *-the main platform and SSSI crossing,* *-realignment of Sizewell Drain,* *-the restringing of pylons*).	Dry reedbed	0.00	3.55
	Wet reedbed	0.67	0.00
	Tall ruderal	0.00	0.08
	Ditches	0.20	0.07
Habitat Loss Totals		**2.9ha**	**7.03ha**

* see paragraph above

14.7.127 The construction works to create the main platform and the SSSI crossing would result in the loss of reedbed, wet woodland and ditch habitat as defined in **Table 14.10** above. As outlined in **section 14.4** of this chapter, primary mitigation measures to create replacement reedbed and ditch habitat have already been implemented at Aldhurst Farm, adjacent to the western edge of Sizewell Marshes SSSI. In a letter dated 16 February 2015 (Ref 14.53), Natural England indicated that they were confident that the [then proposed] wetland habitat creation at Aldhurst Farm would provide satisfactory compensation in quality and quantity for the permanent loss of reedbed habitats at Sizewell Marshes SSSI.

14.7.128 As the new reedbed and ditch habitats are located adjacent to the western edge of Sizewell Marshes SSSI, separated from Sizewell Marshes SSSI only by Lover's Lane, the impacts of habitat fragmentation have been minimised as the component flora and fauna from Sizewell Marshes SSSI would be expected to colonise naturally from the areas of retained reedbed and ditch habitats.

14.7.129 The reedbed and ditch habitat creation undertaken at Aldhurst Farm has established and developed well and, as outlined in the **Appendix 14A3 – Plants and Habitats** and **Appendix 14A7 – Ornithology** of this volume, is already supporting plant and bird species characteristic of reed bed habitat and further colonisation by other species can be expected. **Plate 14.1** shows the reedbed creation:

Plate 14.1: Reedbed habitat at Aldhurst farm (photograph taken 2018)

14.7.130 Wet woodland is not a habitat type for which Sizewell Marshes SSSI is designated although it partly supports the invertebrate assemblage designated feature. The construction works to create the main platform and the SSSI crossing would result in the permanent loss of 2.6ha of wet woodland. As part of the operational landscape design, an area of replacement wet woodland is proposed to the west of the Grove, totalling 0.7ha. In addition. new scrub and woodland planting would form part of the long-term restoration outlined in the **oLEMP**. Although a new area of wet woodland would be established in the long term, an overall net loss of approximately 1.9ha would occur. Opportunities for further wet woodland creation are discussed below in **section 14.16 Invertebrates** of this chapter in respect of invertebrate Assessment Compartment 1.

14.7.131 As indicated in **Chapter 2** of this volume, the proposed development would require the re-stringing of wires on the overhead pylons to the south-west corner of the new Sizewell C platform. This would require the temporary 'loss', through coppicing, of 0.43ha of wet woodland habitat beneath the pylons. The wet woodland would be coppiced to ground level to accommodate the machinery and restringing and subsequently the coppice stumps would be allowed to regrow, and the regrowth managed at an appropriate height. Approximately 0.9ha of fen meadow habitat also lies within this corridor but this would be protected during the operation to install the overhead lines, using appropriate working methods to protect the ground. As outlined in **section 14.4** of this chapter, primary mitigation such as bog matting or similar would be implemented to ensure safe access by machinery and protection of the ground surface and coppiced vegetation. These mitigation measures will have a short term negative impact on the fen meadow habitat, but will prevent long-term damage caused by the powerline re-stringing. As such the works are considered to result in a temporary loss of fen meadow habitat only.

14.7.132 The realignment of the Sizewell Drain would result in the loss of approximately 0.7ha of fen meadow. At a meeting on 26th April 2016 with Natural England, RSPB & SWT it was agreed that Aldhurst Farm would not provide compensation for loss of fen meadow and that a compensatory approach would be required. It was agreed that SZC Co.'s focus should therefore be on impact avoidance and minimisation to this habitat although it was understood that some loss was unavoidable. A number of different approaches for compensation were discussed and most stakeholders were generally supportive of SZC Co.'s preference for a 'site rescue' approach, whereby a degraded fen meadow site would be restored or enhanced. In later discussions with Natural England specialists and others, it was agreed that the focus should be on creation of new fen meadow habitats, i.e. on sites where fen meadow habitats were not currently present. To compensate for the loss of fen meadow habitats from Sizewell Marshes SSSI, two suitable sites in East Suffolk, at Benhall and Halesworth (see **Chapter 2 Description of Permanent Development** of this volume), are included within the application, at which works would be undertaken to develop permanent compensatory fen meadow habitats.

14.7.133 Fen meadow habitats develop on sites with relatively specific underlying hydrological regimes and are typically groundwater dependent (Ref 14.54) (see **Appendix 14A3 – Plants and Habitats** of this volume). The two chosen sites appear to have suitable hydrological regimes which could be modified to enable fen meadow establishment although successful establishment would also depend on appropriate management, potentially including the import of "green hay" from Sizewell Marshes SSSI or other areas of fen meadow and potentially some use of turf transfer from the part of Sizewell Marshes SSSI subject to land-take.

14.7.134 Further work is ongoing to develop site-specific plans to maximise the likelihood of successful fen meadow establishment at both sites and to maximise the extent of habitat created, although successful establishment cannot be guaranteed.

14.7.135 Taking account of the successful primary mitigation already implemented (reedbed and ditch creation) as well as the off-site fen meadow habitat creation the impact on Sizewell Marshes SSSI would constitute a **minor adverse** effect, which is considered to be **not significant**. Whilst 0.7ha of permanent fen meadow habitat would be lost, the areas at the two compensation sites which seem most likely to support fen meadows habitats (the ‘primary foci’) comprise 1.7ha, although the potential extent of fen meadow created which is likely to be created will be defined further by an ongoing workstream. Whilst fen meadow habitats are likely to be challenging to create, two sites have been identified for creation, thereby significantly increasing the likelihood of the compensatory habitation creation works succeeding.

14.7.136 If, in the unlikely event of failure to deliver the fen meadow compensatory habitats at either site, funding of other fen meadow habitat creation projects would be implemented at alternative locations in Suffolk. In the long-term, it is concluded here that the effects on fen meadow habitats as a result of the Sizewell development would be fully compensated.

Disturbance effects on habitats (comprising trampling effects due to displacement of recreational users).

14.7.137 The majority of recreational visits to the Sizewell area are focused on woodland walks within Kenton Hills and Goose Hill or the beach, not to Sizewell Marshes SSSI (**Book 5**, **Report 5.10: Shadow HRA Report**). Currently access to Sizewell Marshes SSSI is restricted to a single permissive path around the edge, with signage and locked gates clearly indicating that the majority of Sizewell Marshes SSSI has no public access. In addition, Sizewell Marshes SSSI is very wet underfoot and this discourages casual access.

14.7.138 Sizewell Marshes SSSI supports wetland habitats of a high sensitivity that could potentially be damaged if a substantial number of additional recreational visits were to occur. Once construction of the proposed development commences, it is likely that at least 30% of recreational users would be displaced to alternative sites *away* from the Sizewell area (**Book 5**, **Report 5.10: Shadow HRA Report**). For these reasons, no increase in recreational disturbance to Sizewell Marshes SSSI is predicted. This would have an overall **neutral, not significant** effect.

Alteration of local hydrology and hydrogeology.

14.7.139 Changes in hydrological conditions are likely due to the following construction elements:

- the diversion of the Sizewell Drain within Sizewell Marshes SSSI;
- installation of a barrier between Sizewell Marshes SSSI and the main platform;
- installation of sheet piling to protect Sizewell Marshes SSSI;

- infilling the former Sizewell Marshes SSSI land; and
- construction of the SSSI crossing to provide access to the main platform.

14.7.140 Sizewell Marshes SSSI supports nationally important wetland habitats which are highly sensitivity to hydrological changes. Any changes in hydrological conditions to both groundwater and surface water (by making conditions wetter or drier) could potentially alter the plant composition of the habitat types present, leading to a loss of individual species that require specific conditions. For example, increased inundation by surface water could smother plants preventing growth and setting of seed by species not adapted to periodic inundation.

14.7.141 The national guidance for the optimum mean water table (for all fen meadows falling within the M22 community) (Ref 14.53) in the summer growing season is between about 5cm and 20cm below ground level. These are likely to be broadly representative of hydrological conditions at the best fen meadow sites but will vary at individual sites.

14.7.142 The **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) identifies two sensitive plant assemblages present within Sizewell Marshes SSSI which are reliant on groundwater influence throughout the growing season, these being:

- groups of low-growing ground-dwelling plant species; and
- plant species associated with low-nutrient and/or high lime content conditions.

14.7.143 Changes to the hydrological regime for the M22 community could result in very wet sites (where the Summer water table is usually above the surface between tussocks), which tend to be less species-rich. Even relatively short periods of inundation in the growing season can be damaging, both because of direct effects on plant communities (e.g. on seed germination) and indirect effects resulting from impacts on vegetation management (too wet for stock to graze). Conversely, while a moderate reduction in water levels may increase species diversity, a long-term reduction of the Summer water table beneath high-quality stands of M22 community could result in some loss of botanical interest, particularly of the most sensitive species; for example shallow rooting species such as Marsh Arrowgrass (*Triglochin palustris*), Lesser Spearwort (*Ranunculus flammula*), Ragged-Robin (*Silene flos-cuculi*) Marsh Pennywort (*Hydrocotyle vulgaris*), Bog Pimpernel (*Anagallis tenella*) and Marsh Lousewort (*Pedicularis palustris*).

14.7.144 To identify the extent of any potential change, a synthetic[13] hydrological baseline for Sizewell Marshes SSSI has been developed against which construction scenarios can be modelled. Results of modelling presented in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) indicate that, in the absence of mitigation, dewatering within the cut off wall could cause a drawdown in groundwater levels within Sizewell Marshes SSSI. The hydrological modelling indicates that the construction phase may cause a drawdown of water levels of less than 10cm for the majority of the time. The highest difference between baseline and with development cases is in the winter of 2024/25 when the dewatering is assumed to be at its peak.

14.7.145 The modelled drawdowns represent the worst-case scenarios and it is not envisaged that these conditions would be maintained for the entirety of the construction phase. Drawdown is most likely adjacent to the cut off wall decreasing substantially moving west. The installation of the cut off wall also has the potential to increase groundwater levels as flow paths will be blocked by an impermeable structure (see **Volume 2, Chapter 19: Groundwater and Surface Water** of the **ES** (Doc Ref. Book 6)).

14.7.146 Modelling undertaken to assess the predicted changes in water levels as a result of constructing the SSSI crossing (culvert and embankment) predicts only a very small, highly localised effect, such that during initial construction there would be a temporary 2cm reduction in water levels to the east of the SSSI crossing and a 1cm reduction to the west. This effect would rapidly diminish over distance, not being apparent beyond a radius of 90m and water levels would return to normal relatively quickly.

14.7.147 Considering the modelling and evidence base presented above, the impact of changes to underlying hydrology would constitute **minor adverse** effect, which is considered to be **not significant**.

14.7.148 Modelling work (see **Volume 2, Chapter 19: Groundwater and Surface Water** of the **ES** (Doc Ref. Book 6)) has predicted no change in the hydro chemical signature of each component of ground water and surface water and no significant changes to water chemistry are envisaged.

Changes in air quality

Dust generation

14.7.149 The detailed dust assessment included in **Chapter 12: Air Quality** of this volume identifies Sizewell Marshes SSSI as being of high sensitivity to dust deposition impacts, as it supports vegetation that could be affected by dust and that is in close proximity to and downwind of the main construction area.

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[13] A synthetic baseline is a computer model of the hydrological regime (water levels above and below ground) for the fen meadow over a typical year. By adding in the proposed development, it is possible to determine how this changes the modelled hydrological regime.

14.7.150 As indicated in **section 14.4** of this chapter, tertiary mitigation would include the development of a dust management plan outlining a range of measures that would ensure dust generation is kept to a minimum and within the threshold limits of 0.5g/m^2/day agreed with consultees. If monitoring indicates exceedance of this threshold, then additional mitigation measures would be adopted.

14.7.151 Overall, the impact of dust deposition on the Sizewell Marshes SSSI would have a negligible adverse effect, which is considered to be not significant. Further information on impacts to ecological receptors has also been provided in **Chapter 12 Air Quality** of this volume.

Oxides of nitrogen and sulphur dioxide

14.7.152 The air dispersal modelling outlined in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) indicates that there would be no exceedance of Critical Levels for the annual process contributions for NO_x.

14.7.153 No exceedances of the Critical Level of SO_2 emissions have been identified during commissioning.

14.7.154 Overall, the impact of both NO_x and SO_2 emissions on the Sizewell Marshes SSSI would have a **negligible adverse** effect, which is considered to be **not significant**. Further information on impacts to ecological receptors is also provided in **Chapter 12 Air Quality** of this volume.

Nutrient nitrogen deposition

14.7.155 Apart from reedbed, Air Pollutant Information System indicates that habitat features within Sizewell Marshes SSSI are sensitive to deposition of both atmospheric nitrogen and acid deposition, for similar reasons as outlined above under the Minsmere European Site. In addition, as outlined in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume), the best areas of fen meadow habitat (Grades 1 and 2) on Sizewell Marshes SSSI support areas of low-growing plant species and species indicative of low fertility, which would be particularly sensitive to an increase in nutrient nitrogen deposition.

14.7.156 Approximately 90% of Sizewell Marshes SSSI (104.33ha total) would lie within the zone where the majority of both nitrogen and acid deposition from the proposed development is likely to occur. This would include all the Grade 1 and Grade 2 fen meadow.

14.7.157 Habitat within Sizewell Marshes SSSI (the fen meadow, and swamp/reedbed) are predicted to see slight nutrient increases during the two-year commissioning period, of the diesel generators. For both of these vegetation types, the background deposition levels (12 kg/N/Ha/yr) are quite close to the lower level (15-25 and 15-30 kg/N/Ha/yr) of the relevant Critical

Load range, suggesting that the predicted increases could have an effect, particularly on fen meadow. The area of reedbed most likely to be affected would be lost to accommodate the main platform. The magnitude of impact of nutrient nitrogen deposition would therefore be medium but the duration would be short-term and temporary with emissions dropping after the commissioning period, after which time vegetation would be expected to recover.

14.7.158 Overall, the impact of nutrient nitrogen deposition on the Sizewell Marshes SSSI would have a short-term, **minor adverse** effect, which is considered to be **not significant**. Further information on impacts to ecological receptors is provided in **Chapter 12 Air Quality** of this volume.

Acid deposition

14.7.159 During commissioning there would be an increase in acid deposition within Sizewell Marshes SSSI of 4.2% at one receptor location and 8.4% at another. However, as background acid deposition already significantly exceeds the Critical Load, this increase would be expected to have only a minimal impact and as outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) grazing marsh is a habitat with a basic influence so soils could be to an extent buffered from such changes. As above the duration would be short-term and temporary with emissions dropping after the commissioning period after which time vegetation would be expected to recover.

14.7.160 Overall, the impact of acid deposition on the Sizewell Marshes SSSI would have a low magnitude of impact and it is reversible, resulting in a **minor adverse** effect, which is considered to be **not significant**.

Traffic Emissions

14.7.161 Traffic emissions during the construction early year (2023) and peak year (2028), and operational year (2034) scenarios. As detailed in **Volume 1**, **Appendix 6H** of the **ES** (Doc Ref. Book 6) only oxides of nitrogen (NO_x), and particulate matter (PM_{10} and $PM_{2.5}$) are assessed in **Chapter 12 Air Quality** of this volume. The air quality effects for the study area as a whole resulting from traffic associated with the construction of the proposed development are predicted to be **not significant** for all sensitive receptors within the study area. Embedded mitigation associated with the scheme design and addition of the associated development sites including park and ride facilities, accommodation campus, a **Construction Workforce Travel Plan, Construction Traffic Management Plan** and rail facilities have all been included to reduce traffic movements and subsequent vehicle emissions.

IEF: Sizewell Levels and Associated Areas and Southern Minsmere Levels CWSs

14.7.162 Sizewell levels and Associated Areas CWS includes the coniferous plantations of Goose Hill and Kenton Hills, whilst the open rides within the plantations support fragments of acid grassland. More extensive acid grasslands and heath are found within Retsom's Field within the Southern Minsmere Levels CWS.

14.7.163 During construction, the main potential impact pathways experienced by the plant and habitat features of this IEF would be associated with:

- direct land-take resulting in habitat loss and fragmentation;
- disturbance effects on habitats (comprising trampling effects due to displacement of recreational users); and
- changes in air quality.

14.7.164 The characterisations of the above impacts are described in detail below.

Direct land-take resulting in habitat loss

14.7.165 The construction of the proposed development would result in the loss of approximately 51ha of land from within Sizewell levels and Associated Areas CWS and the Southern Minsmere Levels CWS. The sites are regarded as being of medium sensitivity to habitat loss. The habitat types that make up the land take are summarised in **Table 14.11**, details of the botanical composition of the habitat types affected are presented in **Appendix 14A3 – Plants and Habitats** of this volume.

Table 14.11: Land take from Sizewell Marshes and Associated Areas CWS and Southern Minsmere Levels CWS

Habitat feature	Extent of land take from the CWS (ha)
Goose Hill (Conifer plantation, mixed plantation and semi-natural broadleaved woodland)	46ha
Acid grassland and heath (Retsom's field).	4.5ha of semi-improved acid grassland 0.3ha dry heath/acid grassland mosaic

14.7.166 The loss of conifer plantation within Goose Hill would be permanent but potentially reversible if additional conifers were planted post-construction but the extent of habitat would be reduced. Approximately 50ha of mixed woodland would be created throughout the site and further strengthening of existing tree belts and hedgerows would occur under the proposals outlined in the **oLEMP.** There would also be a loss of acid grassland from the open rides which would also be permanent. It is possible to recreate acid type grasslands on suitable substrates and this process is already ongoing at Aldhurst Farm and at the reptile receptor areas at Sizewell Gap. Likewise, the loss of an area of heath and acid grassland within Retsom's Field to accommodate WMZ 1 would be for the duration of construction only and the habitat would be reinstated once the WMZ is removed.

14.7.167 As outlined in **section 14.4** of this chapter, habitat loss from within the Sizewell Levels and Associated Areas CWS has been kept to a minimum, with the entirety of the Kenton Hills Conifer Plantation being retained. The conifer plantation of Goose Hill mainly comprises non-native species including Corsican Pine (*Pinus nigra maritima*) and is not considered to be a habitat type of particular intrinsic ecological value, although the CWS citation (Ref 14.55) recognises that the conifers do provide a nesting and foraging resource for a variety of bird species. It is also of some importance to foraging bats (see **section 14.13** of this chapter).

14.7.168 The construction of WMZ 1 in Retsom's Field would result in the loss of 4.5 ha of acid grassland and 0.3ha of heath within the Southern Minsmere Levels CWS. This would be temporary and reversible as habitat would be restored post construction resulting in a moderate magnitude of impact. Landscape-scale habitat creation of extensive areas of summer parched grassland with areas of scrub across the wider EDF Energy estate under the operational masterplan would provide long-term replacement for any losses of acid grassland and heathland.

14.7.169 Despite the fact that the loss of acid grassland and heath is temporary (9-12 years' duration) and reversible, combined with the loss of the conifer plantation (non-reversible) the impact of this habitat loss from the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS would constitute a medium-term, **moderate adverse** effect, which is considered to be **significant.**

Disturbance effects on habitats (comprising trampling effects due to displacement of recreational users)

14.7.170 As outlined in the **Plants and Habitat Synthesis Report** (**Appendix 14B1** of this volume) the Sizewell area which includes Kenton Hills and Goose Hill, receives in the region of 500,000 recreational visits a year. Of these, 29% indicated that they would avoid the Sizewell area during the construction of the proposed development and seek other locations in which to undertake recreation.

14.7.171 As indicated above, Kenton Hills already receives a high level of recreational visits and the existing car park would be extended and Kenton Hills kept open during the construction period. The woodland rides within are well surfaced and no vegetation sensitive to an increase in visitor numbers has been identified. It is considered that an increase in visitor numbers would have a **minor adverse** effect, which is considered to be **not significant**.

Changes in air quality

Dust generation

14.7.172 The Sizewell levels and Associated Areas CWS and Southern Minsmere Levels are sensitive to dust deposition and within the footprint of the site

14.7.173 As indicated in **section 14.4** of this chapter, tertiary mitigation would include the development of a dust management plan outlining a range of measures that would ensure dust generation is kept to a minimum and within the threshold limits of 0.5g/m^2/day agreed with consultees. If monitoring indicates exceedance of this threshold then additional mitigation measures would be adopted.

14.7.174 Overall, the impact of dust deposition on the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

Oxides of nitrogen and sulphur dioxide

14.7.175 The air dispersal modelling outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) predicts an increase in NO_x emissions within the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels due to annual process contributions but, importantly, there would be no exceedance of Critical Levels for the annual process contributions for NO_x. The effect would be temporary for the duration of the commissioning period.

14.7.176 Overall, the impact of NO_x emissions on the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

14.7.177 As for other designated sites, an increase in SO_2 emissions is predicted, but the PEC is less 44% of the Critical Level and no exceedance of annual Critical Levels for SO_2 emissions are predicted for the CWSs. The effect would be temporary for the duration of the commissioning period. Overall, the impact of SO_2 emissions on the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

Nutrient nitrogen

14.7.178 The maximum PC for nutrient nitrogen deposition, as a result of the diesel generators, represents an increase of 46% of the lower Critical Load during the commissioning phase. This would be experienced by an area of coniferous woodland in the Sizewell Levels and Associated areas CWS (i.e. Goose Hill). However, this is the only area that would experience such high increases and the background nitrogen deposition for this location and habitat feature is already more than five times the lower end of the Critical Load range (and nearly twice the upper end figure). The effect would be temporary for the duration of the commissioning period, although the majority of this area would have been cleared to accommodate the proposed development.

14.7.179 Overall, the impact of nutrient nitrogen deposition on the Sizewell Levels and Associated Areas CWS and the Southern Minsmere Levels CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

Acid deposition

14.7.180 The air dispersal modelling presented in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) predicts an increase in acid deposition although notes that existing background deposition already exceeds the Critical Load Threshold. For the Sizewell Levels and Associated Areas CWS, this exceedance is 139.7%. The minor increase due to PC is expected to raise this to 141.3% of the Critical Load. For this reason, this minor increase is not expected to have a significant effect on the CWS. The impact on the Southern Minsmere Levels CWS is predicted to be less than 1% of the Critical Load.

14.7.181 Overall, the impact of acid deposition on the Sizewell Levels and Associated Areas CWS and Southern Minsmere Levels CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Suffolk Shingle Beaches CWS

14.7.182 The Suffolk Shingle CWS includes all the areas of vegetated shingle along the Suffolk Coast that have not already been given a statutory designation (SAC or SSSI): a total of 38.83ha with approximately 7.0ha of habitat located on the seaward frontage of the main platform. This includes the area of vegetated shingle and sand dune immediately on the seaward edge of the site and the existing Sizewell A and B power stations. The vegetated shingle adjacent to the site is considered to be of national importance.

14.7.183 During construction, the key potential impact pathways experienced by the plant and habitat features of the CWS would be associated with:

- direct land take resulting in habitat loss and fragmentation; and
- changes in air quality.

14.7.184 The characterisation of the above impacts is described in detail below.

Direct land take

14.7.185 The construction of the new coastal defences, as well as the establishment of the Sizewell C main platform, would require the removal of the existing habitats within the footprint of these structures. The temporary losses are estimated to be of approximately 2.91ha of vegetated shingle and 4.04ha of vegetated sand dunes from within the CWS. An existing strip of semi-improved grassland outside and to the west of the CWS would also be permanently lost under the new coastal defences.

14.7.186 Once the new Sizewell C platform has been established and the new coastal defences are in place, habitats across these defences and the re-instated foreshore area would be re-established. The balance of habitats between vegetated sand dunes and vegetated shingle to be re-established requires finalisation but it assumed here that the split would include approximately 3.95ha of vegetated shingle and 5.08ha of vegetated sand dunes. The extent of both habitats is therefore anticipated to be slightly greater than the existing extent, as it is assumed these habitats would be established across the entirety of the coastal defences and reinstated foreshore.

14.7.187 The temporary loss of habitat from the Suffolk Shingle Beaches CWS represents approximately 18% of the designated area (38.83ha), resulting in a medium magnitude of impact. The Suffolk Shingle Beaches CWS is considered to be of national importance due to the plant species present.

14.7.188 Primary mitigation outlined in **section 14.4** entails safeguarding and storing the existing surface layers of the shingle and sand substrate (and the seedbank within) and placing it over the new coastal defences and foreshore to allow re-establishment and recolonization of the vegetated shingle and sand dune habitats. Evidence from the construction of the Sizewell B power station and its coastal frontage has demonstrated that recreation of vegetated shingle and stabilised sand dunes across a heavily modified foreshore is feasible and similar measures would be deployed for the establishment of the frontage for the Sizewell C main platform.

14.7.189 Given future sea level rise, the newly established foreshore habitats would be more susceptible to erosion by the sea in a shorter timeframe than if the new sea defences had not been constructed. As outlined under primary mitigation (**section 14.4** of this chapter) a monitoring and mitigation plan for coastal processes effects would be developed to ensure, as far as possible, the maintenance of the extent of foreshore sediments over time. This approach would be expected to maintain vegetated shingle and sand dune habitats for the same period.

14.7.190 The loss of an area of vegetated shingle and sand dune associated with the construction of the new sea defences would be regarded as permanent and non-reversible. This needs to be set in the context of habitat erosion over time by natural processes due to predicted sea level rise (for sea level modelling detail refer to **Chapter 20 Coastal Geomorphology and Hydrodynamics**).

14.7.191 The impact of this habitat loss from the Suffolk Shingle Beaches CWS would constitute a **moderate adverse** effect, which would be considered to be **significant**.

Changes in air quality

14.7.192 As discussed above under Sizewell Levels and Associated Areas CWS, as the Suffolk Shingle Beaches CWS is within the boundary of the proposed development, it would be subject to similar air quality impacts. Including dust, NO_x and SO_2 and both nutrient nitrogen and acid deposition.

14.7.193 However, this habitat would be lost whilst the HCDF is constructed and then reinstated following the construction of the HCDF. Overall, it is considered that this would have a **negligible adverse** effect on reinstated habitats, which is considered to be **not significant**.

IEF: Broadleaved and mixed woodland within the site boundary

14.7.194 Within the site boundary are a number of areas of broadleaved and mixed woodland which collectively have been identified as important at the county level.

14.7.195 During construction, the main potential impact pathways experienced by the plants and habitats of this IEF would be associated with:

- direct land take resulting in habitat loss and fragmentation; and
- changes in air quality.

14.7.196 The characterisations of the above impacts are described in detail below.

Direct land take resulting in habitat loss and fragmentation

14.7.197 The construction of the proposed development would result in the permanent loss of 7.3ha of broadleaved woodland including Coronation Wood. The loss of broadleaved and mixed woodland would be permanent and potentially non-reversible in some locations, although approximately 50ha of mixed woodland would be created throughout the site and further strengthening of existing tree belts and hedgerows would occur under the proposals outlined in the **oLEMP**. Further, 0.7ha of broad-leaved wet woodland would be created in the north of the site.

14.7.198 Primary mitigation outlined in **section 14.4** of this chapter indicates that the majority of the existing broadleaved and mixed woodland resource within the site boundary would be retained. In addition, as presented in the **oLEMP** further planting is identified in key locations thereby reducing effects in the long-term. The impact of this habitat loss would constitute a **minor adverse** effect, which is considered to be **not significant**.

Changes in air quality

14.7.199 The air dispersal modelling outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) included Receptor E11 (Reckham Pits) as an area of broadleaved woodland to assess potential effects on broadleaved woodland habitat within the likely ZoI of the air dispersal modelling (considered to be approximately 1km radius from the point of origin).

Dust generation

14.7.200 Broadleaved woodland is likely to experience some impacts from dust deposition, but the tertiary dust mitigation measures outlined in **section 14.4** of this chapter would keep this to a minimum, resulting a minor adverse effect, which is considered to be not significant.

Oxides of nitrogen and sulphur dioxide

14.7.201 The air dispersal modelling indicates that there would be no exceedance of the annual Critical Levels for NO_x.

14.7.202 Reckham Pits Wood and similar areas of broadleaved and mixed woodland would not experience any exceedances of the Critical Level for SO_2 emissions. This would result in a **neutral**, **not significant** effect.

Nutrient nitrogen and acid deposition

14.7.203 Existing levels of background nitrogen deposition at Reckham Pits Wood are already at the upper Critical Load threshold. There would be an exceedance of the Critical Load threshold for nutrient nitrogen deposition during the commissioning phase. The minor PC contribution increase is unlikely to cause a significant change to existing vegetation given existing levels of nutrient nitrogen deposition.

14.7.204 No exceedance of Critical Load for acid deposition is envisaged.

14.7.205 Overall, the impact of any changes in air quality to broadleaved woodland would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Acid grassland within the site boundary

14.7.206 During construction, the main potential impact pathways experienced by the plant and habitat features of this IEF would be associated with:

- direct land take resulting in habitat loss and fragmentation; and
- changes in air quality.

14.7.207 The characterisations of the above impacts are described in detail below.

Direct land take

14.7.208 The construction of the proposed development would result in the loss of 7.8ha of acid grassland to accommodate WMZs 1 and 5 in Retsom's Field and Black Walks respectively. This would result in a medium magnitude of impact. The loss of acid grassland would be for a period of approximately 9-12 years and is potentially reversible.

14.7.209 Primary mitigation in **section 14.4** of this chapter outlines the landscape scale restoration of the majority of the existing arable areas within the EDF Energy estate to recreate habitat characteristic of the Sandlings, including acid grassland with further details provided in the **oLEMP**.

14.7.210 The loss of acid grassland would be temporary (9-12 years duration) and is likely to be reversible and so the impact of this loss of acid grassland would constitute a **minor adverse** effect, which is considered to be **not significant**.

Changes in air quality

14.7.211 The air dispersal modelling outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) includes areas of acid grassland and heath at Leiston Common (Receptor E7) and Retsom's Field (which lies within Receptor location E13). Leiston Common is approximately 1.5km from the proposed diesel generators, so Receptor E13, which is within 1km, has been used to assess potential effects on acid grassland habitat within the likely ZoI.

Dust

14.7.212 Acid grassland is likely to experience some impacts from dust deposition, but tertiary dust mitigation measures outlined in **section 14.4** of this chapter would keep this to a minimum, resulting a **minor adverse** effect, which is considered to be **not significant**.

Oxides of nitrogen and sulphur dioxide

14.7.213 The air dispersal modelling indicates that, for Retsom's Field, there would be no exceedance of the annual Critical Levels for NO_x but some exceedance of the daily Critical Level for NO_x. This is not thought to be significant given that no exceedances of the annual Critical Level are anticipated, and vegetation should be able to recover from any short-term increase. There are no predicted exceedances of the Critical Level for SO_2 emissions. This would result in a **neutral, not significant** effect.

Nutrient nitrogen and acid deposition

14.7.214 Existing levels of background nitrogen deposition at Receptor E13 are already above the lower Critical Load threshold. There would be an exceedance of the Critical Load threshold for nutrient nitrogen deposition during the commissioning phase. However, the minor PC contribution increase is unlikely to cause a significant change to existing vegetation given existing levels of nutrient nitrogen deposition.

14.7.215 No exceedance of Critical Load for acid deposition is envisaged. Overall, the impact of any changes in air quality acid grassland would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Deptford Pink

14.7.216 The desk-study identified a record for Deptford Pink growing within the site on the sea defence. Deptford Pink is a nationally scarce plant which receives full protection under Schedule 8 of the W&CA (Ref 14.7) although it may not be of native occurrence in this location (**Appendix 14B1 – Plants and Habitat Synthesis** of this volume).

14.7.217 During construction, the key potential impact pathways experienced by the Deptford Pink population would be associated with direct loss of individual plants resulting from land take. The characterisation of this impact is described below.

Direct land take

14.7.218 Earthworks and construction of the new sea defence are likely to remove or substantially disturb the area in which Deptford Pink was located, leading to the loss of the habitat in which this plant was found.

14.7.219 As Deptford Pink requires an open sandy substrate, suitable habitat would be retained on the existing sea defence for the Sizewell B power station and in the longer term would be re-established across the frontage seaward of the new coastal defences for the main platform.

14.7.220 As outlined in **section 14.4** of this chapter, a mitigation and monitoring strategy for Deptford Pink would be developed which would entail the translocation of any adult plants and developing rosettes to a new location on the Sizewell B power station sea defence that would not be directly affected by the construction of the proposed development. The translocation would be monitored pre- and post-construction and would be conducted under licence from Natural England. As the translocation is not guaranteed to be successful the impact of the population loss of Deptford Pink would constitute a **moderate adverse** effect, which is considered to be **significant**.

Inter-relationship effects

14.7.221 This section provides a description of the identified inter-relationship effects that are anticipated to occur on plant and habitat receptors between the individual environmental effects arising from construction of the proposed development.

14.7.222 It is considered that potential changes to local hydrology and air quality could act together to cause changes to vegetation structure, type and composition, particularly within Sizewell Marshes SSSI.

14.7.223 As outlined in tertiary mitigation (**section 14.4** of this chapter) hydrological and botanical monitoring of Sizewell Marshes SSSI would continue through the construction phase. If a negative trend is found and impacts to the SSSI identified, then manipulation of water levels would be used to re-establish the effective hydrological regime. If adverse vegetational changes were detected, further management interventions could be used, including increased grazing to reduce the density of any increasingly dominant coarse grass and sedge species.

ii. Operation

14.7.224 During the operational phase of works, the main impact pathways on plants and habitats would be associated with:

- any long-term alterations of coastal processes;
- any long-term changes in air quality; and
- the long-term changes to habitat types due to the landscape scale restoration of the EDF Energy estate.

14.7.225 A number of the operational impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in a non-significant effect. The impact pathways that have been scoped out of this assessment, along with the rationale for scoping them out, are detailed below.

14.7.226 An operational **Outline Drainage Strategy** (**Volume 2, Appendix 2A**) (outlined in **section 14.4** of this chapter) would manage surface water discharge during the operational phase such that no potential for polluted surface water run-off into designated sites would exist and no significant effects are envisaged.

14.7.227 Hydrological modelling does not indicate any significant changes to water levels during the operational phase of the development (**Volume 2, Chapter 19: Groundwater and Surface Water** of the **ES** (Doc Ref. Book 6)). In addition, hydrological modelling of the SSSI crossing has demonstrated that during the operational phase, water levels would stabilise, and long-term changes are predicted to be less than a 1cm increase in levels to the west of the crossing (i.e. up-gradient), with a corresponding reduction to the east, with no change apparent 60m from the SSSI crossing on both sides. Based on the results of this modelling, no significant changes to the hydrological regime of the Minsmere European Site is envisaged due to the crossing.

14.7.228 The landscape restoration of the EDF Energy estate would convert existing arable land to be used for the temporary construction area into summer parched grassland characteristic of the Suffolk Sandlings. This, together with existing habitat creation at Aldhurst Farm and the reptile receptor area, would create approximately 300ha of dry summer grassland and would link existing acid grassland at Leiston Common and Broom Covert and provide connectivity between heath and acid grassland within the Minsmere European Site to the north and Aldringham Walks to the south. Overall it is considered that this restoration would deliver biodiversity gain (**Chapter 14, Appendix 14.E – Biodiversity Metric Net Gain Calculations Report**) and would be a **moderate beneficial** effect, which is considered to be **significant.**

14.7.229 Following the review of potential impact pathways, it is considered that the following IEFs can be scoped out as it is not envisaged that there are any obvious impact pathways and no significant effects are envisaged. The following IEFs have been scoped out of assessment during the operational phase:

- IEF: Alde, Ore and Butley Estuary SAC, Ramsar site and SSSI.
- IEF: Orfordness to Shingle Street SAC.
- IEF: SSSIs underpinning the Sandlings SPA.
- IEF: Suffolk Shingle Beaches CWS.
- IEF: Deptford Pink.

IEF: The Minsmere European Site

14.7.230 During operation, the main impact pathways experienced by the Minsmere European Site would be associated with:

- any alteration of coastal processes; and
- any changes in air quality.

14.7.231 The characterisations of the above impacts are described in detail below.

Alteration of coastal processes

14.7.232 Modelling results outlined in the **Plants and Habitat Synthesis** (**Appendix 14B1** of this volume) indicate that during operation, the BLF is not expected to have any significant effect on coastal processes during its operational life and **no significant** effects on the Minsmere European Site are envisaged.

14.7.233 Modelling results outlined in the **Plants and Habitat Synthesis** (**Appendix 14B1** of this volume) and detailed in **ES** (Doc Ref. Book 6) **Chapter 20: Coastal, Geomorphology, Hydrodynamics** and **Chapter 22: Marine ecology** indicate that shoreline regression would eventually expose the HCDF and that during the later stages of station operation this may disrupt longshore sediment transport. Additional mitigation measures (beach management practices) are likely to be required. These measures would be time limited and monitored until deemed no longer required, for example natural shoreline regression having eroded the Minsmere European Site frontage to such an extent that beach nourishment is non effective. Due to the proposed mitigation, this is considered to be a **negligible adverse** effect, which would be **not significant**. No significant effects on the Minsmere European Site are envisaged.

Changes in air quality

14.7.234 The air dispersal modelling outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) does not predict any exceedance of the annual Critical Level for NO_x during routine testing which would occur in the operational phase of the power station.

14.7.235 The assessment of impacts against the daily NO_x Critical Level, however, does indicate exceedance. Daily NO_x has been assessed as described in **Chapter 12: Air Quality** of this volume.

14.7.236 Dispersal modelling (see **Appendix 14B1 – Plants and Habitats Synthesis Report** of this volume) shows that the ZoI of any exceedance of daily NO_x is confined to a relatively small area encompassing the southern end of the Minsmere to Walberswick Heaths and Marshes SAC and SSSI and the northern end of the Sizewell Marshes SSSI. It is reasonable to consider that the short-term (24 hour) mean for NO_x is of less importance than the annual mean, as vegetation exposed to levels of NO_x above the Critical Level will be more likely to recover from that exposure if the exceedance is for a short duration. A report from the Centre for Ecology and Hydrology (Ref 14.56) states that 'The United Nations and Economic Committee for Europe (UN/ECE) Working Group on Effects' strongly recommended the use of the annual mean value, as the long-term effects of NO_x are thought to be more significant than the short-term effects. Further, the likelihood of the meteorological conditions that lead to the worst-case impacts coinciding with the operation of the plant is considered to be low (<2%).

14.7.237 No exceedances of the Critical Level for SO_2 emissions are envisaged.

14.7.238 During the routine testing, the nutrient nitrogen deposition increase would be 3.3% of the Critical Load at the dry heath habitat (and lower at the other habitats), representing a small increase against the existing background nitrogen deposition above the lower value of the Critical Load range, and over a small area. This would result in a **minor adverse** effect, which is considered to be **not significant**.

14.7.239 The highest acid deposition increase would be 7% at the receptor within the grazing marsh. The background acid deposition at this location already significantly exceeds the Critical Load and therefore this increase would be expected to have only a small impact. This change has been calculated for the closest part of the Minsmere European Site to the diesel generators (and therefore represents the worst case); the PCs over the rest of the site would be below this value.

14.7.240 As no exceedance of the Critical Level for annual NO_x is anticipated and the fact that the daily NO_x is for such a short duration during the operational phase of the power station, the impact of both nutrient nitrogen and acid deposition on the Minsmere European Site would have a **negligible adverse** effect, which is considered to be **not significant**.

14.7.241 During the operational phase traffic emissions associated with vehicle movements to and from the main development site would be **negligible** and **not significant**. Further details are provided in **Chapter 12 Air Quality** of this volume.

IEF: Minsmere to Walberswick Heaths and Marshes SSSI

14.7.242 During operation, the main impact pathways experienced by this IEF would be associated with:

- alteration of coastal processes; and
- changes in air quality.

14.7.243 The characterisation of the impacts of the above have already been described above for the Minsmere European Site.

IEF: The Sizewell Marshes SSSI

14.7.244 During operation, the key impact pathway experienced by Sizewell Marshes SSSI would be associated with changes in air quality. The characterisation of this impact is described below.

Changes in air quality

14.7.245 As discussed above for the Minsmere European Site, there would be an exceedance of the Critical Level for daily NO_x above the Daily Critical Level during routine operational testing. However, although the predicted atmospheric NO_x levels may increase while the installation is in operation, this is an overestimation as the diesel generators would only operate for a maximum of 720 hours in any one year in total (8.2% of a full common year). Further, the likelihood of the meteorological conditions that lead to the worst-case impacts coinciding with the operation of the plant is considered to be low (<2%). It is therefore considered that these habitats would have time to recover from any short-term exposure to elevated levels.

14.7.246 No exceedances of the Critical Level for SO_2 emissions are envisaged.

14.7.247 Overall, the impact of both NO_x and SO_2 emissions on the Sizewell Marshes SSSI would have a **negligible adverse** effect, which is considered to be **not significant**.

14.7.248 During the routine testing, the nutrient nitrogen deposition increase would be only 0.6% and 0.9% at the two receptor locations, resulting in a very low and low magnitude of impact respectively. This would result in a **negligible adverse** effect to changes in the vegetation, which is considered to be **not significant**.

14.7.249 During routine operational testing, the acid deposition increase would be only 1.4% and 2.8% at the two receptor locations resulting in a low magnitude of impact. This would result in a **negligible adverse** effect to changes in the vegetation, which is considered to be **not significant**. The background acid deposition already significantly exceeds the Critical Load and this increase would be expected to have only a minimal impact. The **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicate that grazing marsh is a habitat with a basic influence so soils are likely to be well buffered from such changes.

14.7.250 Overall, the impact of both nutrient nitrogen and acid deposition on the Sizewell Marshes SSSI would have a **negligible adverse** effect, which is considered to be **not significant**.

14.7.251 During the operational phase traffic emissions associated with vehicle movements to and from the main development site would be **negligible** and

not significant. Further details are provided in **Chapter 12 Air Quality** of this volume.

IEF: Sizewell Levels and Associated Areas CWS

14.7.252 During operation, the main impact pathway experienced by the Sizewell Levels and Associated Areas CWS would be associated with changes in air quality. The characterisation of this impact is described in detail below.

Changes in air quality

14.7.253 During operation, while diesel generators are in operation, there would be an exceedance of the Critical Level for daily NO_x within the Sizewell Levels and Associated Areas CWS. However, although the predicted atmospheric NO_x levels may increase, this is an overestimation of the overall operational load as the diesel generators would only operate for a maximum of 720 hours in any one year (8.2% of a full common year). Further, the likelihood of the meteorological conditions that lead to the worst-case impacts coinciding with the operation of the plant is considered to be low (<2%). It is therefore considered that these habitats would have time to recover from any short-term exposure to elevated levels, and no exceedance of the annual Critical Level is predicted.

14.7.254 Overall, the impact of daily NO_x emissions on the Sizewell Levels and Associated Areas CWS would have a negligible adverse effect, which is considered to be not significant.

14.7.255 The maximum PC for nitrogen deposition, as a result of the diesel generators, represents an increase of 13% during routine operation. This would be experienced by an area of coniferous plantation at Goose Hill within the Sizewell Levels and Associated areas CWS. However, this is the only area of the CWS that would experience such high increases, and the background nitrogen deposition for this location and habitat feature is already more than five times the lower end of the Critical Load range (and nearly twice the upper end figure). More importantly, the majority of the conifer plantation would be cleared for the development.

14.7.256 No exceedances of the Critical Loads for acid deposition are envisaged.

14.7.257 Overall, during operation the impact of nutrient nitrogen and acid deposition on the Sizewell levels and Associated Areas CWS would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Broadleaved and mixed woodland within the site boundary

14.7.258 During operation, the main impact pathway experienced by broadleaved woodland (see **Figure 14A3.1**) within the site boundary would be associated with changes in air quality. The characterisation of this impact is described in detail below.

Changes in air quality

14.7.259 The air dispersal modelling indicates that there would be a small exceedance of the daily Critical Level for NO_x. However, although the predicted atmospheric NO_x levels may increase while the installation is in operation, this is an overestimation as the diesel generators would only operate for a maximum of 720 hours in any one year (8.2% of a full common year) and more importantly no exceedance of the annual Critical Load is envisaged. It is therefore considered that broadleaved woodland would have time to recover from any short-term exposure to elevated levels.

14.7.260 No exceedances of the Critical Levels for SO_2 are envisaged during operation.

14.7.261 The contribution to deposition at Reckham Pits Wood is predicted to be less than 1% of the respective Critical Loads. No exceedance for either nutrient nitrogen or acid deposition are predicted during operation.

14.7.262 Overall, during operation the impact of air quality on broadleaved woodland would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Acid grassland within the site

14.7.263 During operation, the main impact pathway experienced by acid grassland would be associated with changes in air quality. The characterisation of this impact is described in detail below.

Changes in air quality

14.7.264 Within Retsom's Field there would be an exceedance of the daily Critical Level for NO_x although this is not likely to be significant given that no exceedances of the annual Critical Level are anticipated, and that vegetation should be able to recover from any short-term increases.

14.7.265 No exceedances of the Critical Levels for SO_2 are envisaged during operation.

14.7.266 The contribution to deposition at Retsom's Field is predicted to be less than 1% of the respective Critical Loads. No exceedances for either nutrient nitrogen or acid deposition are predicted during operation.

14.7.267 Overall, during operation the impact of air quality on acid grassland would have a **negligible adverse** effect, which is considered to be **not significant**.

Inter-relationship effect

14.7.268 This section provides a description of the identified inter-relationship effects that are anticipated to occur on plant and habitat receptors between the individual environmental effects arising from operation of the proposed development.

14.7.269 No inter-relationship effects have been identified for the operational phase.

d) Mitigation and monitoring

i. Mitigation

14.7.270 Primary and tertiary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter. The majority of residual effects have been reduced to not significant levels.

14.7.271 A total of 0.7ha of new wet woodland is proposed to compensate for the loss of wet woodland associated with the SSSI crossing and the diversion of the Sizewell Drain (Primary mitigation). A wet woodland strategy to define further opportunities for wet woodland compensatory habitats would be developed. The wet woodland strategy would define opportunities to create further areas of wet woodland including the following:

- It would be possible over the long-term to create a small area of wet woodland habitat at Aldhurst Farm although this would at the expense of an area of existing reedbed, a more valued wetland habitat in the context of SSSI compensatory habitat provision. This would not entirely replicate the wet woodland habitats lost from Assessment Compartment 1 but would provide long-term permanent wet woodland habitat in addition to that provided at the north eastern extent of the site.
- Another long term opportunity to create additional wet woodland exists by either (i) allowing the proposed reedbed in the north-east of the site to undergo natural succession to form an extended area of wet woodland (additional 1.2ha).
- Another long term opportunity to create additional wet woodland exists by establishing an additional area of wet woodland at one of the Fen Meadow compensation sites, although not at the expense of fen meadow habitats proposed at these locations. At Benhall, an area of wet Alder woodland is immediately adjacent to the site and could be extended into the site by manipulating water levels or by some local shallow excavation of topsoil.

14.7.272 SZC Co. will develop further its wet woodland strategy in discussion with Natural England and other ecological stakeholders.

ii. Monitoring

Construction

IEF: Minsmere European site

Recreational displacement

14.7.273 Prior to the construction phase commencing, further baseline monitoring would be undertaken in those locations that recreational users indicated they might access as alternatives to the Sizewell area and where potentially significant effects could occur, for example the outer part of the RSPB Minsmere Reserve.

14.7.274 Monitoring would then be repeated during construction, and if monitoring shows an increase in site usage which can be attributed to recreational displacement from the Sizewell area, then local mitigation measures, to be agreed in advance with local land managers and aimed at reducing the impacts of the additional recreational disturbance, would be implemented.

Air quality

14.7.275 As outlined in **section 14.4** of this chapter**,** a construction dust management plan would be developed to minimise the generation of dust. Monitoring would be put in place to determine the success of the dust mitigation measures. If at any point dust levels exceed a deposition rate of $0.5g/m^2/day$ then dust generating activities would be stopped until additional mitigation measures have been put in place.

IEF: Sizewell Marshes SSSI

Habitat loss

14.7.276 As outlined under in the **Appendix 14A3 – Plants and Habitats** of this volume, the reedbed and ditch habitat creation at Aldhurst Farm is well-established and is already supporting plant and bird species characteristic of reedbed habitat. A management strategy for the site, which includes monitoring targets, is in place (Ref 14.57).

14.7.277 The off-site permanent fen meadow compensation sites would require the development of an integrated management and monitoring programme to ensure the site(s) meet the objectives of the habitat creation requirements.

Alteration of hydrology and hydrogeology

14.7.278 As outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) the fen meadow habitats within the Sizewell Marshes SSSI have been subject to a long running monitoring programme undertaken on behalf of the SWT and SZC Co. During construction and operation this monitoring programme would continue, in particular recording the extent of the two sensitive plant assemblages within the Grade 1 and 2 fen meadow, namely low growing species and species indicative of nutrient poor conditions.

14.7.279 As at present, if monitoring indicates a measurable decline in the extent of these sensitive plant assemblages or indicates that habitat condition is deteriorating, for example due an increase in the extent and abundance of coarse grass and sedge species, then it would be appropriate to undertake additional mitigation. Additional mitigation could include additional stock grazing or a cutting regime to remove excess vegetation.

Operation

IEF: Sizewell Marshes SSSI

Habitat loss

14.7.280 As outlined above under construction, monitoring of habitat creation areas, including the Aldhurst Farm habitat compensation area and the permanent fen meadow habitat creation site(s), would extend into the operational period of the power station to ensure the habitats are becoming established and being maintained in accordance with the relevant habitat objectives. This would be particularly important for the permanent fen meadow habitat creation site(s), which might require active interventions to ensure establishment of the required vegetation community.

e) Residual effect

14.7.281 The following tables present a summary of assessment for the habitats and plant communities. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

14.7.282 It should be reiterated that not all such effects are adverse; some are beneficial.

14.7.283 The in-combination effects arising on plant and habitat features (if any) from individual elements of the Sizewell C Project acting together are discussed below. Cumulative effects arising from the proposed development and the associated development elements of Sizewell C Project together with other development proposals acting in combination with Sizewell C Project on designated sites, are discussed in **Volume 10: Cumulative and Transboundary** of the **ES** (Doc Ref. Book 6).

Table 14.12: Summary of effects arising from the construction phase for plants and habitats

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
Minsmere European Site	Alteration of coastal processes	None proposed.	Minor adverse (not significant)	A monitoring and mitigation plan for the coastal processes effects would be developed to ensure the maintenance of the extent of foreshore sediments covering the HCDF to offset any potential erosion for a period.	Minor adverse (not significant)
	Disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users)	The rights of way and access strategy for the EDF Energy estate would minimise the displacement of people away from the proposed development area and to nearby European sites to minimise disturbance to ground-nesting bird species and trampling of vegetation. In addition, a monitoring programme for recreational displacement and identify local mitigation measures would be agreed with local land managers, which could be introduced to further reduce recreational disturbance.	Minor adverse (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Minor adverse (not significant)
	Alteration of local hydrology and hydrogeology	The realignment of the Sizewell Drain and the construction of associated water control features would enable manipulation of the water levels within Sizewell Marshes SSSI to safeguard retained areas of fen meadow and reedbed habitats.	Negligible adverse (not significant)	None required	Negligible adverse (not significant)

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
	Changes in air quality Dust generation	A dust management plan would be implemented, including details of monitoring, mitigation and complaints procedures.	Negligible adverse (not significant).	None required.	Negligible adverse (not significant)
	Changes in air quality Combustion emission from diesel generation	Diesel generator stack heights set as high as could be achieved under the design envelope for the power station and emissions of nitrogen oxides controlled through primary means. Use of earth bunds with grassing/seeding, including a bund along the length of the southern temporary construction area boundary (5m height).	Neutral (not significant)		Neutral (not significant)
	Changes in air quality Oxides of nitrogen	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
	Changes in air quality Sulphur dioxide	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
	Changes in air quality Nutrient nitrogen deposition	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
	Changes in air quality Acid deposition	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
Alde, Ore and Butley Estuary SAC, Alde-Ore Estuary Ramsar site	Disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users)	The rights of way and access strategy for the EDF Energy estate would be developed as outlined for the Minsmere European site.	Minor adverse (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Minor adverse (not significant)

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
and Alde-Ore Estuary SSSI					
Orfordness to Shingle Street SAC and SSSI	Disturbance effects on habitats (comprising trampling and other effects due to displacement of recreational users)	The rights of way and access strategy for the EDF Energy estate would be developed as outlined for the Minsmere European site	Minor adverse (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Minor adverse (not significant)
Minsmere to Walberswick Heaths and Marshes SSSI	See Minsmere European Site above.				
The SSSIs underpinning the Sandlings SPA	Disturbance effects on habitats (comprising trampling effects due to displacement of recreational users).	The rights of way and access strategy for the EDF Energy estate would be developed as outlined for the Minsmere European site.	Minor adverse (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Minor adverse (not significant)
Sizewell Marshes SSSI	Direct land take resulting in habitat loss and fragmentation	The establishment of new reedbed and ditches at Aldhurst Farm (completed in 2016) has provided replacement for the land take of these habitats within Sizewell Marshes SSSI. A fen meadow strategy is in place which defines two sites in Suffolk on which permanent fen meadow habitat would be developed to compensate for the permanent loss of about 0.7ha of fen meadow habitat from within Sizewell Marshes SSSI. Uncertainties remain regarding the	Moderate adverse (significant)	Habitat monitoring to ensure habitat creation meets its objectives. Aim to create/ restore more fen meadow habitat than is being lost to allow for uncertainties in creation; use of two sites reduces risk	Minor adverse (not significant)

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
		success of fen meadow habitat creation which may take time to be fully effective. 0.7ha of wet woodland to be created in the north-east of the site.		Compensatory funding in the event of failure to deliver compensatory habitats at either location, to enable fen meadow creation at other sites Wet woodland strategy to identify further wet woodland habitat opportunities	
	Disturbance effects on habitats (comprising trampling effects due to displacement of recreational users).	The rights of way and access strategy for the EDF Energy estate would be developed as outlined for the Minsmere European site.	Neutral (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Neutral (not significant)
	Alteration of local hydrology and hydrogeology	The realignment of the Sizewell Drain and the construction of associated water control features would enable manipulation of the water levels within Sizewell Marshes SSSI, and would help to ensure that any alterations to the hydrological regime caused by construction activities can be brought back to the correct parameters needed to safeguard retained areas of fen meadow and reedbed habitats.	Minor adverse (not significant)	None required.	Minor adverse (not significant)
	Changes in air quality Dust generation	Development and implementation of a dust management plan.	Negligible adverse (not significant).	Monitoring of plant communities an increase in management	Negligible adverse (not significant).

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
	Changes in air quality Oxides of nitrogen and sulphur dioxide	None proposed.	Negligible adverse (not significant).	(cutting and grazing) if excessive plant growth a problem	Negligible adverse (not significant).
	Changes in air quality Nutrient nitrogen deposition	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
	Changes in air quality Acid deposition	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
	Traffic emissions	None proposed.	Minor adverse (not significant)		Minor adverse (not significant)
Sizewell levels and Associated Areas CWS and Southern Minsmere Levels CWS	Direct land-take resulting in habitat loss.	Landscape-scale restoration to summer parched grassland with scrub across the wider EDF Energy estate under the operational masterplan is providing long-term replacement for any losses of acid grassland and heathland.	Moderate adverse (significant)	None proposed.	Moderate adverse (significant)
	Disturbance effects on habitats (comprising trampling effects due to displacement of recreational users).	The rights of way and access strategy for the EDF Energy estate would be developed as outlined for the Minsmere European site.	Minor adverse (not significant)	If monitoring identifies a requirement for additional mitigation measures these would be agreed with local site managers.	Minor adverse (not significant)
	Changes in air quality.	Implementation of a dust management plan.	Negligible adverse (not significant)	None required	Negligible adverse (not significant)
Suffolk Shingle	Direct land take	Sand and shingle substrates from the existing surface layers of the frontage would be stockpiled to preserve the	Moderate adverse	None proposed	Moderate adverse

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
Beaches CWS		seedbank of the coastal vegetation and would be incorporated into the final landscaping of the new sea defence to enable reinstatement of the coastal vegetation. A monitoring and mitigation plan for coastal processes effects would be developed to ensure, as far as possible, the maintenance of the extent of foreshore sediments covering the HCDF.	(significant)		(significant)
	Changes in air quality	Implementation of a dust management plan.	Negligible adverse (not significant)	None required	Negligible adverse (not significant)
Broadleaved and mixed woodland within the site boundary	Direct land take resulting in habitat loss and fragmentation	Additional woodland planting as part of landscape scale restoration outlined in **oLEMP**.	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Changes in air quality Dust generation	Implementation of dust management plan	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Changes in air quality Oxides of nitrogen and sulphur dioxide	None proposed.	Neutral (not significant)		Neutral (not significant)
	Changes in air quality Nutrient nitrogen and acid deposition	None proposed.	Negligible adverse (not significant)		Negligible adverse (not significant)
Acid grassland within the site	Direct land take resulting in habitat loss and fragmentation	Landscape-scale restoration to summer parched grassland with scrub across the wider EDF Energy estate under the operational masterplan is providing long-term replacement for any losses of acid grassland.	Minor adverse (not significant)	None required	Minor adverse (not significant)

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
	Changes in air quality Dust generation	Implementation dust management plan.	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Changes in air quality Oxides of nitrogen and sulphur dioxide	None proposed.	Neutral (not significant)		Neutral (not significant)
	Changes in air quality Nutrient nitrogen and acid deposition	None proposed.	Negligible adverse (not significant)		Negligible adverse (not significant)
Deptford Pink	Direct land take	Development of translocation strategy for Deptford Pink.	Moderate adverse (significant)	None proposed.	Moderate adverse (significant)

Table 14.13: Summary of effect arising from the operational phase for plants and habitats

Receptor	Description of Effect	Primary or Tertiary mitigation	Classification of effect	Additional Mitigation	Residual Effect
Minsmere European site	Alteration coastal processes	Additional beach nourishment	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
Minsmere to Walberswick Heath and Marshes SSSI	Alteration coastal processes	Additional beach nourishment	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
Sizewell Marshes SSSI	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
Sizewell Levels and Associated Areas CWS	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
Broadleaved and mixed woodland	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse
Acid grassland within the site	Changes in air quality	None proposed.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant)
Suffolk Sandlings habitat	Landscape scale restoration of EDF Energy estate to create a unified coordinated approach to habitat restoration and management		Moderate beneficial (significant)	Ongoing monitoring of habitat establishment and monitoring of habitat management to ensure delivering defined objectives.	Moderate beneficial (significant)

14.8 Invertebrates

a) Baseline

14.8.1 The following baseline is presented in full in **Appendix 14A4 – Invertebrates** of this volume. Habitats within the site and wider survey area support a number of protected invertebrate species, species with recognised conservation status and invertebrate assemblages of high conservation value and, in some cases, national importance. The assemblages present, and their importance, have been determined using Natural England's own Invertebrate Species-habitat Information System (ISIS; now called Pantheon) on the basis of the extensive survey data collected since 2007. The presence of extensive areas of wetland, woodland, coastal and heathland habitats of conservation value within the vicinity of the site means that the area is of importance for invertebrates.

14.8.2 Valued wetland invertebrate assemblages, especially those associated with "permanent wet mire" and "reed-fen and pool" habitats (typical of mires and seepages which may have little open water but remain permanently wet), are well represented across Sizewell Marshes SSSI and are considered of national importance in most cases. The invertebrate assemblage associated with "mineral marsh and open water" habitats (typically found in floodplain wetlands, fluctuating meres, carr and wet woodland), while not as well represented, is also considered of high conservation value. The presence of these assemblages emphasizes the importance of the complex matrix of wetland habitats within Sizewell Marshes SSSI, and in the adjacent Minsmere European Site/SSSI.

14.8.3 Invertebrate assemblages associated with dry sandy habitats (such as the "unshaded early successional mosaic, bare sand and chalk" and "open short sward" invertebrate assemblages) are also well represented in the coastal zone habitats to the east of Sizewell Marshes SSSI, and are also considered to be of national importance. This includes habitats within Suffolk Shingle Beaches CWS, Minsmere European Site/SSSI and the site of the main platform itself, which is considered analogous to "Open Mosaic Habitat of Previously Developed Land", a habitat of principal importance under Section 41 of the NERC Act (Ref 14.10).

14.8.4 Similar invertebrate assemblages of dry sandy habitats are present in the conifer plantations to the north and west of Sizewell Marshes SSSI, namely Goose Hill, Kenton Hills and Nursery Covert. The rides within Goose Hill, in particular, which are sheltered with a mixture of dry, sandy habitats of benefit to species typically found on heathlands, support invertebrate assemblages of national importance. Assemblages associated with these habitats benefit from the connectivity of such habitats at a landscape scale, and the proximity of the valuable coastal and heathland habitats elevates the importance of the sandy woodland rides within these conifer plantations.

14.8.5 Finally, the field margins around the arable fields to the north-west of the conifer plantations, supports an invertebrate assemblage of County importance, associated with unshaded early successional habitats. This is considered primarily due to an overspill effect of invertebrate assemblages from surrounding areas of high-quality habitat.

14.8.6 Following consultation with Natural England (Ref 14.58), the invertebrate populations and habitats within the ZoI of the site were consolidated into a set of 15 Assessment Compartments (shown on **Figure 14A4.3**) on the basis of their distinct constituent invertebrate habitats and their position within the landscape. The baseline conditions in each compartment are summarised within **Table 14.14**.

Table 14.14: Invertebrate baseline condition summary by Assessment Compartment (see Figure 14A4.3 for locations)

Assessment Compartment	Associated designated site with invertebrate interest	Field survey results		Conclusions
		Recorded species with recognised conservation status (status definitions below table)	Supported invertebrate assemblages	
1	Within Sizewell Marshes SSSI	Thirty-two species (out of 769 (2.5%)), including one legally protected/International Union for Conservation of Nature (IUCN) Endangered (GB) (Norfolk hawker dragonfly *Aeshna isoceles*), three Red Data Book (RDB)2, two RDB3 and 25 Nationally Scarce species. Three are also NERC Act Section 41 species.	This compartment supports invertebrate assemblages, associated with permanent wet mire and reed-fen and pool habitats, of national importance and assemblages, associated with flowing water, mineral marsh and open water, wet woodland, scrub and wood decay habitats, of high conservation value.	The value of this compartment lies within the complex matrix of habitats which all have invertebrate assemblages of at least high conservation value associated with them. At a landscape scale, this compartment provides a connection between important designated wetland habitats to the north and south.
2	Within Sizewell Marshes SSSI	Nineteen species (out of 360 (5.2%)), including one RDB3, one Nationally Rare and 17 Nationally Scarce species.	This compartment supports permanent wet mire and mineral marsh and open water invertebrate assemblages of national importance, as well as invertebrate assemblages of high conservation value associated with reed-fen and pools, open water, wood decay and wet woodland habitats.	Of the habitats recorded, the ditch network, reedbed and wet woodland all contribute to the overall very high conservation value of Assessment Compartment 2, as does its proximity to other compartments within the Sizewell Marshes SSSI.
3	Within Sizewell Marshes SSSI	Ten species (out of 272 (3.7%)), including one Nationally Rare, two IUCN Near Threatened, and seven Nationally Scarce species.	This compartment supports invertebrate assemblages, associated with permanent wet mire and reed-fen and pool habitats, of national importance, as well as an assemblage, associated with grassland and scrub habitat, also considered to be of some conservation value.	Both the ditch network and the botanically-diverse fen meadow contribute to the overall conservation value of the Assessment Compartment 3.

Assessment Compartment	Associated designated site with invertebrate interest	Field survey results		Conclusions
		Recorded species with recognised conservation status (status definitions below table)	Supported invertebrate assemblages	
4/4a	None	Twenty-three species (out of 624 (3.7%)), including one IUCN Vulnerable (grayling *Hipparchia Semele* butterfly), one RDB3 (White-mantled Wainscot moth *Archanara neurica* (very locally restricted range)), and 21 Nationally Scarce species. Three of these are also NERC Act Section 41 species.	This compartment supports unshaded early successional mosaic, bare sand, scrub edge and permanent wet mire invertebrate assemblages of national importance. Also recorded were invertebrate assemblages of high conservation value associated with open short sward, scrub-heath and moorland and rich flower habitats.	The majority of this habitat contains features similar to the "open mosaic habitat on previously developed land" habitat of principal importance under Section 41 of the NERC Act, and provides a continuation of the dry sandy habitats found within Assessment Compartments 5 and 6. The "permanent wet mire" assemblage reflects the value of the wet woodland understorey, especially adjacent to the more open carr habitat towards Assessment Compartment 3.
5	Within Suffolk Shingle Beaches CWS	Twenty-two species (out of 232 (9.5%)), including one RDB1 (The spider-hunting wasp *Evagetes pectinipes* (rarely recorded outside Kent)), one IUCN Vulnerable (grayling butterfly), two RDB3, one IUCN Near Threatened and 17 Nationally Scarce. Two of these are also NERC Act Section 41 species.	This compartment supports invertebrate assemblages associated with unshaded early successional mosaic and open short-sward habitats of national importance, as well as grassland & scrub and bare sand assemblages of high conservation value.	This strip of habitat, on the seaward side of Assessment Compartment 4, comprises coastal shingle, vegetated shingle, vegetated sand dune and dune grassland, and provides important connectivity for such dry, sandy habitats along the Suffolk coastline.

Assessment Compartment	Associated designated site with invertebrate interest	Field survey results: Recorded species with recognised conservation status (status definitions below table)	Field survey results: Supported invertebrate assemblages	Conclusions
6/6a	Partly within Minsmere European site/SSSI	Eleven species (out of 248 (4.4%)), including one Nationally Rare IUCN Endangered (The wolf spider *Hygrolycosa rubrfasciata*)), one IUCN Vulnerable (grayling butterfly), two Near Threatened and seven Nationally Scarce. Two of these are also NERC Act Section 41 species.	This compartment supports an aquatic invertebrate fauna of national importance as well as invertebrate assemblages of very high conservation value associated with grassland and scrub, unshaded early successional mosaic habitat and open short-sward grassland.	The invertebrate assemblages that are supported within the habitats in this compartment are likely to be of higher conservation value than the results show; the relatively lower number of species of conservation status was largely due to a lower sampling effort than for other Assessment Compartments.
7	Partly within Sizewell Marshes SSSI	This compartment was surveyed by a habitat assessment only and is dominated by unmanaged wet woodland with a minor dead wood resource consisting of some dead and dying Downy Birch (*Betula pubescens*) that supported fungus communities.		
8	Within Sizewell Marshes SSSI	Five Nationally Scarce species (out of 48 (10.4%)) were recorded in this compartment.	This compartment supports invertebrate assemblages associated with peatland and marshland habitats.	This compartment comprises wet woodland and open water habitat within the Sizewell Marshes SSSI. However, lack of survey effort, consisting of an aquatic survey of just one ditch, lead to under representation of invertebrate assemblages.
9	Partly within Sizewell Marshes SSSI	Twelve species (out of 297 (4%)), including one legally protected/ IUCN Endangered (GB) (Norfolk hawker), one IUCN Vulnerable (orange-horned green colonel soldier fly *Odontomyia angulata*), one NERC Act Section 41 species and Nine Nationally Scarce species were recorded in this compartment.	This compartment supports invertebrate assemblages associated with peatland and marshland habitats of high conservation value.	The invertebrate assemblages of conservation value that this compartment supports were solely associated with wetland habitats. This reflects the survey effort, which was centred around the grazing ditches and their vegetated margins. Other, un-surveyed habitats are present within this compartment which

Assessment Compartment	Associated designated site with invertebrate interest	Field survey results		Conclusions
		Recorded species with recognised conservation status (status definitions below table)	Supported invertebrate assemblages	
				would likely support further assemblages with species of conservation value.
10	Within Sizewell Marshes SSSI	This compartment was surveyed by a habitat assessment only and consists of a large area of dense reedbed considered to be more floristically diverse than typical reed-swamp due to the succession from fen meadow in some places.		
11	Within Sizewell Marshes SSSI	Seventeen species (out of 253 (6.7%)), including two RDB2, two IUCN Near Threatened, one NERC Act Section 41 species, and 12 Nationally Scare species, were recorded in this compartment.	This compartment supports a peatland invertebrate assemblage of high conservation value and a marshland assemblage of some conservation value, associated with the network of ditches.	The invertebrate assemblages of conservation value that this compartment supports are solely associated with wetland habitats. This reflects the survey effort, which was centred around the grazing ditches and their vegetated margins. Other, un-surveyed habitats are present within this compartment which would likely supports further assemblages with species of conservation value.
12	Within Sizewell Marshes SSSI	Sixteen species (out of 257 (6.2%)), including one legally protected/ IUCN Endangered (GB) (Norfolk hawker dragonfly), two RDB2, two NERC Act Section 41 species, and 11 Nationally Scarce.	This compartment supports peatland and well-vegetated, shallow waterbody invertebrate assemblages of high conservation value associated with the network of ditches.	The invertebrate assemblages of conservation value that this compartment supports are solely associated with wetland habitats. This reflects the survey effort, which was centred around the grazing ditches and their vegetated margins. Other, un-surveyed habitats are present within this compartment which would likely supports further assemblages with species of conservation value.

Assessment Compartment	Associated designated site with invertebrate interest	Field survey results		Conclusions
		Recorded species with recognised conservation status (status definitions below table)	Supported invertebrate assemblages	
13	None	Nineteen species (out of 559 (3.4%)), including two IUCN Vulnerable (grayling and white admiral *Limenitis camilla* butterflies), one RDB3, 15 Nationally Scarce and the antlion *Euroleon nostras*. Two of these are also NERC Act Section 41 species.	This compartment supports invertebrate assemblages associated with unshaded early successional mosaic, wood decay, bare sand and chalk, scrub edge, rich flower and scrub-heath and moorland habitats of national importance.	The more open areas within the conifer plantation benefit from shelter and there was a mixture of dry sandy habitats beneficial to strongly heat-loving species typically found on heathlands. Localised geological variation also provides some interesting transitions to wetlands. The mature trees, including conifers and resource of wood decay habitat, which was often left *in situ* evidently provided habitat for a range of species associated with wood decay.
14	None	Four species (out of 161 (2.5%)), including one IUCN Vulnerable (white admiral butterfly, also a NERC Act Section 41 species), one RDBi (the weevil *Procas granulicollis*, not previously recorded in Suffolk), and two Nationally Scarce.	This compartment supports invertebrate assemblages of conservation value associated with unshaded early successional mosaic and grassland and scrub matrix.	The conifer plantation within this compartment supports species with strong associations to dry sandy and in some case heathland habitats. This compartment provides a continuation of such habitats found within the wider area.
15	None	Twenty-four species (out of 443 (5.4%)), including one legally protected (sale only)/ IUCN Endangered (white-letter hairstreak *Satyrium w-album* butterfly), one IUCN Vulnerable, one Nationally Rare IUCN Near Threatened, and 21 Nationally Scarce.	This compartment supports unshaded early successional mosaic and scrub edge invertebrate assemblages of national importance.	It was concluded that this compartment, being comprised of arable fields with vegetated margins, provides an element of overspill for high quality neighbouring habitats in the wider landscape. This proximity to more valuable invertebrate habitats helps to elevate its importance.

Table 14.14 Conservation Status category definitions:

Legally Protected: Protected under Schedule 5 of the W&CA (Ref 14.7).
RBD1 (Endangered): Pre 1994 classification – Species in danger of extinction and whose survival is unlikely if causal factors continue to operate.
RDB2 (Vulnerable): Pre 1994 classification – Species that are declining throughout their range or occupy vulnerable habitats and are likely to move into the Endangered category.
RDB3 (Rare): Pre 1994 classification – Species which are not currently either Endangered or Vulnerable are at risk and exist in 15 or fewer 10-km squares.
RDBi (Indeterminate): Pre 1994 classification – Species considered to be either Endangered, Vulnerable or Rare but with insufficient information to say which.
IUCN Endangered: Post 1994 IUCN threat guidelines – Species, which the best available evidence indicates, is facing a very high risk of extinction in the wild.
IUCN Vulnerable: Post 1994 IUCN threat guidelines – Species, which the best available evidence indicates, is facing a high risk of extinction in the wild.
IUCN Near Threatened: Post 1994 IUCN threat guidelines – Species which do not qualify for Endangered or Vulnerable now but is likely to qualify in the near future.
Nationally Rare: Post 1994 GB rarity status – Species which have not been recorded from more than 15 10-km squares in the UK.
Nationally Scarce: Post 1994 GB rarity status – Species which have been recorded from more than 16 and no more than 100 10-km squares in the UK.
Section 41 species: Species considered of principal importance listed on Section 41 of the NERC Act (Ref 14.10).

14.8.7 Following a review of the known baseline within the ZoI, **Table 14.15** identifies the Assessment Compartments carried forward into the detailed assessment that follows. Those carried forward contain invertebrate assemblages considered to qualify as IEFs, as they are of sufficient conservation value and could potentially be sufficiently affected by the proposed development to represent a material consideration in the decision-making process.

Table 14.15: Invertebrate Assessment Compartments taken forward for detailed assessment

Assessment compartment	Importance of invertebrate assemblage (CIEEM/EIA Methodology)	Justification	Scope in/out
1	National/High	There would be direct habitat loss. Part of Sizewell Marshes SSSI with an invertebrate assemblage of national importance.	IEF Scoped in
2	National/High	There may be direct habitat loss in the east end of this compartment. Part of Sizewell Marshes SSSI with an invertebrate assemblage of national importance.	IEF Scoped in
3	National/High	There may be direct habitat loss. Part of Sizewell Marshes SSSI with an invertebrate assemblage of national importance.	IEF Scoped in
4/4a	National/High	There would be direct habitat loss. Contains invertebrate assemblages of national importance. Provides habitat extension and buffering for designated sites, and part of the compartment is within Sizewell Marshes SSSI.	IEF Scoped in
5	National/High	There would be direct habitat loss. Part of Suffolk Shingle Beaches CWS, but actually contains an invertebrate assemblage of national importance.	IEF Scoped in
6/6a	International/High	There would be no direct habitat loss. Part of Minsmere European site/SSSI, and also supports an invertebrate assemblage of national importance. Whilst potential impact pathways exist, such as recreation pressure and hydrological effects, however the effects would be mitigated through primary and	Scoped out

Assessment compartment	Importance of invertebrate assemblage (CIEEM/EIA Methodology)	Justification	Scope in/out
		tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment would not be directly affected by the proposed development.	
7	County/Medium	Part of the compartment lies within Sizewell Marshes SSSI, but there would be no direct habitat loss. Whilst potential impact pathways exist, through pollution and changes in underlying hydrology, the effects upon the invertebrate assemblages are unlikely to be significant. The effects are mitigated through primary and tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment would not be directly affected by the proposed development.	Scoped out
8	National/High	Lies within Sizewell Marshes SSSI, but there would be little or no direct habitat loss. Potential impact pathways do exist, though, through pollution and changes in underlying hydrology.	IEF Scoped in
9	National/High	Part of the compartment lies within Sizewell Marshes SSSI, but there would be no direct habitat loss. Potential impact pathways exist through pollution and changes in underlying hydrology; however, the effects would be mitigated through primary and tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment would not be directly affected by the proposed development.	Scoped out
10	National/High	Lies within Sizewell Marshes SSSI, but there would be no direct habitat loss. Potential impact pathways exist through pollution and changes	Scoped out

Assessment compartment	Importance of invertebrate assemblage (CIEEM/EIA Methodology)	Justification	Scope in/out
		in underlying hydrology; however, the effects would be mitigated through primary and tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment would not be directly affected by the proposed development.	
11	National/High	Lies within Sizewell Marshes SSSI, but there would be no direct habitat loss. Potential impact pathways exist through pollution and changes in underlying hydrology, but the effects upon the invertebrate assemblages are very unlikely to be significant. However, the potential impact of emission deposition on the fen meadow habitat could have secondary impacts on invertebrates.	IEF Scoped in
12	National/High	There may be minor direct habitat loss. Lies within Sizewell Marshes SSSI and supports an invertebrate assemblage of high conservation value. The potential impact of emission deposition on the fen meadow habitat could have secondary impacts on invertebrates. Also, the removal of the wet woodland to the east of this compartment could have a nocturnal lighting impact.	IEF Scoped in
13	National/High	There would be extensive direct habitat loss. Supports an invertebrate assemblage of national importance.	IEF Scoped in
14	County/Medium	There would be no direct habitat loss. Supports an invertebrate assemblage of high conservation value however any indirect effects are mitigated through primary and tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment will	Scoped out

Assessment compartment	Importance of invertebrate assemblage (CIEEM/EIA Methodology)	Justification	Scope in/out
		not be directly affected by the proposed development.	
15	County/Medium	There will be direct habitat loss, albeit temporary, mostly comprising intensive arable fields. Although the field margins do support a broad invertebrate assemblage of some importance, the effects of this loss are mitigated through primary and tertiary mitigation measures outlined in Section 14.12 of this chapter. The invertebrate assemblage present within this compartment would be temporarily affected by the proposed development however, it is considered that there is sufficient habitat within the surrounding area to maintain the assemblage during the works.	Scoped out

b) Future baseline

14.8.8 As described in **section 14.7** of this chapter, the habitats, and therefore the invertebrate assemblages they support, would remain largely in their current form, at least in the medium term.

14.8.9 However, the effects of climate change on habitats will influence the invertebrate species and assemblages that are supported. In the medium to long-term, with increasing summer temperatures and reduced rainfall, vegetation may shift towards heathland and summer parched grassland communities and water available for wetland habitats could be reduced. This will result in the invertebrate assemblages associated with open, dry habitats, such as those supported by Assessment Compartments 4, 5, 13 and 15, increasing in size and diversity and invertebrate assemblages associated with wetland habitats, such as those supported within Sizewell Marshes SSSI, decreasing.

14.8.10 Invertebrate species are likely to shift in their distribution northwards in response to increasing temperatures which may result in colonisation of new native species or non-native immigrant species to the area. Furthermore, earlier starting spring and later finishing autumn may result in increasing number of generations of some species that maybe supported within the habitats on site.

14.8.11 In the short-term, in the absence of cutting and grazing management, the gradual successional change to Willow and Alder carr woodland would reduce the numerous available microhabitats created by the current wetland habitat mosaic. This in turn would reduce the available niches for habitat specific invertebrate species leading to a reduction in the number of specialist invertebrate assemblages that could be supported on site.

c) Assessment

i. Construction

14.8.12 During the construction phase of works, the main impact pathways for invertebrates and invertebrate assemblages would be associated with:

- direct land take resulting in habitat loss, degradation and fragmentation;
- incidental mortality of species;
- alteration of coastal processes;
- the effects of nocturnal lighting (especially on moths);
- disturbance effects on invertebrate assemblages (comprising trampling effects and nutrient changes due to displacement of recreational users);
- alteration of local hydrology and hydrogeology leading to drying out or flooding of sensitive wetland habitats for invertebrates;
- decreases in water quality; and
- air quality changes.

14.8.13 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in a non-significant effect on invertebrate assemblages. The impact pathways that have been scoped out of this assessment, along with the rationale for scoping them out, are as follows:

- **Alteration of coastal processes**. This impact pathway has been discussed in full in **paragraphs 14.7.30 – 14.7.34,** which concluded that the proposed development was unlikely to significantly affect coastal processes and would have a **negligible effect**, which is considered to be **not significant** on Minsmere European Site/SSSI. The effect on the invertebrate assemblages supported within the ZoI would therefore also be **negligible** and **not significant**.

- **The effects of nocturnal lighting (especially on moths)**. Construction lighting may have an attraction effect on nocturnal invertebrate species leading to incidental mortality through collision, predation and behaviour change. Primary mitigation measures, consisting of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) and boundary treatments, would be in place to reduce excess lighting and spillage on surrounding habitats and some Assessment Compartments have natural barriers, such as woodland and hedgerows, which would lessen this impact further. This impact may, therefore, only affect the invertebrate assemblages within Assessment Compartments within or directly adjacent to the site boundary, namely Assessment Compartments 1, 2, 3, 5, 8 and 12 where mitigation measures are unlikely to be sufficient to block out light and natural boundaries do not exist, or are being removed. Therefore, whilst effects of nocturnal lighting are scoped out for the remaining Assessment Compartments, it is considered further for Assessment Compartments 1,2, 3, 5, 8 and 12.

- Disturbance effects on invertebrate assemblages (comprising trampling effects due to displacement of recreational users). Disturbance effects due to displacement of recreational users has been discussed in full in the section 14.7 (paragraphs 14.7.35 – 14.7.47) and constitutes a minor adverse effect, which is considered to be not significant on the invertebrate assemblages within the ZoI.

- Alteration of local hydrology and hydrogeology and decreases in water quality. Hydrological change has been discussed in full in the section 14.7 (paragraphs 14.7.139 – 14.7.148) and is considered to constitute a negligible adverse effect on habitats which is not significant. As outlined in **section 14.4**, the measures within the Outline Drainage Strategy (**Volume 2, Appendix 2A**) would ensure that there is no detriment to water quality within the ZoI. The impact pathway would therefore have a negligible adverse effect, which is considered to be not significant on the invertebrate assemblages within the ZoI.

- **Air quality changes.** The **Plants and Habitats Synthesis Report** (**Appendix 14B1**) discusses the impact of three air quality change pathways; dust, diesel generator emissions and emission deposition. **Section 14.7** of this chapter concludes that dust and diesel generator emissions on habitats, would have a negligible adverse effect, and is considered to be not significant. It can, therefore, be assumed that the effect on the invertebrate assemblages they support is also negligible adverse **and** is considered to be not significant. The air quality dispersal modelling discussed the **section 14.7** of this chapter (**paragraphs 14.7.156 – 14.7.161**) suggests the majority of emission deposition would occur within 1km of the point of source. This is likely to affect the fen meadow of high quality in Sizewell Marshes SSSI, in particular, and the magnitude of impact would therefore be high. However, the duration would be short-term and temporary, with the emissions dropping after the commissioning period, after which time vegetation would be expected to recover and therefore would be considered a **minor adverse** effect, which is considered to be **not significant**. The high-quality fen meadow, highlighted in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) within Sizewell Marshes SSSI, is situated within Assessment Compartments 3, 11 and 12 and a resulting change in vegetation composition and structure may indirectly affect the invertebrate assemblages supported by this habitat. Therefore, whilst air quality is scoped out for the remaining Assessment Compartments, it is considered further for Assessment Compartments 3, 11 and 12.

14.8.14 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by each IEF/assessment compartment are identified and detailed within the subsequent sections.

IEF: Assessment Compartment 1 invertebrate assemblage

14.8.15 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss, degradation and fragmentation; and
- incidental mortality of species including the effects of nocturnal lighting (especially on moths) and during site clearance works including habitat loss.

14.8.16 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss, degradation and fragmentation

14.8.17 Accommodating the main platform requires the realignment of the Sizewell Drain and the construction of the SSSI crossing across the Leiston Drain, to provide access. Approximately 78% of the habitats within Assessment Compartment 1 would be permanently lost. Land take from the compartment would result in the permanent loss of 1.7ha of wet woodland (0.7ha temporary loss), 3.4ha of dry reedbed, 0.7ha of temporary loss of wet reedbed, 0.1ha of tall ruderal and 0.31km of ditches (0.65km of temporary loss). There would also likely be some local degradation of adjacent habitats (outside of the direct footprint but within the site boundary) as a result of the habitat clearance related to the establishment of the construction site.

14.8.18 Assessment Compartment 1 is part of Sizewell Marshes SSSI (see **paragraph 14.7.123**) and land take from it would be permanent and represents the loss of approximately 4.9% of the Sizewell Marshes SSSI.

This would directly affect the invertebrate assemblages of national importance and high conservation value supported within Assessment Compartment 1 by reducing the extent of available breeding, foraging and sheltering habitat.

14.8.19 However, extensive areas of similar habitat would be retained within the wider SSSI which support the same wetland invertebrate assemblages recorded in Assessment Compartment 1.

14.8.20 As outlined in **section 14.4** of this chapter, primary mitigation measures to provide replacement reedbed and ditch habitats have already been implemented at Aldhurst Farm, adjacent to the western edge of Sizewell Marshes SSSI. In total, approximately 5ha of new reedbed and 2km of ditches have already been established.

14.8.21 Natural England in 2014/2015 consultation responses for the Aldhurst Farm habitat creation scheme noted that the habitat creation at Aldhurst Farm would provide ‘satisfactory compensation’ for the quantity and quality of reedbed and ditch habitat lost from Sizewell Marshes SSSI. The proximity of Aldhurst Farm to the Sizewell Marshes SSSI and the size of the created habitat provides extensive opportunities for invertebrate assemblages associated with reedbed and ditch habitats to colonise this area. In addition, further proposed reedbed creation to the north of the SSSI, along the north eastern boundary of the site will provide further additional permanent habitat availability in the long-term.

14.8.22 The impact of the loss of reedbed and ditch habitat on the invertebrate assemblages supported by such habitats within Assessment Compartment 1 would therefore constitute a **minor adverse** effect, which is considered to be **not significant**.

14.8.23 Early indications are that the reedbed flora is already well established in the wetlands of Aldhurst Farm although the establishment of the expected invertebrate fauna is currently unknown. There is likely to be a time-lag between the loss of high-quality habitat in Assessment Compartment 1 and the newly created habitats at Aldhurst Farm reaching optimum condition and supporting reedbed and ditch invertebrate assemblages of similar importance to Assessment Compartment 1. This time-lag is therefore considered to be a residual effect and is discussed further in **Table 14.16.**

14.8.24 As part of the landscape design for the development, 0.7ha of replacement wet woodland will be provided. This will provide some mitigation for the loss of wet woodland habitat from Assessment Compartment 1 which supports an invertebrate assemblage of high conservation value, although this new habitat would not be adjacent to the existing areas of wet woodland or the Leiston Drain.

14.8.25 Assessment Compartment 1 provides a complex mosaic of wetland habitats which provides numerous niches for invertebrates to inhabit, and the creation of reedbed and ditch habitat at Aldhurst Farm would not support species which are at least in part reliant on the wet woodland resource. It would however be possible over the long-term to create a small area of wet woodland habitat at Aldhurst Farm although this would at the expense of an area of existing reedbed, a more valued wetland habitat in the context of SSSI compensatory habitat provision. Such an approach, would not entirely replicate the wet woodland habitats lost from Assessment Compartment 1 but would provide long-term permanent wet woodland habitat in addition to that provided at the north eastern extent of the site. Further long term opportunities to create additional wet woodland exist by either (i) allowing the proposed reedbed in the north-east of the site to undergo natural succession to form an extended area of wet woodland (additional 1.2ha) and / or (ii) establishing an additional area of wet woodland at one of the Fen Meadow compensation sites, although not at the expense of fen meadow habitats proposed at these locations. At Benhall, an area of wet Alder woodland is immediately adjacent to the site and could be extended into the site by manipulating water levels or by some local shallow excavation of topsoil.

14.8.26 With the current net loss of wet woodland habitat predicted, and which excludes the further opportunities identified above, the impact of the loss of wet woodland on the invertebrate assemblage within Assessment Compartment 1 would constitute a **moderate adverse** effect, which is considered to be **significant**.

14.8.27 The construction of the SSSI crossing over the Leiston Drain may also result in the fragmentation of wetland habitats between the retained Sizewell Marshes SSSI and Minsmere European Site/SSSI. This could cause some localised fragmentation of invertebrate populations moving between the two designated sites. The crossing comprises a causeway under which the Leiston Drain would flow through a 68m long culvert. The drain would be unimpeded during construction, and whilst the banks would be retained within the culvert, the banksides would lose all vegetation, other than at each end of the culvert, due to shading impacts. Despite the loss of bankside habitat causing some minor discontinuity of vegetation along the Leiston Drain, aquatic invertebrates would still be able to move through the culvert within the watercourse, and mobile terrestrial invertebrates would be able to travel over the top of the causeway. The impact of habitat fragmentation on invertebrate assemblages supported by Assessment Compartment 1 therefore constitutes a **negligible adverse** effect, which is considered to be **not significant**.

Incidental mortality of species (including the effects of nocturnal lighting).

14.8.28 Land take in Assessment Compartment 1 would result in the incidental mortality of species associated with the habitats being lost through vegetation and ground clearance works. This would include invertebrate species with recognised conservation status that have been recorded in this compartment. In addition, it is anticipated that nocturnal species attracted to light (in particular, moths) could also suffer mortality during the construction phase, should habitat clearance reduce the barrier effect of current vegetation or bright lighting be used to illuminate work in close proximity to retained habitats. The effect this could have is the reduction of individuals within the supported invertebrate assemblages.

14.8.29 The invertebrate assemblages supported within Assessment Compartment 1 contain species which are present within the greater Sizewell Marshes SSSI which would be retained. The incidental mortality of species within this compartment would be localised and is not expected to lead to the detriment of populations in the wider area.

14.8.30 Tertiary mitigation measures, as outlined in **section 14.4** of this chapter, include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) which would minimise light spill onto surrounding habitats.

14.8.31 Incidental mortality would therefore have a **minor adverse** effect, which is considered to be **not significant**. However, the effect of clearance and nocturnal lighting cannot be completely eliminated through mitigation measures, so this is considered a residual effect and discussed in **Table 14.16**.

IEF: Assessment Compartment 2 invertebrate assemblage

14.8.32 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss and degradation; and
- incidental mortality of species including the effects of nocturnal lighting (especially on moths).

14.8.33 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss and degradation

14.8.34 The construction of the main platform and the realignment of the Sizewell Drain would result in the permanent loss of 0.23ha of habitat within Assessment Compartment 2 consisting of the permanent loss of 0.11ha of dry reedbed, 0.12ha of wet woodland and 7m of ditch. There would also likely be some local degradation of adjacent habitats (outside of the direct footprint but within the site boundary) as a result of the habitat clearance activities.

14.8.35 Assessment Compartment 2 is part of Sizewell Marshes SSSI (see **paragraph 14.7.123**) and land take would be permanent. There would be a reduction of available habitat for breeding, sheltering and foraging for the invertebrate assemblages of national importance and high conservation value within this compartment.

14.8.36 As outlined in **section 14.4** of this chapter, primary mitigation measures to create replacement reedbed and ditch habitat have already been implemented at Aldhurst Farm. Furthermore, the area of land take within this compartment is small (8% of Assessment Compartment 2) and the vast majority of such habitats within the wider Sizewell Marshes SSSI would be retained.

14.8.37 Given the limited extent of the habitat within Assessment Compartment 2 being lost, the abundance of similar retained habitat within the retained SSSI and the habitat creation at Aldhurst Farm, the impact of habitat loss on reedbed and ditch invertebrate assemblages supported by Assessment Compartment 2 would constitute a **minor adverse** effect, which is considered to be **not significant**. However, as discussed in **paragraph 14.8.23,** there is likely to be a time-lag between the loss of high-quality habitat in Assessment Compartment 2 and the newly created habitats at Aldhurst Farm reaching similar quality, and therefore supporting an assemblage of similar importance. This residual effect is discussed in **Table 14.16**.

14.8.38 As part of the landscape design for the development, 0.7ha of replacement wet woodland will be provided. This will provide some mitigation for the loss of wet woodland habitat. Further opportunities to provide additional compensatory wet woodland habitat are discussed above under Assessment Compartment 1. The area of wet woodland loss in Assessment Compartment 2 is small. The impact of habitat loss on the invertebrate assemblage supported by the wet woodland in Assessment Compartment 2 would therefore constitute a **minor adverse** effect, which is considered to be **not significant**. The residual effect is discussed further in **Table 14.16**.

Incidental mortality of species (including the effects of nocturnal lighting).

14.8.39 Incidental mortality is discussed in above in respect of Assessment Compartment 1 and, within Assessment Compartment 2, would have a **minor adverse** effect, which is considered to be **not significant**. However, the effect of clearance and nocturnal lighting cannot be completely eliminated through mitigation measures. The residual effect is discussed in **Table 14.16**.

IEF: Assessment Compartment 3 invertebrate assemblage

14.8.40 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss and degradation;
- incidental mortality of species including the effects of nocturnal lighting (especially on moths); and
- changes in habitat vegetation composition and structure through air quality changes.

14.8.41 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss and degradation.

14.8.42 The construction of the main platform and the realignment of the Sizewell Drain would result in the permanent loss of 0.41ha of fen meadow and 3m of ditch habitat from within Assessment Compartment 3. There is also likely to be some local degradation of adjacent habitats (outside of the direct footprint but within the site boundary) as a result of the habitat clearance activities.

14.8.43 This compartment is situated within Sizewell Marshes SSSI and land take would be permanent. This would lead to a reduction of available habitat for breeding, foraging and sheltering for the invertebrate assemblages of national importance and of conservation value, supported within this compartment.

14.8.44 As outlined in **section 14.4** of this chapter, primary mitigation measures to create replacement ditch habitat have already been implemented at Aldhurst Farm. Primary mitigation measures also include a fen meadow strategy (**Appendix 14C4** of this volume) which would create at least 1.7ha of new, permanent fen meadow to compensate for the loss of fen meadow habitats through construction activities to establish the main platform (discussed in full in **paragraph 14.7.130**). Furthermore, the area of habitat loss in this compartment would be moderate (22% of Assessment Compartment 3) and there are similar fen meadow and ditch habitats directly adjacent and within the retained Sizewell Marshes SSSI.

14.8.45 Due to the relatively small area of habitat being lost from the compartment, the availability of similar adjacent habitat and the primary mitigation measures, the impact of habitat loss on the invertebrate assemblages within Assessment Compartment 3 would constitute a minor adverse effect, which is considered to be not significant.

14.8.46 However, as discussed above, there is expected to be a time-lag between the loss of existing high-quality habitat and newly created habitats reaching similar quality, and therefore supporting an invertebrate assemblage of similar importance. This residual effect is discussed in **Table 14.16**.

Incidental mortality of species (including the effects of nocturnal lighting).

14.8.47 Incidental mortality is discussed under Assessment Compartment 1 above and, within Assessment Compartment 3, this impact would have a **minor adverse** effect, which is considered to be **not significant**. The effect of clearance and nocturnal lighting cannot be completely reduced through mitigation measures and so this is considered a residual effect and discussed in **Table 14.16**.

Changes in habitat vegetation composition and structure through air quality changes.

14.8.48 The fen meadow habitat within Assessment Compartment 3 is of high quality and supports areas of low growing plant species and species indicative of low fertility (see the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) discussed in the **section 14.7** of this chapter). These features would be sensitive to a temporary increase in nutrient nitrogen deposition through temporary changes in air quality during commissioning.

14.8.49 An increase in nutrient nitrogen deposition could directly affect the composition and structure of the fen meadow vegetation. This in turn may reduce the amount of available habitat for invertebrate species that specialise in this habitat, particularly for any invertebrate species that are dependent on the more sensitive plant species. This would result in a reduction in the conservation value of the assemblage supported by Assessment Compartment 3. There are adjacent areas of high-quality fen meadow although these may also be affected by the same changes in air quality.

14.8.50 As outlined in **section 14.4** of this chapter, primary mitigation measures to create replacement ditch habitat have already been implemented at Aldhurst Farm. Primary mitigation measures also include a fen meadow strategy (Appendix 14C4) which would create new, permanent fen meadow to compensate for the loss of fen meadow habitats through construction activities to establish the main platform (discussed in full in paragraph 14.15.131). Despite the possible changes in vegetation, fen meadow specialists account for a small number of species within the invertebrate assemblages supported by Assessment Compartment 3. Furthermore, any air quality change would be temporary so this impact would therefore constitute a **minor adverse** effect, which is considered to be **not significant**.

IEF: Assessment Compartment 4/4a invertebrate assemblage

14.8.51 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss and degradation; and
- incidental mortality of species.

14.8.52 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss

14.8.53 The construction of the main platform would result in the loss of 27ha of dry, sandy open mosaic habitat within Assessment Compartment 4 and approximately 0.81ha of wet woodland within Assessment Compartment 4a.

14.8.54 The effect would be a reduction in available breeding, foraging and sheltering habitat for the invertebrate assemblages of national importance supported by Assessment Compartments 4 and 4a and the assemblages of high conservation value, supported by Assessment Compartment 4.

14.8.55 The invertebrate assemblages of national importance, supported within Assessment Compartment 4, are associated with unshaded early successional mosaic and bare sand habitats which are abundant along the coastline in adjacent designated sites. Primary mitigation measures, outlined in **section 14.4** of this chapter, to compensate the loss of habitat within Assessment Compartment 4 have been implemented (in 2015) in areas set aside for reptile mitigation (discussed in full in **Appendix 14C2** of this volume) and at Aldhurst Farm. A total of 107ha of habitat has been created and consists of dry, sandy grassland with scrub, brash piles and bare ground patches. The created habitat areas, while not directly adjacent to Assessment Compartment 4 are sufficiently close to provide opportunities for associated invertebrate assemblages to colonise these newly established habitat areas.

14.8.56 The impact of habitat loss on the invertebrate assemblages within Assessment Compartment 4 is considered to constitute a **minor adverse** effect, which is considered to be **not significant**.

14.8.57 There is likely to be a time-lag between the loss of existing high-quality habitat from this compartment and newly created acid grassland habitats reaching optimum condition and supporting invertebrate assemblages of similar importance. This residual impact is discussed further in **Table 14.16**.

14.8.58 As part of the landscape design for the development, 0.7ha of replacement wet woodland would be provided. This will provide some mitigation for the loss of wet woodland habitat within Assessment Compartment 4a which supports an invertebrate assemblage of high conservation value. Further opportunities to establish additional areas of wet woodland are discussed under Assessment Compartment 1 above. There are areas of wet woodland present within Sizewell Marshes SSSI to the west of this compartment which would not be impacted by land take. The impact of the loss of wet woodland on the invertebrate assemblage it supports would constitute a **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality of species

14.8.59 Land take in Assessment Compartment 4/4a would result in the incidental mortality of species associated with the habitats being lost through vegetation and ground clearance works. This would include species with recognised conservation status that have been recorded in this compartment.

14.8.60 The invertebrate assemblages supported within Assessment Compartment 4/4a contain species which are present within the wider Sizewell Marshes SSSI and within retained dry, sandy habitats along the coastline, which would be unaffected.

14.8.61 The incidental mortality of species would be localised and would not lead to the detriment of populations in the wider area and therefore constitutes a **minor adverse** effect, which is considered to be **not significant**. However, the effect of habitat clearance cannot be completely reduced through measures such as compensatory habitat provision in the immediate area, so this is considered a residual impact and discussed in **Table 14.16**.

IEF: Assessment Compartment 5 invertebrate assemblage

14.8.62 During construction, the main impact pathways experienced by this IEF would be associated with:

- direct land take resulting in habitat loss; and
- incidental mortality of species including the effects of nocturnal lighting (especially on moths).

14.8.63 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss

14.8.64 The construction of the HCDF would result in the in the loss of approximately 6.95ha of vegetated shingle and vegetated sand dunes within the site. This loss of coastal habitat would affect the invertebrate assemblages of national importance and high conservation value, supported by Assessment Compartment 5, by reducing available foraging, breeding and sheltering habitat.

14.8.65 The invertebrate assemblages of national importance are associated with unshaded early successional mosaic and open short sward habitats which, while present within this Assessment Compartment, are not exclusive to shingle beaches. Areas of similar habitats are present along much of the Suffolk coast and the EDF Estate are likely to support invertebrate assemblages of a similar nature. Although primary mitigation measures, outlined in **section 14.4** of this chapter, are not in place to create compensatory coastal shingle habitat prior to construction, the creation of dry, sandy habitats within the acid grassland mosaics across the wider EDF Energy estate, discussed in **paragraph 14.8.55,** would provide habitat for the many of the species of the invertebrate assemblage supported by Assessment Compartment 5.

14.8.66 Furthermore, a sacrificial shingle barrier with a sandy cap(which would be installed in front of the HCDF using sand and shingle substrate from removed shingle and dune habitat (**section 14.4** of this chapter)) is proposed, which should naturally colonise with similar flora and, in the operational phase of the proposed development, would re-connect areas of similar habitat to the north and south along the coast. The invertebrate assemblage can be expected to rapidly recolonise the recreated habitats on the new sea defences once the vegetation has become established. However, this would not be installed for several years after the initial loss of shingle and dune habitat so there would be a period of fragmentation of coastal habitat north and south of Assessment Compartment 5.

14.8.67 The impact of habitat loss on the invertebrate assemblages within Assessment Compartment 5 would therefore constitute a **moderate adverse** effect, which is considered to be **significant**. However, as discussed above, the time-lag before created habitats reach optimum condition would lead to a residual effect and this is discussed in **Table 14.16**.

Incidental mortality of species (including the effects of nocturnal lighting)

14.8.68 Incidental mortality is discussed under Assessment Compartment 1 above. In addition, it is anticipated that nocturnal species attracted to light (in particular, moths) could also suffer mortality during the construction phase, if bright lighting is used to illuminate work in close proximity to retained habitat.

14.8.69 Tertiary mitigation measures, as outlined in **section 14.4** of this chapter, include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) which would minimise light spill onto surrounding habitats.

14.8.70 Incidental mortality within Assessment Compartment 5 would, therefore, have a **minor adverse** effect, which is considered to be **not significant.** However, the effect of incidental mortality, through habitat clearance and nocturnal lighting, cannot be completely reduced through mitigation measures, so this is considered a residual impact and discussed in **Table 14.16**.

IEF: Assessment Compartment 8 invertebrate assemblage

14.8.71 During construction, the main impact pathway experienced by this IEF would be associated with:

- incidental mortality due to the effects of nocturnal lighting (especially on moths).

14.8.72 Incidental mortality is discussed under Assessment Compartment 1 above and, within Assessment Compartment 8, would have a **minor adverse** effect, which is considered to be **not significant**. However, it is anticipated that nocturnal species attracted to light (in particular, moths) could also suffer mortality during the construction phase, if bright lighting is used to illuminate work in close proximity to retained habitat.

14.8.73 Tertiary mitigation measures, as outlined in **section 14.4** of this chapter, include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) which would minimise light spill onto surrounding habitats. This is discussed further in **Table 0.16**.

IEF: Assessment Compartment 11 invertebrate assemblage

14.8.74 During construction, the main impact pathway experienced by this IEF would be associated with:

- changes in habitat vegetation composition, degradation and structure through air quality changes.

14.8.75 This impact pathway is discussed under the Assessment for Compartment 1 above. The potential vegetation composition changes within Compartment 11 are predicted to be minor and temporary and the remaining vegetation would still provide shelter and food sources for the invertebrate assemblage. Habitat composition changes would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Assessment Compartment 12 invertebrate assemblage

14.8.76 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss and degradation;
- incidental mortality of species including the effects of nocturnal lighting (especially on moths); and
- changes in habitat vegetation composition and structure through air quality changes.

14.8.77 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss and degradation.

14.8.78 The construction of the main platform and the removal of habitat to the west of Sizewell B power station would result in the temporary loss of 0.9ha of fen meadow, 0.43ha of wet woodland and 0.9km of ditch habitat within Assessment Compartment 12. There is also likely to be some local degradation of adjacent habitats (outside of the direct footprint but within the site boundary) as a result of the habitat clearance activities. However, whilst this will result in some vegetation removal, some material will be coppiced and will regenerate.

14.8.79 This Assessment Compartment is situated within Sizewell Marshes SSSI and land take would be temporary. This would lead to a temporary reduction of available habitat for breeding, foraging and sheltering for the invertebrate assemblages of national importance and of conservation value, supported within this compartment.

14.8.80 As outlined in **section 14.4** of this chapter, primary mitigation measures to create replacement ditch habitat have already been implemented at Aldhurst Farm. Primary mitigation measures also include a fen meadow strategy (**Appendix 14C4** of this volume) which would create new, permanent fen meadow to compensate for the loss of fen meadow habitats through construction activities to establish the main platform (discussed in full above). Furthermore, the area of habitat loss in this compartment would be small (4% of Assessment Compartment 12) and there is similar fen meadow and ditch habitat directly adjacent and within the retained Sizewell Marshes SSSI.

14.8.81 Due to the relatively small area of habitat being lost, the availability of similar adjacent habitat and the primary mitigation measures, the impact of habitat loss on the invertebrate assemblages within Assessment Compartment 12 would constitute a **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality of species (including the effects of nocturnal lighting)

14.8.82 Incidental mortality is discussed in under Assessment Compartment 1 and, within Assessment Compartment 12, this would have a **minor adverse** effect, which is considered to be **not significant**. The effect of clearance and nocturnal lighting cannot be completely reduced through mitigation measures. In particular, the clearance of the wet woodland strip between this compartment and the Sizewell B power station would remove an important barrier and result in an increase of nocturnal lighting exposure in Assessment Compartment 12, and so this is considered a residual effect and discussed in **Table 14.16**.

Changes in habitat vegetation composition and structure through air quality changes

14.8.83 This impact pathway is discussed in under Assessment Compartment 1 and would lead to a **minor adverse** effect, which is considered to be **not significant**.

IEF: Assessment Compartment 13 invertebrate assemblage

14.8.84 During construction, the main impact pathways experienced by this invertebrate assemblage would be associated with:

- direct land take resulting in habitat loss and degradation; and
- incidental mortality of species including the effects of nocturnal lighting (especially on moths).

14.8.85 The characterisation of the above impacts is described in detail below.

Direct land take resulting in habitat loss and degradation

14.8.86 To accommodate the temporary construction area, car park and training building, 83% of habitat would be lost from this assessment compartment. This includes 46ha of the Goose Hill woodland (plantation coniferous, mixed plantation and semi-natural broadleaved woodland). There is also likely to be some local degradation of adjacent habitats (outside of the direct footprint but along the fringes of the site boundary) as a result of the vegetation clearance.

14.8.87 Of the total land take, 66% would be permanent and 34% would be temporary, and would affect the invertebrate assemblages of national importance and high conservation value, supported by Assessment Compartment 13, by reducing the available habitat required for breeding, foraging and sheltering. A total of 50ha of mixed woodland will be created across the site, post development.

14.8.88 Whilst 46ha of woodland is being lost, the main area of value is largely along the approximately 2.2ha of sheltered, open, sandy tracks and rides which support invertebrate assemblages of national importance. The long-term vision within the EDF Energy estate defined within the **oLEMP**, is to create more Sandlings habitat post-construction, such as dry acid grasslands and sandy woodland. As discussed in section 14.8.95, these changes in habitats across the site are predicted to have a long term beneficial impact on invertebrates associated with these dry, sandy habitats. The habitat creation within the reptile mitigation areas, as outlined in **section 14.4** of this chapter, would provide further habitats for the invertebrate assemblages supported by Assessment Compartment 13.

14.8.89 The impact of habitat loss on the invertebrate assemblages within Assessment Compartment 13 would therefore constitute a **minor adverse** effect in the short term, which is considered to be **not significant**. However, as discussed under Assessment Compartment 4/4a, the time-lag before the created habitats reach optimum condition would lead to a residual effect and is discussed in **Table 14.16**.

Incidental mortality of species (including the effects of nocturnal lighting)

14.8.90 Incidental mortality is discussed under Assessment Compartment 1 and, within Assessment Compartment 13, would have a **minor adverse** effect, which is considered to be **not significant.** However, the effect of clearance and nocturnal lighting cannot be completely eliminated through mitigation measures and so this is considered a residual effect and is discussed in **Table 14.16**.

Inter-relationship effects

14.8.91 This section provides a description of the identified inter-relationship effects that are anticipated to occur on invertebrate assemblage receptors between the individual environmental effects arising from construction of the proposed development.

14.8.92 It is considered that potential changes to local hydrology and air quality could act together to cause changes to vegetation structure and composition, particularly within Sizewell Marshes SSSI. This in turn could reduce the suitability of this habitat to support the invertebrate assemblages of national importance which have been recorded within Sizewell Marshes SSSI.As outlined in tertiary mitigation, hydrological monitoring of the SSSI would continue through the construction phase and if a negative trend is found then mitigation, including manipulation of water levels, would be used to correct any adverse impact. Botanical modelling would also be used to determine whether any there are any changes to the vegetation, particularly within retained fen meadow habitats. This would help inform the need to change any element of the site management including the extent and intensity of grazing, to maintain the existing vegetation community and dependent species.

ii. Operation

14.8.93 During the operational phase of works, the main impact pathways on invertebrate assemblages would be associated with:

- any changes in water quality; and
- changes to habitat types due to the landscape scale habitat creation across the EDF Energy estate.

14.8.94 An operational **Outline Drainage Strategy** (**Volume 2, Appendix 2A**), outlined in **section 14.4** of this chapter, would manage surface water discharge during the operational phase such that there would be no potential for polluted surface water runoff into the surrounding habitats. This would result in a **negligible adverse** effect, which is considered to be **not significant** on the invertebrate assemblages supported in the ZoI.

14.8.95 The landscape scale habitat creation proposed across the EDF Energy estate would convert existing areas of arable land into dry acid grassland characteristic of the Suffolk Sandlings. This landscape scale habitat creation which is described in the **oLEMP**, together with existing habitat creation areas at Aldhurst Farm, the marsh harrier habitat improvement areas and at the reptile receptor areas throughout the EDF Energy estate, would create approximately 218ha of acid grassland and would link existing acid grassland at Leiston Common and Broom Covert and provide connectivity between heathland and acid grassland habitats within the Minsmere European Site to the north and the Sandlings SPA to the south. This would provide extensive areas of habitat for the associated invertebrate assemblages of national importance supported within Assessment Compartments 4, 5, 6, 13, 14 and 15. It is considered that this habitat creation would deliver biodiversity gains and would constitute a **major beneficial** effect which, is considered to be **significant**. (Further information is presented in the **Chapter 14, Appendix 14.E: Biodiversity Metric Net Gain Calculations Report** of this volume).

Inter-relationship effect

14.8.96 This section provides a description of the identified inter-relationship effects that are anticipated to occur on invertebrate assemblage receptors between the individual environmental effects arising from operation of the proposed development.

14.8.97 No inter-relationship effects have been identified for the operational phase.

d) Mitigation and monitoring

i. Mitigation

Construction

14.8.98 A significant moderate adverse effect is predicted to occur on the wet woodland invertebrate assemblages of high conservation valuer, supported by Assessment Compartments 1, 2 and 4a through loss of habitat. Additional secondary mitigation measures in relation to habitats are not proposed as there is no practical way to avoid the impacts described beyond the measures proposed as primary mitigation, which reduce the magnitude of the impact but not to the extent that an adverse significant effect could be fully eliminated. However, possible opportunities to create additional wet woodland habitats are discussed above. This residual impact is discussed in **Table 14.16**.

14.8.99 Norfolk hawker is a protected species under Schedule 5 of the Wildlife and Countryside Act (1981) and a mitigation plan to recover larvae of this species along with other macro-invertebrates in the impacted lengths of the Sizewell Drain, the Leiston Drain and related ditches will be developed. This would be integrated with a ''fish rescue' for these watercourses during the relevant early construction works.

Operation

14.8.100 As no significant adverse effects are predicted, no additional secondary mitigation is proposed.

ii. Monitoring

IEF invertebrate assemblages supported by Assessment Compartments 1, 2, 3, 4/4a, 5, 13 and 15.

Direct land take resulting in habitat loss

14.8.101 The reedbed and ditch habitat created within Aldhurst Farm, wet woodland and the acid grassland habitats created within the reptile mitigation areas as part of the primary mitigation measures, would become more diverse over time, as additional plant species colonise these areas as well as the additional reedbeds created at the north eastern extent of the site In turn, these areas would support a greater diversity of invertebrate species. The **oLEMP** provides an overview of the approach which would be used to create and manage the habitats proposed across the EDF Energy estate as well as providing an outline of the monitoring which would be used to assess the success of the habitat establishment.

14.8.102 Monitoring would target invertebrate assemblages of national importance and high conservation value which are characteristic of the habitats to be lost, including populations of Norfolk Hawker, to assess the extent to which these assemblages become established in the new habitats within the site boundary and across the wider EDF Energy Estate.

Changes to habitat type due to the landscape scale habitat creation on the EDF Energy estate

14.8.103 As explained above, the creation of Suffolk Sandlings dry acid grassland habitat during operation across the EDF Energy estate would be subject to monitoring to determine the extent to which invertebrate assemblages become established.

e) Residual effects

14.8.104 The following tables present a summary of the invertebrate assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

14.8.105 It should be reiterated that not all such effects are adverse; some are beneficial.

Table 14.16: Summary of effect araising from the construction for invertebrates

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Assessment Compartments 1, 2 and 4° – wet woodland invertebrate assemblage.	2.5ha of wet woodland supporting an associated invertebrate assemblage of high conservation value would be lost during construction.	0.7ha of wet woodland is to be created at the north eastern extent of the site.	Moderate adverse (significant)	Wet woodland strategy to be developed: Opportunity for the creation of wet woodland habitat in the long term at Aldhurst Farm Opportunity to allow the new reedbed in the north-east of the site to develop into wet woodland through natural successional processes Opportunity to create wet woodland at the Fen Meadow sites	Moderate adverse (significant).
Assessment Compartments 1, 2, 3, 4/4°, 5, 13 and 15 – reedbed, ditch and dry sandy habitats invertebrate assemblage.	Habitat loss of reedbed, ditch and dry sandy habitat.	Creation of reedbed and ditch habitat at Aldhurst Farm as well as reedbed creation to the north eastern extent of the site Habitat creation as part of the reptile and marsh harrier mitigation would also benefit the invertebrate assemblage. In addition, the landscape scale habitat creation across the EDF Energy estate would convert existing areas of arable land	Minor adverse (not significant). There would be a time-lag between the loss of established, high-quality habitat and the newly created habitats reaching optimum condition to support invertebrate assemblages of similar importance.	A mitigation plan to recover larvae of Norfolk Hawker, along with other macro-invertebrates in the impacted lengths of the Sizewell Drain, the Leiston Drain and related ditches will be developed.	Minor adverse (not significant).

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
		into dry acid grassland characteristic of the Suffolk Sandlings (further details are provided in the **oLEMP** Doc. 8.2).			
Assessment Compartments 1, 2, 3, 4/4a, 5, 8, 12 and 13 – invertebrate assemblage.	Incidental mortality of species through clearance and nocturnal effects of lighting within the invertebrate assemblages supported by these compartments.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) would minimise light spill onto surrounding habitats.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Assessment Compartments 3, 11 and 12.	Changes in habitat vegetation composition and structure of fen meadow habitat and associated invertebrate assemblage through air quality changes.	Creation of fen meadow habitat at two locations off-site.	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Table 14.17: Summary of effect arising from the operational phase for invertebrates

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Assessment Compartments 4/4a, 5, 6, 13, 14 and 15.	Landscape restoration (through the **oLEMP**) on the EDF Energy estate whereby arable land is being converted to dry acid grassland characteristic of the Suffolk Sandlings.	Conversion of arable land to acid grassland.	Major beneficial (significant).	None required.	Major beneficial (significant).
Assessment Compartments 1, 2, 3, 8, 11 and 12.	No impacts during operation are envisioned.				

14.9 Fish

a) Current baseline

14.9.1 The desk-study identified no records of fish species. In addition, whilst no specific fish surveys have been undertaken, glass (young) eels (*Anguilla anguilla*) were found in the Leiston Drain during aquatic macrophyte surveys showing that the Minsmere sluice is permeable to eels and that eels are therefore present within the ditch network of Sizewell Marshes SSSI. In addition, anecdotal evidence from the SWT suggest that Sizewell Marshes SSSI supports a population of coarse fish including rudd (*Scardinius erythrophthalmus*).

14.9.2 The baseline for this EcIA is been provided in **Appendix 14A1** to **14A9** of this volume. In addition, the Eels Regulations Assessment appended to **Chapter 22 Marine Ecology** should also be read in conjunction with this chapter.

b) Future baseline

14.9.3 In the absence of the construction and operation of the proposed development, it is anticipated that the habitats would remain largely in their current form, and the baseline for fish, including eels would remain stable.

c) Assessment – construction and operation

14.9.4 During the construction and operational phase of works, the main impact pathways would be associated with:

- direct land take resulting in habitat loss, fragmentation and obstruction of passage for migratory fish;
- entrapment of eels leading to long-term population declines;
- changes in water quality; and
- alteration of local hydrology (including water chemistry) and hydrogeology.

14.9.5 Each of these construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in an effect which is not significant. The impact pathways that have been scoped out of this assessment for fish and eels, along with the rationale for scoping them out, are as follows.

14.9.6 As detailed under primary mitigation during both construction and operation, a surface water and foul water management strategy would be implemented to manage surface water discharges from the site. Impacts of changing water quality on fish have therefore been scoped out of detailed assessment.

14.9.7 The hydrological modelling work presented in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that potential hydrological effects on the terrestrial environment would be restricted to temporary drawdown of approximately 10cm and that no significant effects on water levels within the ditch network are anticipated to occur in close proximity (less than 1km) to the site (see **ES** (Doc Ref. Book 6) **Chapter 19: ground and surface water**). Hydrological effects (water quality, hydrology and hydrogeology) on fish and eels have, therefore, been scoped out of the detailed assessment.

14.9.8 As outlined under **section 14.7** of this chapter there would be a loss of approximately 2km of ditch habitat which has already been recreated within the habitat creation at Aldhurst Farm which is in direct hydrological connection with the ditch network of Sizewell Marshes SSSI and there would new habitat created when the Sizewell Drain is realigned. So overall no net loss of fish (ditch) habitat is anticipated. In addition, as outlined in **section 14.4** of this chapter, the culvert crossing of the Leiston Drain would be of sufficient dimensions to leave the bed and bank of the Leiston Drain unmodified and the proposed control structure on the realigned Sizewell Drain would incorporate a fish pass so no obstruction to migratory fish and eels is anticipated. The installation of such a structure is in line with the Eel Regulations (Ref 14.122) as demonstrated in the **Eels Regulations Screening Report**.

14.9.9 In addition, as outlined under the **section 14.4** of this chapter (tertiary mitigation), when the Sizewell Drain is realigned, a fish (and eel) rescue would be carried out, relocating stranded individuals across to the new realigned drain or undisturbed section of the Sizewell Drain.

14.9.10 Therefore, overall, no significant effects on fish, including eel, are anticipated, during either construction or operation.

d) Mitigation and monitoring

14.9.11 As no significant effects are anticipated, no additional mitigation or monitoring is required.

e) Residual effects

14.9.12 There would be no significant residual effects on fish, including eels, during both construction and operation.

14.10 Amphibians

a) Current baseline

14.10.1 A detailed description of the amphibian baseline of the site has been provided in **Appendix 14A5 – Amphibians and** a summary of the baseline conditions is provided below. Where there are amphibians of conservation concern, this is stated, and the conservation status provided along with the appropriate legislation.

14.10.2 **Section 14.6** of this chapter details the designated sites that have been identified within the ZoI of the site. No designated site (statutory or non-statutory) cite amphibians as a qualifying feature.

14.10.3 Desk-study records from SBIS have not identified any great crested newt breeding ponds or natterjack toad (*Epidalea calamita*) within the site.

14.10.4 There is a single desk-study record for natterjack toad at Vault Hill, RSPB Minsmere Reserve in 2005, approximately 1.5km north of the site boundary. Desk-study records situated approximately 3.2km north of the site boundary relate to reintroductions carried out by the RSPB in 1985 whilst additional reintroductions were started at Mount Pleasant pools, Minsmere in 2005, approximately 3.5km north of the site boundary. There are single desk-study records for common frog (*Rana temporaria*) and smooth newt (*Lissotriton vulgaris*) within the EDF Energy estate.

14.10.5 Natterjack toad was successfully introduced in 2005 into Retsom's Field, part of which lies within the current site boundary. SWT (on behalf of SZC Co.) has monitored the natterjack toad population annually, recording successful spawning in one functioning pond (Pond N1, see **Figure 14A5.1** in **Annex 14A5.1**) between 2008 and 2018. Based on spawn string counts from SWT survey data, there is a population size of around 30 adult natterjack toads within pond N1; it appears that tadpole peak counts have been steadily increasing but, since 2012, the adult population size has remained relatively constant. The existing close-cropped, sheep-grazed turf of Retsom's Field constitutes ideal terrestrial foraging habitat; they are known to hibernate within rabbit warrens in Retsom's Field (SWT, *pers. comm*.).

14.10.6 Surveys carried out between 2007 and 2010 recorded no great crested newt in waterbodies on the EDF Energy estate; eDNA surveys in 2016 also found no great crested newts. The terrestrial habitat present is suitable for great crested newt although conditions for all newt species within the EDF Energy estate are considered to be sup-optimal due to the geological conditions and the presence of sticklebacks and coarse fish in the ditches and waterbodies. Surveys in 2014 recorded great crested newt in four ponds located within 500m of the western edge of the site boundary; three of these ponds are likely to be the same medium-sized meta-population (with ponds between

160-300m from the site boundary) and the fourth pond a separate medium-sized metapopulation 490m from the site boundary. Survey results have also revealed small numbers of smooth newt, common toad (*Bufo bufo*) and common frog within the site.

14.10.7 Natterjack toad and great crested newt are European Protected Species (EPS) on Schedule 2 of the Conservation of Habitats and Species Regulations (Ref 14.5), and, along with common toad, are both priority species in the Suffolk BAP (Ref 14.20) and Suffolk's Priority Species and Habitats list (Ref 14.21), and are included under Section 41 of the NERC Act (Ref 14.10).

14.10.8 Natterjack toad is considered to be of national importance under the CIEEM guidelines (Ref 14.24) and of high importance, following the EIA-specific assessment methodology.

14.10.9 Considering the few confirmed populations within the ZoI, all of which are over 150m away from the site, great crested newt is considered to be of local importance under the CIEEM guidelines (Ref 14.24) and of very low importance following the EIA-specific assessment methodology. This species is considered an IEF due to their legal protection rather than their conservation status in relation to the proposed development. Given the level of importance, they are not considered within the detailed assessment that follows, but appropriate mitigation has been described to avoid any breach of legislation.

14.10.10 All other amphibian species are scoped out of detailed assessment due to both the lack of major breeding populations and their more limited conservation importance.

14.10.11 Following a review of the amphibian baseline within the ZoI, **Table 14.18** lists the amphibian IEFs which have been carried forward into the detailed assessment. A detailed justification for these features is also found within **Appendix 14A5 – Amphibians** of this volume.

Table 14.18: Amphibian IEFs taken forward for detailed assessment

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
Natterjack toad.	National/High.	This species is found at relatively few sites across the whole of Britain, and has seriously declined in the last 50 years. Natterjack toads were reintroduced in 2005 to a pond approximately 50m from the site boundary, where this species has successfully bred. There is, therefore, the potential for impacts on this species and it has been scoped into the detailed assessment.	IEF Scoped in.

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
Great crested newt.	Local/Very Low.	Great crested newt has not been found breeding in ponds within the site, and the habitat is sub-optimal; however, there are populations approximately 160m to the west of the site boundary. For this reason, great crested newts are considered an IEF owing primarily to their legal protection rather than their conservation status on site; they are included as an IEF but have been scoped out of the detailed assessment.	IEF Scoped out.
Other amphibians.	Local/Very Low.	These species are found in relatively small numbers in several of the waterbodies, and in terrestrial habitats, across the site. No significant effects are envisioned; therefore, they have been scoped out of the detailed assessment.	Scoped out.

14.10.12 Therefore, natterjack toad is the only IEF taken forward for a detailed assessment:

b) Future baseline

14.10.13 The population of natterjack toads in Retsom's Field is currently isolated and efforts are being made to provide additional breeding habitat within Retsom's Field and in the adjacent RSPB Minsmere Reserve, to provide a link from this introduced population to relict populations to the north (SWT, *pers. comm*.). Assuming this conservation initiative is continued, this could result in improved connectivity to adjacent reintroduced populations at two locations at the RSPB Minsmere Reserve, and reduce the potential risk of stochastic extinction to the Retsom's Field population.

14.10.14 The impacts that climate change may have on UK species have been summarised in Report Cards published by the Living with Environmental Change Network (Ref 14.59). The area of climatic suitability for some amphibians, including natterjack toad and common toad, could expand and this could allow northward range expansion, although this would depend on their ability to move between habitat fragments. Northern expansion is unlikely to have an impact on amphibians in Suffolk.

14.10.15 A 30-year study conducted at Woolmer Forest, Hampshire (one of the key natterjack sites in the south of England), has found that future climate change predictions (particularly warmer May temperatures) may be beneficial to natterjack toads (Ref 14.60).

c) Assessment

i. Construction

14.10.16 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in an effect which is not significant. The impact pathways that have been scoped out of this assessment for amphibians, along with the rationale for scoping them out, are as follows:

- **Habitat fragmentation (including connectivity)**. This impact is scoped out for natterjack toad. As described above, the natterjack toad population in Retsom's Field is on the east side of the site, with the land to the west of Retsom's Field being unsuitable for natterjack toads. The nearest populations are to the north of the site, so the proposed development would not result in habitat fragmentation.

- **The alteration of coastal processes (erosion, accretion and sedimentation)**. This impact is through the addition of temporary or permanent structures which may have direct or indirect effects on the integrity of coastal dune systems. However, as outlined in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) the site is forecast to have a minimal impact on coastal processes and therefore no significant effects on terrestrial habitat are envisaged (other than changes that would occur by purely natural processes). Therefore, this impact pathway has been scoped out.

- **Disturbance effects on species populations as a result of recreational pressure (through trampling of supporting habitats)**. This may arise through the displacement of recreational users from the beach frontage at Sizewell and/or the influx of workers into the area during the construction phase. However, there would be no access to amphibian habitats within the vicinity of the construction site as a result of security fencing and it is considered extremely unlikely that amphibians within any of the sites to which recreational users may be displaced would be significantly affected. Therefore, no impacts on natterjack toad populations are considered likely as a result of this impact pathway.

- **Effects of changes in local hydrology and hydrogeology, air quality and water quality during construction**. Due to the embedded primary and tertiary mitigation, impacts to the water quality or the hydrological regime of ponds within the ZoI are unlikely to occur, in particular as natterjack toad breeding pond (Pond N1, see **Figure 14A5.1** in **Annex 14A5.1**) is arterially lined and independent of groundwater influences. Tertiary mitigation would include compliance with relevant environmental legislation that would minimise dust pollution and air quality changes that may impact ponds and associated vegetation. There are not expected to be any significant effects on natterjack toads related to this impact.

14.10.17 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by natterjack toad are identified and assessed within the subsequent sections.

IEF: Natterjack toads

14.10.18 During construction, the main impact pathways experienced by the natterjack toad population would be associated with:

- land take resulting in habitat loss;
- incidental mortality of species; and
- disturbance effects on species population (comprising light, noise and visual effects).

14.10.19 The characterisation of the above impacts is described below:

Land take resulting in habitat loss

14.10.20 The majority of the site comprises habitat unsuitable for natterjack toad, being predominantly arable fields and forestry plantation. However, the proposed construction of a WMZ within Retsom's Field, at the north-eastern edge of the temporary construction area, would result in the direct loss of approximately 3.55ha of suitable foraging habitat for the breeding population of natterjack toads in this location. This is circa 24% of the total area of Retsom's Field (14.9ha).

14.10.21 The breeding pond itself would not be affected, as it is 45m north of the application boundary. The WMZ has also been located to avoid impacts on the few features within Retsom's Field that provide structural diversity (and thus resting and hibernation opportunities). These include several rabbit warrens and the now-defunct pond N2.

14.10.22 Retsom's Field supports short-sward sheep-grazed grassland that is suitable for natterjack toad foraging. The loss of foraging habitat could have an impact on the natterjack population present within pond N1. The habitat loss, though temporary, would last for up to 9-12 years throughout construction. There are areas of adjacent marshy grassland and coastal dune systems which are also typical foraging habitats although accessibility of these habitats to the toads may be compromised by wide ditches as they are poor swimmers.

14.10.23 The population of natterjack toad in Retsom's Field represents isolated and breeding is restricted to a solitary pond (N1). Based on the survey results and the availability of terrestrial foraging habitats in the wider area, it is assumed that N1 has reached its adult carrying capacity and/or juvenile survival rate is low (presumably due to a lack of suitable terrestrial refuge and overwintering opportunities).

14.10.24 Natterjack toads require three elements of habitat structure: open, unshaded terrestrial habitat with areas of un-vegetated (or minimally vegetated) ground with predominantly low growing vegetation; unshaded, ephemeral ponds for reproduction with shallow, shelving margins and few predators or competitors (Ref 14.60); and suitable refuge from extremes of temperature or dryness (either substrates, such as sandy soils, in which they can dig burrows, or cover objects on the surface where they can shelter) (Ref 14.61). These habitat features need to be close together as this species is unable to cross extensive areas of unsuitable terrain to move between Summer/Winter and breeding habitats. At least some of the population of natterjack toads at Retsom's Field hibernate within rabbit warrens within the field although these will be retained and protected during the construction phase and retained in the long-term.

14.10.25 As detailed in the tertiary mitigation (**section 14.4** of this chapter), a natterjack toad mitigation strategy (**Appendix 14C7A** of this volume) as well as a draft Natural England Protected Species licence (**Appendix 14C7B** of this volume) has been developed which includes mitigation for the loss of foraging habitat in Retsom's field, through creating a strategically placed new pond suitable for use by natterjack toads as well as improving refuge and overwintering opportunities within Retsom's Field. It is anticipated that habitat loss would have a long-term and temporary, **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality

14.10.26 There is the potential for incidental injury or mortality to natterjack toad, from construction plant carrying out vegetation and ground clearance works, during the preliminary works and site establishment phases of construction of the WMZ in Retsom's Field.

14.10.27 The natterjack toad is primarily nocturnal but may bask in vegetation in early morning sunshine shortly after hibernation and emerge from their burrows around dusk later in the year to feed; otherwise, they spend much of the daytime in burrows or crevices under debris, and hibernate underground (Ref 14.60). They are also relatively slow-moving and would be unlikely to escape effectively from site clearance machinery.

14.10.28 The extent of the effect is unlikely to extend much beyond the 3.5ha of the land take. Reptile surveys using artificial refugia along the woodland edge of Goose Hill/Retsom's Field, in Goose Hill and the main platform (see **Appendix 14A6 – Reptiles** of this volume) revealed no incidental observations of natterjack toads, suggesting they do not use the habitat to the west of Retsom's Field. The effect would occur during Phase 1 site establishment and preparation of earthworks (Years 1 to 2 of the Construction Phase).

14.10.29 As detailed in the tertiary mitigation (**section 14.4** of this chapter), a natterjack toad mitigation strategy (**Appendix 14C7A** of this volume) as well as a draft Natural England European Protected Species licence (**Appendix 14C7B** of this volume) has been developed which will include amphibian-proof fencing and pre-construction checks of refugia to remove any natterjack toads from under the construction footprint and so avoid incidental mortality.

14.10.30 Taking into consideration the tertiary mitigation and the measures to be implemented, it is assumed that incidental mortality would have a short-term and temporary **minor adverse** effect, which is considered to be **not significant.**

Disturbance effects on species population (comprising light, noise and visual effects)

14.10.31 Increases in light, noise and visual disturbance from construction activities (including increased vehicle movements, construction site lighting, and/or increased human presence) could potentially impact on the population of natterjack toads within Retsom's Field.

14.10.32 Noise disturbance could affect the mating calls of male natterjack toads, thus decreasing breeding efficiency. Natterjack toad males call to attract females for mating, usually after dark, and males can be induced to start calling by incidental noises (Ref 14.60). Information on the sensitivities of UK amphibians of conservation concern to noise disturbance is equivocal (Ref 14.62). There is evidence that the common toad increases locomotion and escape behaviours in response to white noise (Ref 14.63), and that an Australian frog species calls at higher pitch in traffic noise (Ref 14.64). Radford also reports on evidence for a negative impact on frog mating behaviour in Belize (Ref 14.65) due to anthropogenic noise.

14.10.33 Increased lighting levels could also disrupt foraging or reproductive behaviour of the natterjack toad or increase predation risk from corvids or grass snake. Artificial lighting has been shown to affect the feeding behaviour of nocturnal frogs, reducing their visual acuity and ability to find prey (Ref 14.66).

14.10.34 However, the impacts of noise and light disturbance on breeding and foraging natterjack toads would be sufficiently controlled by the primary mitigation outlined in **section 14.4** of this chapter. The WMZ itself would be constructed during daylight hours and activity in the vicinity of the operational WMZ would be limited to maintenance visits. The majority of construction work would on the wider site would take place between 07:00 and 22:00 with more noise intrusive activities, closest to Retsom's Field being undertaken during daylight hours. Therefore, the disturbance effects would have a long-term and temporary but **minor adverse** effect, which is considered to be **not significant**.

Inter-relationship effects

14.10.35 This section provides a description of the identified inter-relationship effects that are anticipated to occur on amphibian receptors between the individual environmental effects arising from construction of the proposed development.

14.10.36 Whilst there would be potential changes to local hydrology, air quality and water quality particularly during the construction phase and whilst the WMZ will be in operation within a portion of Retsom's Field, there is a low likelihood that these could act together to cause changes to vegetation structure and composition within Retsom's Field. If this occurred, this could reduce the suitability of this habitat to support natterjack toads.

14.10.37 As outlined in tertiary mitigation (see **section 14.4** of this chapter) hydrological and botanical monitoring of the area would continue through the construction phase and if a negative trend is found then mitigation such as increased grazing or manipulation of water levels would occur. Given the confirmed breeding pond is lined and not hydrologically linked to the site, there is no risk of the pond drying out from any very local groundwater change. However, modelling would be used to determine the operating parameters of the new WMZ so that it would not pose an increase flood risk to Retsom's field which could then compromise the natterjack population. Botanical modelling would be used to determine whether any there are any changes to the vegetation. This would help inform the need to change any element of the site management including the extent and intensity of grazing or mowing, to maintain the existing habitats and natterjack toads in particular.

ii. Operation

IEF: Natterjack toad

14.10.38 During operation, the key impact pathway experienced by this IEF would be associated with removal of the WMZ and habitat reinstatement. The characterisation of this impact is described in detail below.

Land take and habitat reinstatement

14.10.39 Once the construction phase is complete, the WMZ within Retsom's Field would be removed and the footprint restored to acid grassland returning it to its baseline close-cropped, sheep-grazed turf condition. This would return the habitat to one that is of benefit to natterjack toads and would be restoring the baseline habitat. This would result in an overall **minor beneficial effect**, which is considered to be **not significant**.

Inter-relationship effect

14.10.40 This section provides a description of the identified inter-relationship effects that are anticipated to occur on amphibian receptors between the individual environmental effects arising from operation of the proposed development.

14.10.41 No inter-relationship effects have been identified for the operational phase.

d) Mitigation and monitoring

i. Mitigation

14.10.42 Primary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter as well as further tertiary mitigation measures detailed in the Natterjack Toad Mitigation Strategy (**Appendix 14C7A** of this volume) and the Natterjack Toad Draft Natural England European Protected Species Licence (**Appendix 14C7B** of this volume). Additional secondary mitigation measures are not proposed.

ii. Enhancement

14.10.43 Natterjack toad populations are usually limited by the number of suitable breeding ponds available rather than the extent of terrestrial habitat. Increasing the number of breeding ponds available is therefore likely to increase the size of the natterjack toad population in time. The potential creation of a new breeding pond is proposed within Retsom's Field. This is discussed further in the Natterjack Toad Draft Natural England European Protected Species Licence.

iii. Monitoring

14.10.44 A natterjack toad monitoring programme, both during and after construction, would provide early warning of any changes in the population so that appropriate action could be taken. Any new ponds and the natterjack toad population status would be monitored post construction. Any newly created/managed habitats would also be monitored to ensure these remain suitable for natterjack toads.

e) Residual effects

14.10.45 The following tables present a summary of the amphibian assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

Table 14.19: Summary of effects araising from the construction for amphibians

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Natterjack toad	Land take resulting in habitat loss	**Natterjack toad mitigation strategy and draft Natural England European Protected Species Licence** Tertiary mitigation includes enhancements of the retained habitat areas along with the provision of an additional breeding pond and refuges.	Minor adverse (not significant)	None required.	Minor adverse (not significant)
	Incidental mortality	**Natterjack toad mitigation strategy and draft Natural England European Protected Species Licence** Tertiary mitigation includes provision of amphibian-proof fencing and pre-construction checks of any refugia.	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Disturbance effects on species population (comprising light, noise and visual effects).	**Natterjack toad mitigation strategy and draft Natural England European Protected Species Licence** Primary mitigation includes a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) and boundary treatments.	Minor adverse (not significant)	None required	Minor adverse (not significant)

Table 14.20: Summary of effects arising from the operational phase for amphibians

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Natterjack toad	Habitat reinstatement and creation	Tertiary mitigation includes reinstatement of WMZ to acid grassland and restoration of much of wider EDF Energy estate to acid grassland (through the **oLEMP**).	Neutral (not significant)	None required	Minor beneficial (not significant)

14.11 Reptiles

a) Current baseline

14.11.1 A detailed description of the reptile baseline information of the site is provided in **Appendix 14A6 – Reptiles** of this volume and a summary of the baseline conditions is provided below. Where there are reptiles of conservation concern, this is stated, and the conservation status provided along with a summary of the appropriate legislation.

14.11.2 **Section 14.6** of this chapter identifies the designated sites that have been identified within the ZoI of the site. No designated site (statutory or non-statutory) cite reptiles as a qualifying feature.

14.11.3 Desk-study data from SBIS obtained for notable species of conservation concern within 2km of the site boundary. All four common UK species, namely adder (*Vipera berus*), common lizard (*Zootoca vivipara*), grass snake *(Natrix helvetica helvetica*) and slow-worm (*Anguis fragilis*), are widely distributed across suitable habitats within the site.

14.11.4 Surveys carried out between 2007 and 2012 recorded regular observations of all four common reptile species including adults, sub-adults and juveniles. There was a concentration of common lizard in habitats closer to the coastline, most notably within un-grazed improved grassland swards, and the coastal grassland habitats, with low numbers in isolated locations in the plantation woodlands of Dunwich Forest/Goose Hill. Large numbers of slow-worm were recorded within woodland habitats along ride edges, with an absence of records in more open habitats towards the coast. No clear habitat preference was identified for adder, as this species was observed within both plantation woodland and more open grassland habitats surveyed. However, a small concentration of adder was recorded within Dunwich Forest/Goose Hill. Grass snake exhibited a similar distribution to adder.

14.11.5 Further surveys were undertaken to provide more robust population estimates of the four reptile species. These involved surveys in 2015/2016 of all representative habitats suitable for reptiles, notably arable hedgerow margin, conifer plantation, ride, scrub, Goodrums Fen, open grassland/scrub habitat on main platform, and landscape plantation on the main platform, within the site.

14.11.6 Methods of population assessment for reptiles included:

- a literature review of what constitutes low, good and exceptional populations;
- comparisons of the numbers of reptiles recorded during survey work with the numbers of reptiles subsequently translocated from the same

area from a range of studies (including one at the adjacent Galloper Wind Farm site); and

- extrapolations of typical densities and habitat assessment on site (as determined from the Phase 1 habitat survey maps and aerial photographs) to give population density estimates.

14.11.7 Mean population density estimates were calculated as follows: common lizard 6.0 per ha, slow-worm 12.1 per ha, adder 9.3 per ha, and grass snake 6.1 per ha.

14.11.8 Of the four common reptile species, adder is the most under threat in the UK, particularly from habitat loss and isolation of populations, and populations in the UK are declining. They have a population stronghold in the Suffolk coastal habitat (including the EDF Energy estate). It is difficult to determine the conservation status of grass snake; this species is often associated with wetlands and has good quality habitat available to it within the EDF Energy estate. Common lizard and slow-worm are less threatened than the two snake species and have good quality habitat available to them within parts of the EDF Energy estate.

14.11.9 All four species are protected under Schedule 5 of the W&CA (Ref 14.7) and are included within Section 41 of the NERC Act (Ref 14.10). Adder, common lizard, grass snake and slow-worm are also priority species in the Suffolk BAP (Ref 14.20) and Suffolk's Priority Species and Habitats list (Ref 14.21).

14.11.10 The site and its ZoI constitutes a "Key Reptile Site" as defined by Froglife (Ref 14.67) criteria, as it fulfils all of the first four criteria; that is: supports three or more reptile species; supports two snake species (grass snake and adder); supports an exceptional population of adder ; and supports an assemblage scoring 8 or 10. The Breckland and Sandlings areas of Suffolk both contain large tracts of important reptile habitat, which is becoming increasingly scarce in lowland Britain.

14.11.11 The reptile assemblage as a whole (rather than the four individual species) is therefore considered to be of regional importance under the CIEEM guidelines (Ref 14.24) and of medium importance under the EIA-specific assessment methodology.

b) Future baseline

14.11.12 The impacts that climate change may have on UK reptile species have been summarised in Report Cards published by the Living with Environmental Change Network (Ref 14.59). Common lizard and adder are projected to lose suitable climatic conditions across England under many climate change scenarios, over a 20 to 25-year timescale.

14.11.13 Given the current habitat heterogeneity within the EDF Energy estate, on-going habitat management and protection, the good or excellent existing population status of the four common reptile species, and the importance to these species of the surrounding Sandlings areas of Suffolk, then future populations of these species should be stable.

14.11.14 With the change from primarily agricultural land at Aldhurst Farm to the creation of wetland and other reptile-friendly habitat enhancement at this site (implemented in 2015), reptile numbers, particularly grass snake, are likely to increase. Habitat enhancement on previous arable land at the Studio Field complex (Sizewell Gap area) to the south-west of the EDF Energy estate (implemented in 2012), which is ongoing, should also lead to increases in reptile numbers. Both areas are defined as reptile receptor translocation sites which would be used to receive reptiles from the main development site prior to site clearance. Even without translocation, it is anticipated that the reptile populations of these areas could increase naturally as the acid grassland habitats become better established and more diverse over time.

c) Assessment

i. Construction

14.11.15 During the construction phase of works, the main impact pathways on reptile populations would be associated with:

- direct land take resulting in habitat loss;
- habitat fragmentation (including connectivity);
- incidental mortality of species;
- disturbance effects on species population (comprising light, noise and visual effects); and
- alteration of coastal processes.

14.11.16 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in an effect which is not significant. The impact pathways that have been scoped out of this assessment for reptiles, along with the rationale for scoping them out, are as follows:

- **Disturbance effects on species populations as a result of recreational pressure (through trampling of supporting habitats).** This may arise through the displacement of recreational users from the beach frontage at Sizewell and/or the influx of workers into the area during the construction phase. The provision of alternate recreational green space primary mitigation outlined in **section 14.4** of this chapter, would reduce the potential for an effect. Therefore, no impacts on reptile populations are considered likely as a result of this impact pathway.

- **Effects of changes in local hydrology and hydrogeology, air quality and water quality on reptiles.** The common reptile species in the UK are primarily terrestrial, although grass snake spend time in aquatic environments. Given the embedded primary and tertiary mitigation (see **section 14.4** of this chapter), it is not considered likely that an impact to the water quality within the ZoI would be experienced, and there would be no significant effect on reptile populations. Tertiary mitigation includes measures to minimise dust pollution and to limit air quality changes that may impact both ponds (and associated vegetation) and terrestrial habitats. Due to the embedded primary and tertiary mitigation, it is considered unlikely there would be an effect on the water quality of watercourses (see **ES** (Doc Ref. Book 6) **Chapter 19, Groundwater and Surface Water**) used by reptiles (primarily grass snake) within the ZoI would be experienced, and so there would be no significant effect on these receptors.

- **Alterations of coastal process.** This impact is considered within **section 14.7** of this chapter, for the assessment of plants and habitats. As outlined in this section, the proposed development would have no significant effect upon coastal processes and therefore potential impacts on terrestrial habitat due to changes in coastal processes are not envisaged. Therefore, no significant effects on reptile populations are considered likely as a result of this impact pathway.

14.11.17 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by the reptile assemblage have been identified and detailed within the subsequent sections.

IEF: Reptile assemblage

14.11.18 During construction, the key potential impact pathways experienced by the local reptile assemblage/ population would be associated with:

- land take resulting in habitat loss;
- habitat fragmentation (including connectivity);
- incidental mortality of species; and
- disturbance effects on species population (comprising light, noise and visual effects).

14.11.19 The characterisation of the above impacts is described in detail below.

Land take resulting in habitat loss

14.11.20 The construction layout plans for the proposed development show land take of approximately 332ha (see **ES (**Doc Ref. Book 6**) Chapter 3, Description of construction of Sizewell C**) although much of this area is considered unsuitable for reptiles, being under arable production, forestry plantation, and/or hard standing. The area of suitable habitat for reptiles and their prey species that would be lost comprises approximately 71ha, of which 36ha represents permanent land take (habitat loss) from the footprint of the completed proposed development (access road and SSSI crossing, car parking, security buildings, coastal defences, and the main platform).

14.11.21 The site clearance phase of the proposed development would result in a loss of habitat that could have an impact on the ability of species in the reptile assemblage to survive and reproduce. Any temporary habitat loss could last for a period of up to 9-12 years, i.e. throughout the construction period, but this would vary depending on the activity required in a particular area.

14.11.22 Habitat loss relates to direct loss of suitable foraging habitat, habitat for mating and egg-laying (where relevant), habitat for basking, as well as habitat features used by reptiles for hibernation, and migration to and from the hibernation areas and egg-laying areas (where appropriate). The potential complete loss of foraging, basking, mating, egg-laying and hibernation habitat would have a negative impact on the constituent species populations of the reptile assemblage within the construction footprint.

14.11.23 The total number of common lizard, slow-worm, adder and grass snake in good reptile habitat under the footprint of the completed proposed development is estimated to be approximately 1,869, 7,441, 1,566 and 970 respectively (see the **Appendix 14C2 – Reptile Mitigation Strategy** of this volume for more detail).

14.11.24 Primary mitigation outlined in **section 14.4** of this chapter includes extensive areas of replacement habitat for reptiles which have been created in advance of construction. These areas include lifecycle features such as basking banks and hibernacula required by reptiles. No secondary mitigation is proposed given the primary mitigation implemented.

14.11.25 Taking the primary mitigation into consideration, land take and habitat loss would have a low impact on the reptile assemblage, resulting in a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.11.26 The construction footprint of the proposed development would cause a temporary (9-12 year year) west-east barrier to reptiles moving across the wider landscape, running from the Campus area, through the arable fields east of Upper Abbey Farm, the woodlands of Goose Hill, through the north-east corner of Sizewell Marshes SSSI, and the main platform. The SSSI crossing would, however, provide a dispersal route for grass snake.

14.11.27 Habitat fragmentation has the potential to lead to population isolation, particularly for the two large and more mobile snake species in the reptile assemblage, affecting their ability in the retained habitat to migrate from hibernation sites to basking, breeding and/or foraging areas.

14.11.28 Barriers to dispersal from hibernation to foraging areas can lead to population losses in isolated adder populations (Ref 14.68, Ref 14.69). Adder is often restricted to habitat islands, a problem for a small snake with limited migratory abilities. Inbreeding can make them genetically vulnerable to environmental change and disease so linking habitats is crucial to their conservation. A study on grass snake in Europe (Ref 14.70) found no genetically distinct grass snake populations in the study area (covering 90km^2), implying that there is an exchange of individuals between small remnants of original habitat and that gene flow may prevent any genetic differentiation of subpopulations distributed over a relatively large area and suggesting that grass snake are highly adaptable to habitat fragmentation.

14.11.29 The primary mitigation outlined in **section 14.4** of this chapter describes the areas of newly created reptile habitat principally to the south of the site. This would reduce the effects of fragmentation by creating a large single block of suitable habitat linking areas of retained habitat such as Sizewell Marshes SSSI, Broom Covert, Aldhurst Farm and Leiston Common. In addition, this would provide linkage to areas such as Aldringham Walks to the south and west of the site. The creation across the EDF Energy estate of extensive areas of acid grasslands would also substantially improve habitat connectivity in the long-term.

14.11.30 Overall, it is difficult to accurately quantify the magnitude of this impact given the temporary impact on dispersal to the north from the construction site is off-set by increased connectivity to the south and south-west from the habitat creation. Habitat fragmentation is considered to have a low impact on the reptile assemblage, resulting in a **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality of species

14.11.31 There is the potential for incidental injury or mortality to reptiles from construction plant carrying out vegetation and ground clearance works, during the Phase 1 preliminary works and site establishment phases (including preparation of earthworks) of construction. There is also the potential for incidental injury or mortality to occur through the use and movement of stockpiled spoil and material, as these could be used by basking or sheltering reptiles. However, given the scale of works and the proposed boundary treatments, it is considered unlikely that reptiles would access the site footprint once construction commences.

14.11.32 The adder is diurnal, and when threatened, its first line of defence is to move quickly and silently into deep cover (Ref 14.67). This could put individuals at risk during any vegetation clearance programme. The grass snake is diurnal, and relies initially on wariness to avoid predation, but then may "play dead" if attacked by a predator (Ref 14.67), which would make it more vulnerable to accidental mortality from construction machinery. For the smaller and less mobile common lizard and slow-worm, the potential impact of vegetation and ground clearance may be even more important than for the two snake species. Common lizard movements are limited to a few tens of metres (Ref 14.67). Slow-worm live primarily underground, underneath objects on the ground, or in vegetation litter and tussocks, and do not move long distances (home ranges are of the order of several hundred square meters) (Ref 14.67).

14.11.33 Certain life stages may be at additional risk of mortality if particular key habitats (such as hibernation and egg-laying sites) are damaged during site clearance. Slow-worm and adder may hibernate communally (Ref 14.67), so would be at additional risk of incidental mortality to groups of individuals if a hibernation site was destroyed. Grass snake egg laying sites are also communal and traditional (Ref 14.67).

14.11.34 As outlined in **section 14.4** of this chapter, primary mitigation has included the creation of a large area of suitable reptile receptor habitat in to which reptiles would be translocated from under the construction footprint, so as to minimise the potential for incidental mortality. Further details are provided in the **Reptile Mitigation Strategy** (**Appendix 14C2** of this volume) and below.

14.11.35 Incidental mortality would have a low impact on the reptile assemblage, resulting in a **minor adverse** effect, which is considered to be **not significant**.

Disturbance effects on species population (comprising light, noise and visual effects)

14.11.36 Increases in light, noise and visual disturbance as a result of construction activities could impact on the reptile populations within the ZoI. This may arise through direct construction activities, increased vehicle movements and increased human presence on site during construction.

14.11.37 Adder and grass snake are primarily diurnal but are known to be active at night in the summer, and so may be disturbed by extraneous lighting. Adder spend the two to three weeks after emerging from hibernation basking in a relatively inactive state (Ref 14.67), so are at risk from disturbance during this time period. Slow-worm primarily live at or below ground level (Ref

14.67), so are less likely to be affected by these impacts. The adder is able to detect low frequency sounds, but there is little information on the impact of anthropogenic noise on adder and UK reptiles (Ref 14.69).

14.11.38 After the initial site clearance phase, reptiles would be (largely) absent from the construction footprint and as outlined in **section 14.4** of this chapter, boundary treatments would ensure that disturbance impacts on adjacent habitat would be minimised.

14.11.39 Disturbance would have a low impact on the reptile assemblage, resulting in a **minor adverse** effect, which is considered to be **not significant**.

Inter-relationship effects

14.11.40 This section provides a description of the identified inter-relationship effects that are anticipated to occur on reptile assemblage receptors between the individual environmental effects arising from construction of the site.

14.11.41 Habitat fragmentation could render hibernation sites (for both snake species) and egg-laying sites (grass snake) unviable if they were isolated by unsuitable habitat from foraging sites. Primary mitigation has included the creation of a large area of suitable reptile receptor habitat into which reptiles would be translocated from under the construction footprint, so as to minimise the potential for this inter-relationship effect.

ii. Operation

IEF: Reptile Assemblage

14.11.42 During operation, no significant adverse effects on the reptile assemblage are envisaged.

14.11.43 The key impact would be the landscape scale habitat creation across the EDF Energy estate which would create extensive areas of Suffolk Sandlings acid grassland as well as additional areas of scrub and broad-leaved woodland. This landscape-scale habitat creation would have a **moderate beneficial** effect on the reptile assemblage, which is considered to be **significant**.

Inter-relationship effects

14.11.44 This section provides a description of the identified inter-relationship effects that are anticipated to occur on reptile assemblage receptors between the individual environmental effects arising from operation of the proposed development.

14.11.45 No inter-relationship effects have been identified for the operational phase.

d) Mitigation and Monitoring

i. Mitigation

14.11.46 Primary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter. As the assessment concluded no significant effects when considering the primary mitigation measures, no further secondary mitigation measures for the reptile assessment are required to reduce or avoid a significant effect, for either the construction or operational phase.

ii. Enhancement

14.11.47 Due to the primary mitigation in place (see **section 14.4** of this chapter), no additional enhancement is proposed.

iii. Monitoring

14.11.48 The receptor sites would be monitored during the pre-construction period to confirm that suitable reptile habitats have become established and to confirm that appropriate management measures are in place. Similar long-term monitoring would occur during and after the translocation process. Once translocation is complete, there would be regular monitoring of the receptor site populations to ensure that a stable age class of reptiles is present (i.e. all age classes present) and that young of reptile species are present, to determine the success of the translocation.

14.11.49 Further details on monitoring are provided in the **Reptile Mitigation Strategy** in **Appendix 14C2** of this volume.

e) Residual effects

14.11.50 The following tables present a summary of the reptile assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

14.11.51 It should be reiterated that not all such effects are adverse; some are beneficial.

Table 14.21: Summary of effects arising from the construction for reptiles

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Reptile Assemblage	Land take resulting in habitat loss	Primary mitigation includes establishment of reptile mitigation areas and replacement habitat in advance of construction, as described in the **Reptile Mitigation Strategy**.	Minor adverse (not significant)	None required.	Minor adverse (not significant)
	Habitat fragmentation (including connectivity)	Primary mitigation includes establishment of reptile mitigation areas and replacement habitat in advance of construction, as described in the **Reptile Mitigation Strategy**.	Minor adverse (not significant)	None required.	Minor adverse (not significant)
	Incidental mortality of species	Tertiary mitigation includes installation of reptile-proof fencing, searching refugia and moving individuals outside of the development footprint into receptor sites, as described in the **Reptile Mitigation Strategy**.	Minor adverse (not significant)	None required.	Minor adverse (not significant)
	Disturbance effects on species population (comprising light, noise and visual effects).	Tertiary mitigation includes a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) and boundary treatments.	Minor adverse (not significant)	None required.	Minor adverse (not significant)

Table 14.22: Summary of effects arising from the operational phase for reptiles

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Reptile Assemblage	Habitat creation	Landscape scale creation of acid grasslands across the EDF Energy estate through the **oLEMP**.	Moderate beneficial (significant)	None required.	Moderate beneficial (significant)

14.12 Ornithology

a) Current baseline

14.12.1 A detailed description of the ornithology baseline of the site is provided in **Appendix 14A7 – Ornithology** of this volume and a summary of the baseline conditions is provided below. Detailed individual species accounts (including desk-study results and survey data) are provided in **Annex A147.4** and **Annex 14A7.5** of this volume. Ornithology baseline figures are presented in **Annex 14A7.1** of this volume.

14.12.2 In addition to the ornithology baseline, an **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) has been produced. This provides further detail of the evidence base underpinning the impact assessment.

14.12.3 The site is located in close proximity to a number of designated sites of International and National nature conservation importance for breeding, wintering and passage birds as well as non-statutory sites of Regional or County importance (designated sites are shown on **Figures 14A2.1, 14A2.2** and **14A2.3 (Annex A14A2.1** of this volume). Full details of the designated sites with ornithological interest features within the ZoI of the proposed development have been provided in **Appendix 14A2 – Designated Sites** of this volume, with a short summary below.

14.12.4 To the north of the site is the Minsmere-Walberswick SPA and Ramsar site and Minsmere to Walberswick Heaths and Marshes SSSI which comprises a range of habitat types supporting a diverse assemblage of breeding, passage and wintering bird species. To the south lies the Sandlings SPA/Sandlings Forest SSSI supporting breeding nightjar (*Caprimulgus europaeus*) and woodlark (*Lullula arborea*) and the Alde-Ore Estuary SPA, Ramsar site and SSSI with a diverse assemblage of wetland and sea bird species. Offshore lies the Outer Thames Estuary SPA (supporting wintering red-throated diver (*Gavia stellata*) and foraging tern species during the breeding season) and the Sizewell Rigs CWS supporting breeding kittiwake (*Rissa tridactyla*). Adjacent to the site is Sizewell Marshes SSSI with an assemblage of bird species typical of lowland wet grassland. Sizewell Levels and Associated areas CWS and Southern Minsmere Levels CWS to the north of the site also supports a range of important bird species.

14.12.5 The footprint of the site and surrounding area support a diverse bird assemblage characteristic of woodland, farmland and wetland (Sizewell Marshes SSSI and Minsmere to Walberswick Heaths and Marshes SSSI) habitat, including Red listed bird species of BoCC (Ref 14.36) and/or are included under Section 41 of the NERC Act (Ref 14.10).

14.12.6 Thirty-two potential IEFs were identified and brought forward from the ornithology baseline (as listed in **Table 14.23**). **Table 14.23** also summarises the known distribution of the IEFs near to the site. Justification for the scoping in of the bird species/assemblages is provided in full within **Appendix 14A7 – Ornithology** of this volume**.** Full details of each bird species, including which species are interest features of which designated site, are provided in the species accounts (**Annex 14A7.4** and **Annex 14A7.5**).

Table 14.23: Bird species/assemblages identified as IEFs (based on information set out within Appendix 14A7 – Ornithology)

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
Bittern (*Botaurus stellaris)* (breeding and wintering).	International/High	The Minsmere-Walberswick SPA supports a breeding population of bitterns. Bittern do not breed within the EDF Energy estate or Minsmere South Levels; however, they do forage within Minsmere South Levels and have also been occasionally observed using Sizewell Marshes SSSI during the Winter. Minsmere South levels comprises part of the Minsmere SSSI, although outside of the SPA boundary.
Avocet *(Recurvirostra avosetta)* (breeding and wintering).	International/High	A qualifying feature of the Alde-Ore Estuary SPA. Pre-2010, avocet bred on the Minsmere South Levels, now they only use the area for feeding. Elsewhere, the Minsmere-Walberswick SPA supports up to 91 breeding pairs. Also regularly recorded commuting along the coastline during the breeding and Winter season.
Redshank *(Tringa totanus)* (wintering).	International/High	A qualifying feature of the Alde-Ore Estuary SPA. This species has been regularly recorded commuting along the coastline during the breeding and wintering season. Redshank were also observed, as incidental species during bittern and harrier surveys (2014, 2015 and 2016) within Minsmere South Levels during the breeding season; however, no confirmed breeding was identified. Data from the RSPB indicates that redshank breed within the RSPB Minsmere Reserve with approximately 30 pairs recorded in 2019.
Shoveler *(Anas clypeata)* *(*breeding and wintering).	International/High	An interest feature of the Minsmere-Walberswick SPA with nine pairs recorded in 2017 and 21 pairs recorded in 2018. This species was confirmed as present within Sizewell Marshes SSSI and Minsmere South Levels during the breeding season, however, no confirmed breeding sites were identified (last confirmed breeding record was in 2007).
Gadwall *(Anas strepera)* (breeding and wintering).	International/High	An interest feature of the Minsmere-Walberswick SPA with five pairs recorded in 2018. This species was confirmed as present within Sizewell Marshes SSSI and South Minsmere Levels during the Winter period. Breeding season observations were of single or pairs of birds, and breeding gadwall have previously been recorded within the survey area by SWT. Gadwall were also regularly recorded commuting along the coastline during the breeding and wintering seasons.

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
Teal *(Anas crecca)* (breeding and wintering).	International/High	An interest feature of the Minsmere-Walberswick SPA (for the breeding population) with very few records of recent breeding (the most recently available 5 year mean peak count recorded one breeding pair). This species has been regularly observed commuting along the coastline, with large numbers recorded during the Winter. Observations of teal within the site during the breeding season are rare.
White-fronted goose *(Anser albifrons)* (wintering).	International/High	An interest feature of the Minsmere-Walberswick SPA. This species has been occasionally observed during the Winter, with all records within the site associated with the arable fields at the northern end of the EDF Energy estate. The RSPB indicates that the geese feed on North Warren to the south of the site and commute to roost on the Minsmere South Levels at night, presumably flying over the site. White-fronted Geese were heard at night on the South Levels in winter 2019-20 (RSPB pers. comm.)
Marsh harrier *(Circus aeruginosus)* (breeding).	International/High	An interest feature of the Minsmere-Walberswick SPA with up to 16 breeding pairs. Whilst marsh harrier do not breed within the site, they do use Minsmere South Levels, Sizewell Marshes SSSI and the arable fields at the northern end of the EDF Energy estate as a foraging resource during the breeding season. In 2019, marsh harrier established a breeding territory within Aldhurst Farm within the new reedbed adjacent to the site, which was created to offset the loss of reedbeds associated with Sizewell C. This territory is additional to ten nests which raised 12 young on the nearby RSPB Minsmere Reserve.
Marsh harrier (wintering).	National/High	Constant presence of wintering birds within the Minsmere to Walberswick Heaths and Marshes SSSI. Marsh harrier use Minsmere South Levels, Sizewell Marshes SSSI and the arable fields at the northern end of the EDF Energy estate as a foraging resource during the Winter.
Hen harrier *(Circus cyaneus)* (wintering).	International/High	An interest feature of the Minsmere-Walberswick SPA with historically up to 15 wintering individuals. In accordance with widespread declines in the wintering populations in southern England, recent survey work has recorded the odd individual occasionally in the Winter period and no Winter roosting sites were identified.
Nightjar (breeding).	International/High	An interest feature of the Minsmere-Walberswick SPA and Sandlings SPA with historically up to 21 pairs recorded; in addition, five churring males were recorded at Sandlings SPA at Aldringham Walks in 2018. Nightjar surveys were undertaken at Goose Hill and Kenton Hills in 2014; however, the habitat was considered sub-optimal for this species, thus nightjar has not been recorded within the site during the ornithological surveys.

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
Woodlark (breeding and wintering).	International/High	An interest feature of the Sandlings SPA with up to 54 pairs recorded this SPA. This species has been historically observed during the Winter and breeding season within the site; however, no breeding was confirmed.
Red-throated diver (wintering).	International/High	An interest feature of the Outer Thames Estuary SPA. This species is present along the entire coastline, including adjacent to the site; however, the greatest numbers were recorded to the north (at Dunwich) and south (Orford Ness) of Sizewell.
Little tern *(Sternula albifrons)* (breeding).	International/High	An interest feature of the Minsmere-Walberswick SPA, Alde-Ore Estuary SPA and Outer Thames Estuary SPA. This species has been recorded commuting and foraging adjacent to the Sizewell A and B power stations. The amount of activity varies significantly depending on the location of the nearest breeding colony each year, (this species tends to forage in close proximity to its breeding sites). Little tern colonies have been relatively unsuccessful within Suffolk in recent years due to disturbance, although ten pairs raised at least seven young raised to fledging on the South Scrape at RSPB Minsmere Reserve in 2019. The small number of birds recorded during the bird surveys reflects this current scarce status.
Common tern *(Sterna hirundo)* (breeding).	International/High	An interest feature of the Outer Thames Estuary SPA. This species has been observed foraging or commuting, with the majority of the birds seen foraging adjacent to the Sizewell A and B power stations. The nearest breeding colony in the vicinity of the site is the RSPB Minsmere Reserve which in 2019 supported 200 pairs (highest count since 1974) which raised 53 young to fledging.
Sandwich tern *(Sterna sandvicensis)* (breeding).	International/High	An interest feature of the Alde-Ore Estuary SPA. This species has been observed foraging or commuting along the coastline. The last known breeding colony in the vicinity of the site is on the South Scrape at the RSPB Minsmere Reserve, which re-established in 2019 with 50 pairs (up 56% from 2018) raising 28 young to fledging (up from two fledglings in 2018).
Kittiwake (breeding).	Regional/High	The Sizewell Rigs CWS has been designated specifically for this species. The rigs (associated with the Sizewell A and B power stations) are used by a relatively large colony of kittiwake (approximately 200 nests). This site is one of only two kittiwake colonies between Yorkshire and Kent (the second colony being located on a wall at Ness Point, Lowestoft). The rigs therefore provide an important nesting resource for kittiwake on the east coast.

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
		In 2019, a small number of kittiwake attempted to breed on South Scrape at the RSPB Minsmere Reserve although no eggs were laid.
Lesser black-backed gull *(Larus fuscus)* (breeding).	International/High	An interest feature of the Alde-Ore Estuary SPA. This species has been observed flying over the arable fields at the northern end of the EDF Energy estate, roosting within Minsmere South Levels and commuting, foraging and loafing along the coast. Small numbers breed on the Minsmere-Walberswick SPA/Ramsar site.
Waterbird assemblage qualifying feature of Alde-Ore Ramsar site (breeding and wintering) and SSSI.	International/High	Species listed as forming part of the Alde-Ore Estuary Ramsar site (breeding and wintering)/SPA (wintering) assemblage qualification include black-tailed godwit *(Limosa limosa),* dunlin *(Calidris alpina),* lapwing *(Vanellus vanellus),* shoveler, teal, wigeon *(Anas penelope),* shelduck *(Tadorna tadorna*), white-fronted goose, avocet and redshank. Collectively these species constitute a valuable breeding and wintering waterbird assemblage which could utilise habitats within, or adjacent to the site.
Marshland and reedbed assemblage qualifying feature of Minsmere-Walberswick Ramsar site (breeding)/ assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI (breeding/wintering).	International/High	Species listed as forming part of the Minsmere-Walberswick Ramsar site and Minsmere to Walberswick Heaths and Marshes SSSI qualification include bittern, gadwall, teal, shoveler, marsh harrier, avocet and bearded tit *(Panurus biarmicus).* Collectively these species constitute a valuable breeding and wintering waterbird assemblage which could utilise habitats within, or adjacent to the site. Survey work during the Winter 2018/19 confirmed bearded tit using the newly created reedbed habitats at Aldhurst Farm just to the west of the site.
Bird assemblage associated with Sandlings Forest SSSI and other component SSSI of the Sandlings SPA.	International/High	Species listed as forming part of the Sandlings SPA and Sandlings Forest SSSI include nightjar and woodlark.

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
Bird assemblage associated with Sizewell Marshes SSSI.	National/High	This feature comprises the breeding bird assemblage which forms one of the qualifying features of the Sizewell Marshes SSSI. Note the designated features is – breeding bird assemblage – lowland wet grassland and does not actually specify which species make up the assemblage. Previously breeding waders such as lapwing and snipe *(Gallinago gallinago)* were present but wader species no longer breed on the SSSI. Collectively the species associated with the SSSI constitute a valuable wintering/passage/breeding bird assemblage.
Stone-curlew *(Burhinus oedicnemus)* (Schedule 1 species).	Regional/High	Within East Anglia, stone-curlew are confined to the Sandlings and Breckland areas and are a breeding species within the wider Minsmere to Walberswick Heaths and Marshes SSSI (i.e. outside of the core RSPB Minsmere Reserve), with a peak count of 15 pairs. Stone-curlew have been recorded incidentally, with a single observation on Minsmere South Levels in April 2015.
Barn owl (Schedule 1 species).	Local/Low	Confirmed to be breeding at Lower and Upper Abbey (two pairs), and one breeding pair within Sizewell Marshes SSSI. Barn owl have also been regularly recorded foraging across the site throughout the year (especially within the rough marshy grassland and reedbeds of Sizewell Marshes SSSI, and the marshy grassland to the north of the proposed development directly adjacent to RSPB Minsmere Reserve.
Kingfisher *(Alcedo atthis)* (Schedule 1 species).	County/Medium	Kingfisher were confirmed to be breeding within the site (at least one pair) and utilise the ditch network associated with the Sizewell Marshes SSSI as a foraging resource.
Hobby *(Falco subbuteo)* (Schedule 1 species).	County/Medium	Hobby were confirmed/ likely to be breeding within large mature trees at Goose Hill, Ash Wood and/ or Broom Cover (up to two pairs) although no breeding pairs were recorded in 2018. The woodland areas and Sizewell Marshes SSSI provide suitable foraging habitat for this species.
Peregrine *(Falco peregrinus)* (Schedule 1 species).	County/Medium	Known to breed on the existing Sizewell A and B power station complex (at least one pair). Peregrine forage widely over the proposed development site and wider landscape.
Black redstart *(Phoenicurus ochruros)* (Schedule 1 species).	County/Medium	Confirmed to be breeding within existing Sizewell A and B power station complex (up to three pairs). The power station complex and adjacent coastal habitat provide suitable foraging habitat for the species.

IEF	Importance under CIEEM guidelines/ EIA-specific methodology	Current baseline summary
Cetti's warbler *(Cettia cetti)* (Schedule 1 species).	County/Medium	Cetti's warbler breed in suitable habitat within Sizewell Marshes SSSI (up to 13 pairs).
Birds of nature conservation importance within the site. (*grey partridge (Perdix perdix), turtle dove* (*Streptopelia turtur*), *cuckoo (Cuculus canorus), marsh tit (Parus palustris), skylark* (*Alauda arvensis*), *starling* (*Sturnus vulgaris*), *song thrush (Turdus philomelos), spotted flycatcher (Muscicapa striata), house sparrow* (*Passer domesticus*), *yellow wagtail (Motacilla flava), linnet* (*Carduelis cannabina*), *yellowhammer* (*Emberiza citronella*)).	County/Medium	The proposed development site provides valuable nesting and foraging opportunities for a range of important bird species, including farmland birds and passerines. The assemblage present within the site comprises Red and Amber listed BoCC (Ref 14.36), species listed under Section 41 of the NERC Act (Ref 14.10) and/or Suffolk BAP priority species (Ref 14.20), and non-breeding and/or wintering Schedule 1 species (Ref 14.21) present within the site. Collectively these constitute a valuable wintering/passage/breeding bird assemblage.

b) Future baseline

14.12.7 In the absence of the proposed development, it is considered that the habitats within and adjacent to the site would continue to be managed in their current form, and therefore would continue to support a similar suite of bird species and bird populations and assemblages

14.12.8 Impacts on birds that could result from climate change are likely to include changes in the timings of seasonal events, leading to loss of synchrony between species and the availability of food; changes in species abundance and range; and changes in the habitats which species occupy (Ref 14.59). However, it is considered unlikely that any such impacts would result in a material alteration to the current ornithological features in the short-term.

14.12.9 Many habitats are considered to be resistant to changes in environmental conditions due to their wide biogeographic amplitude; however, there is still much uncertainty surrounding the effect that climate change will have on habitats particularly where there is interaction with other pressures. Predictions of the impact that climate change will have on the future baseline of habitats are based on the UK Climate Projections (UKP09) of a 3˚C temperature rise by 2100 and the biodiversity climate change report card technical papers 1 (Ref 14.59).

14.12.10 The effects of climate change on birds and their habitats in the long-term are difficult to predict, but changes in the amount and distribution of rainfall could affect food availability and breeding success. Different species of bird are likely to respond to environmental changes in different ways, but when current national trends are taken into consideration, it is likely the importance of the bird populations within the ZoI in the absence of the Sizewell C Project would be expected to remain constant in the long term.

c) Assessment

14.12.11 This assessment focuses on the potential effects arising during the construction and operational phases of the proposed development on ornithology features in the terrestrial environment. Although there are a number of nationally designated sites (for example the Alde Ore Estuary SSSI and the Sandlings Forest SSSI) that lie some distance from the site, is considered that the majority of impacts directly affecting bird species would occur in close proximity to the footprint of the site within those designated sites that lie adjacent to it. The only impact that could affect more distant designated sites would be through any increase in recreational pressure.

14.12.12 **Table 14.24** outlines the potential impacts relevant to the ornithological assessment to ensure consistency between the EIA and HRA ornithological assessments. The potential ornithological effects identified are based on information gathered from recent and historic surveys (refer to **Appendix**

14A7 – Ornithology of this volume), published literature (where available), baseline data associated with other disciplines (such as noise and hydrological modelling), and (where appropriate) professional judgement.

14.12.13 This chapter presents an assessment for those species that are qualifying features of European sites that are considered relevant in an EIA context (as listed in **Table 14.23**). The **Shadow HRA Report** (**Book 5, Report 5.10**) includes detailed assessments of the bird species associated with SPAs/Ramsar sites and, therefore, includes the relevant IEFs listed in **Table 14.23** where these IEFs are relevant to the assessment of effects on European sites.

Table 14.24: Potential ornithological effects

Screening category	Definition	
	Construction	Operation
Alteration of coastal processes/sediment transport	This includes the potential for erosion, accretion and sedimentation (short- and long-term). The focus is largely on indirect effects (rather than direct effects which are covered under “direct habitat loss and fragmentation”). This distinction has been made to avoid the double counting of effects.	
Water quality effects – terrestrial environment	This covers potential supporting parameters and chemical effects on freshwater (surface and groundwater) (such as nutrient concentrations in addition to chemical status) as well as any potential indirect effects on habitats and species. Any foul water flows would be treated to ensure water quality effects are controlled (as part of the primary/ tertiary mitigation measures, described in **section 4** of this chapter).	This covers potential changes in supporting parameters (e.g. long-term flow changes associated with the cut-off wall and realignment of ditches), as well as any consequential indirect effects on habitats and species. No chemical effects are predicted during the operational phase in this context (as all discharge would be via the cooling water system).
Alteration of local hydrology and hydrogeology	This covers potential physical effects on freshwater (including surface and groundwater resources), i.e. effects on flows and water levels, as well as any consequential indirect effects on habitats and species.	
Changes in air quality	This covers changes in air quality through non-radioactive emissions to air and any consequential direct or indirect effects on habitats and species. Potential non-radiological air quality effects have been considered where the site is within 10km of the site (and not considered beyond this distance). Note: the ZoI for particulate (dust) emissions is generally much smaller than this (<200 m from the emission source).	
Radiological effects	This relates to the direct and indirect effects of any radiological emissions to soils, water and/or air.	This relates to the direct and indirect effects of radiological emissions to air and the marine environment.
Direct habitat loss and fragmentation	This effect is limited to direct effects on habitats (not species). Indirect effects are covered in elsewhere, as noted above.	As for construction.
Disturbance effects on species populations	This effect is limited to potential disturbance effects on target species (not habitats), e.g. noise, light and human activity, and includes species displacement. Potential recreational effects are covered separately below.	
Disturbance due to increased recreational pressure	Potential effects due to increased recreational pressure have been considered where the European site in question is within the ZoI of potential recreational effects. That is:	The potential for disturbance due to increased recreational pressure is considered to be of a lesser magnitude during the operational phase due to the large reduction in the number of workers required for this

Screening category	Definition	
	Construction	Operation
	• Zone of Physical Change – a 2 km area around site. • Displacement Zone – an 8 km area around site. • Buffer Zone – an 8 km area around settlements within the Displacement Zone. Potential effects include trampling of supporting habitat, as well as disturbance effects to species and populations.	phase The removal of impacts from the coastal fringe and the reinstatement of the permissive path from the coast to Kenton Hills would also enable visitors who may be displaced during construction to return to these areas.
Physical interaction between species and Project infrastructure	Relates to the potential direct effects on qualifying features arising due to interactions (e.g. collisions) with the infrastructure or machinery associated with the proposed development. Indirect effects could arise via effects on prey species (e.g. impingement and entrainment of small fish and their larvae and eggs.)	

i. Construction

14.12.14 During the construction phase, the main impact pathways on birds would be associated with:

- Direct land-take resulting in habitat loss and fragmentation;
- Disturbance/displacement effects on birds (comprising noise, lighting and visual effects); and
- Disturbance/displacement due to increased recreational pressure.

14.12.15 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in an effect which is not significant. The impact pathways that have been scoped out of this assessment for birds, along with the rationale for scoping them out, are as follows:

- Alteration of coastal processes. The Coastal Process and Geomorphology Synthesis Report (**Appendix 20A** of this volume) summarised in the Plants and Habitats Synthesis Report (**Appendix 14B1** of this volume), indicates that the construction of the marine components of the proposed development is highly unlikely have a significant effect on coastal processes, and no erosion (or other effects) on terrestrial habitat (caused by the proposed development) is expected.
- **Changes in water quality.** During the construction, an **Outline Drainage Strategy** (**Volume 2, Appendix 2A**) would be implemented to manage surface water discharges from the site. These systems would be designed to discharge treated water to the surface water drainage network at greenfield run-off rates. Foul water would be pumped to a central treatment plant, prior to discharge to sea. This would prevent the contamination of surface waters with sewage effluent during construction. Therefore, due to the embedded primary and tertiary mitigation, no significant effects on water quality or ornithological features associated with wetland habitats are predicted (see **Chapter 19: Groundwater and Surface Water** of this volume).
- **Alteration of local hydrology and hydrogeology.** The hydrological modelling work summarised in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that potential hydrological effects on the terrestrial environment would occur in close proximity (less than 1km) to the site. However, any potential hydrological effects would be restricted to the Minsmere-Walberswick SPA, the Minsmere to Walberswick Heaths and Marshes SSSI

(hereafter known as the Minsmere SSSI) and Sizewell Marshes SSSI, with hydrology and hydrogeology effects on other statutory and non-statutory designated sites (and their associated bird assemblages) being ruled out. Within Minsmere-Walberswick SPA and SSSI, the hydrological modelling indicates that there are unlikely to be impacts on habitat to the north of the Minsmere New Cut and that the functioning of the Minsmere Sluice is unlikely to be compromised. The hydrological modelling indicates that the construction phase may cause a drawdown of water levels of less than 10cm for the majority of the time, with very short periods where drawdown is greater than 10cm (up to 13cm) relative to baseline conditions (see Figure 19A.87). These short drawdown periods of up to 13cm are in the winter months and the drawdowns are less than 10cm in the spring/summer growing season. The highest difference between baseline and with development cases is in the winter of 2024/25 when the dewatering is assumed to be at its peak. The maximum extent directly affected would be of approximately 0.6ha under a worst case scenario in which drought is assumed. This represents 0.025% of the Minsmere- Walberswick SPA and SSSI total area of 2,325.89ha. This level of hydrological change is unlikely to significantly affect vegetation composition/structure or its associated bird assemblage.

- Changes to air quality would not have a direct effect on bird species but could potentially alter the composition and structure of habitat types on which bird species depend (for example through an increase in nutrients). The air quality dispersal modelling work presented in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that the likely ZoI for potential air quality effects is limited, with the majority of emissions and deposition occurring within 1km radius of the point of source. For the construction phase, the largest transport contribution of nutrient nitrogen deposition and acid deposition occurs for the 2028 busiest day scenario. The HRA concludes that adverse effect on integrity would not for any European site during the construction phase based on this scenario. As outlined in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume), with primary and tertiary mitigation in place (see **section 14.4** of this chapter), potential air quality effects on habitats and their associated ornithological features, are considered unlikely.

- **Physical interaction between species and proposed development infrastructure.** During the construction phase, there is the potential for birds to come into contact with proposed development infrastructure, for example, through road traffic accidents and collision with new pylon infrastructure**.** The development proposals require the repositioning of one existing overhead pylon and four new overhead gantries. However, there would be no significant increase in the extent of overhead lines (compared to the cabling already in place within the existing complex) and the new pylon and gantries would be within the footprint of the main platform in areas likely to be avoided by birds. Therefore, as outlined in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume), primary and tertiary mitigation measures would be put in place (see **section 14.4** of this chapter) to avoid/minimise such potential interactions.

14.12.16 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by each IEF are identified in **Table 14.25** and detailed within the subsequent sections.

14.12.17 Species with an asterisk(*) within **Table 14.24** are IEFs that have also been assessed through the HRA process. As some of the European sites and qualifying features are also considered relevant to the scope of the EIA (see **Table 14.23** and **Table 14.25**), potential impacts on the relevant species are assessed in this chapter. A summary of the evidence base on which these conclusions have been reached is provided within the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume), with the **Shadow HRA Report** (**Book 5, Report 5.10**) providing the assessment of all European sites relevant to scope of the HRA for the Sizewell C Project. **Table 14.26** provides a summary of the HRA conclusions.

Table 14.25: Impact pathways which could be experienced by each IEF

IEF (including importance under CIEEM guidelines/EIA-specific methodology)	Direct habitat loss and fragmentation	Disturbance effects (noise lighting and visual)	Disturbance due to increased recreational pressure
Bittern (breeding and wintering)* **International/High**		✓	✓
Avocet (breeding and wintering)* **International/High**		✓	✓
Redshank (wintering)* **International/High**			✓
Shoveler (breeding and wintering)* **International/High**		✓	✓
Gadwall (breeding and wintering)* **International/High**		✓	✓
Teal (breeding and wintering)* **International/High**		✓	✓
White-fronted goose (wintering)* **International/High**		✓	✓
Marsh harrier (breeding)* **International/High**	✓	✓	✓
Hen harrier (wintering)* **International/High**	✓	✓	✓
Nightjar (breeding)*	✓	✓	✓

IEF (including importance under CIEEM guidelines/EIA-specific methodology)	Direct habitat loss and fragmentation	Disturbance effects (noise lighting and visual)	Disturbance due to increased recreational pressure
International/High			
Woodlark (breeding and wintering)* **International/High**	✓	✓	✓
Red-throated diver (wintering)* **International/High**		✓	
Little tern (breeding)* **International/High**		✓	✓
Common tern (breeding)* **International/High**		✓	✓
Sandwich tern (breeding)* **International/High**			✓
Lesser black-backed gull (breeding)* **International/High**			✓
Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI (breeding/wintering) **National/High**		✓	✓
Bird assemblage associated with Sandlings Forest SSSI and component SSSI of the Sandlings SPA (breeding/wintering) **National/High**			✓
Bird assemblage associated with Alde Ore Estuary SSSI (breeding/wintering) **National/High**			✓

IEF (including importance under CIEEM guidelines/EIA-specific methodology)	Direct habitat loss and fragmentation	Disturbance effects (noise lighting and visual)	Disturbance due to increased recreational pressure
Bird assemblage associated with Sizewell Marshes SSSI (breeding/wintering) **National/High**	✓	✓	
Kittiwake (breeding) Sizewell Rigs CWS. **Regional/High**		✓	
Marsh harrier (wintering) **High**	✓	✓	✓
Stone-curlew (Schedule 1 species) **Regional/High**			✓
Barn owl (Schedule 1 species) **Local/Low**	✓	✓	
Hobby (Schedule 1 species) **County/Medium**	✓	✓	
Peregrine (Schedule 1 species) **County/Medium**	✓	✓	
Black-redstart (Schedule 1 species) **County/Medium**	✓	✓	
Cetti’s warbler (Schedule 1 species) **County/Medium**	✓	✓	
Other birds of nature conservation importance within the site **County/Medium**	✓	✓	

Table 14.26: Summary of HRA assessment and EIA conclusions (for species assessed in both)[14]

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
Bittern (breeding and wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
Avocet (breeding and wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
Shoveler (breeding and wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

[14] The Table only includes those species assessed within the HRA; to provide an alignment with the corresponding ES conclusions.

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
	Disturbance due to increased recreational pressure		
Gadwall (breeding and wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
Teal (breeding and wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
White-fronted goose (wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
	Disturbance due to increased recreational pressure		
Marsh harrier (breeding) **International/High**	Direct habitat loss and fragmentation	Adverse effect on integrity cannot be excluded for the Minsmere-Walberswick SPA and Ramsar site due to potential noise and visual disturbance to marsh harrier during the construction phase. Compensatory habitats have been established to compensate for this possible effect.	Potential for moderate adverse effect (significant effect), arising from construction noise impacts Compensatory habitats have been established to the north of the temporary construction area to compensate for the possible impact of loss of foraging on the Sizewell Marshes SSSI, such that in the **ES** (Doc Ref. Book 6) a conclusion of no significant effect is predicted.
	Disturbance effects (noise lighting and visual)		
	Disturbance due to increased recreational pressure		
Hen harrier (wintering) **International/High**	Direct habitat loss and fragmentation	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance effects (noise lighting and visual)		
	Disturbance due to increased recreational pressure		
Nightjar (breeding) **International/High**	Direct habitat loss and fragmentation	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance effects (noise lighting and visual)		

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
	Disturbance due to increased recreational pressure		
Woodlark (breeding and wintering) **International/High**	Direct habitat loss and fragmentation	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance effects (noise lighting and visual)		
	Disturbance due to increased recreational pressure		
Red-throated diver (wintering) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
Little tern (breeding) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
	Disturbance due to increased recreational pressure		
Common tern (breeding) **International/High**	Disturbance effects (noise lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
	Disturbance due to increased recreational pressure		
Sandwich tern (breeding) **International/High**	Disturbance due to increased recreational pressure	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Lesser black-backed gull (breeding) **International/High**	Disturbance due to increased recreational pressure	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

14.12.18 Given the number of bird species and groups assessed, the assessment is presented by impact rather than by the species or group (the approach used for all other sections of this chapter). Bird species / groups have been grouped together (to avoid repetition) where impacts are considered to be similar.

Direct land-take resulting in habitat loss and fragmentation

14.12.19 This impact pathway refers to habitat that would be lost under the footprint of the site. The habitat loss would include both permanent (a period of more than 9-12 years) and temporary (up to a period of 9-12 years) land-take (as defined in **section 14.5** of this chapter).

14.12.20 There would be no habitat loss within any European designated site, or the adjacent Minsmere to Walberswick Heaths and Marshes SSSI; however, habitat suitable for foraging and breeding birds would be lost within the site as a result of the proposed development. Loss of habitat can affect birds directly by removing habitat required for nesting and for foraging (leading to a reduction in breeding populations and breeding success); and indirectly through habitat fragmentation potentially making the remaining habitat patches too small to support viable breeding or wintering populations (requiring bird populations to travel further afield to find resources such as food and nesting sites).

14.12.21 **Table 14.27** summarises the habitat types due to be lost and the proportion of the total area lost within the site (both permanent and temporary). Habitat loss was considered to be temporary if the area is to be replaced by habitat of the same type within the site. Habitat loss was considered to be permanent if no such replacement is proposed. Primary mitigation measures such as advanced habitat creation at Aldhurst Farm and elsewhere have been embedded in the site design to reduce impacts of habitat loss and fragmentation.

Table 14.27: Habitat loss required to accommodate the proposed development (excluding any offsetting and habitat creation outside of the MDS site)

Habitat Feature	Extent of permanent land take by habitat type (percentage of total habitat within the baseline)*	Extent of temporary land take by habitat type (percentage of total habitat within the baseline)*
Arable and improved farmland and semi-improved grassland	129ha (61%)	81ha (39%)

Habitat Feature	Extent of permanent land take by habitat type (percentage of total habitat within the baseline)*	Extent of temporary land take by habitat type (percentage of total habitat within the baseline)*
Wet woodland (within Sizewell Marshes SSSI)	2.6ha (70%)	0.7ha (21%)[15]
Fen meadow (within Sizewell Marshes SSSI)	0.7ha (44%)	0.9ha (56%)[16]
Reedbed habitat (within Sizewell Marshes SSSI)	3.6ha (84%)	0.7ha (16%)
Ditch habitat within Sizewell Marshes SSSI	670m (25%)	1990m (75%)
Other woodland (conifer plantation, mixed plantation, semi-natural broad-leaved woodland and wet woodland)	45ha (66%)	0.7ha (1%)
Hedgerows	0km (0%)	3.8km (41%)
Scrub	1ha (100%)	0ha (0%)

*The percentages in brackets show the proportions of the total areas of habitat within the baseline. For example 70% of the wet woodland on the site is permanently lost.

14.12.22 This impact is relevant to the following IEFs:

- Bird populations associated with European sites, namely:
  - Marsh harrier (breeding), hen harrier (wintering), nightjar (breeding) populations of the Minsmere-Walberswick SPA.
  - Breeding woodlark and nightjar populations of the Sandlings SPA.
- bird assemblage associated with Sizewell Marshes SSSI;
- bird species listed on Schedule 1 of the W&CA (Ref 14.7): wintering marsh harrier, barn owl, hobby, peregrine, black redstart and Cetti's warbler recorded within footprint of the site; and
- other birds of nature conservation importance within the site.

[15] Area within corridor due to be temporarily impacted by the installation of overhead lines
[16] Area within corridor due to be temporarily impacted by the installation of overhead lines

Bird populations associated with European sites

Marsh harrier

14.12.23 Wetland habitats (i.e. coastal grazing marsh and reedbed or fen habitats) provide the key foraging areas for the Minsmere-Walberswick SPA marsh harrier population. The construction works at the main development site would lead to the permanent loss of approximately 7.03 ha of the Sizewell Marshes to accommodate the SSSI crossing the western part of the main platform, and the realignment of Sizewell Drain (with the affected area being that part of the Sizewell Marshes SSSI which lies within the Order Limits). This area represents approximately 7% of the coastal grazing marsh and reedbed habitats within the Sizewell Marshes, but a much smaller proportion of the total area of wetland foraging habitat available to the SPA marsh harrier population (e.g. the extent of wetland foraging habitat on the Minsmere South Levels exceeds that found within the Sizewell Marshes).

14.12.24 This habitat loss represents a small proportion of the available wetland foraging habitat for the SPA marsh harrier population and occurs within a wider area (the Sizewell Marshes) which is less heavily used by foraging marsh harriers than other areas of wetland habitat closer to the nesting area (e.g. the Minsmere South Levels). To mitigate for the loss of habitat within Sizewell Marshes SSSI (and provide alternative wetland habitat), primary mitigation measures to create replacement 2km of ditches and 5.4ha of reedbed and open water habitat have already been implemented at Aldhurst Farm, with a further 1.2ha of wet reedbed habitat creation planned within the north of the site.

14.12.25 It is concluded that the impact of this permanent habitat loss on the breeding marsh harrier population of the SPA is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Hen harrier

14.12.26 As for marsh harrier, wetland habitats may be important as foraging areas for the Minsmere-Walberswick SPA non-breeding hen harrier population. Therefore, the loss of the 7.03 ha of wetland habitat within the Sizewell Marshes to could affect the SPA hen harrier population. However, baseline surveys recorded relatively little foraging activity by hen harriers within the vicinity of the main development site, including on the Sizewell Marshes, and this area of habitat loss represents a small proportion of the wetland foraging habitat available to the SPA hen harrier population.

14.12.27 It is concluded that the impact of this permanent habitat loss on the non-breeding hen harrier population of the SPA is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Nightjar and woodlark

14.12.28 Baseline surveys provided little evidence of breeding nightjar or woodlark within or close to the areas encompassed by the main development site. It is also unlikely that SPA birds rely on suitable habitat near to the main development site for foraging because the main breeding sites within the Minsmere-Walberswick SPA are over 1 km from the main development site, with the Sandlings SPA being further away.

14.12.29 As a worst case, it is concluded that the impact of permanent habitat loss on the breeding nightjar population of the Minsmere-Walberswick SPA and the breeding nightjar and woodlark populations of the Sandlings SPA is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird assemblage associated with Sizewell Marshes SSSI

14.12.30 The citation for Sizewell Marshes SSSI identifies a bird assemblage typical of lowland wet grassland and mentions the presence of breeding wildfowl (including shoveler, gadwall, and teal) and waders (including snipe and lapwing); however, it does not provide an exhaustive list of species which would comprise the assemblage.

14.12.31 The main species likely to constitute an assemblage of wetland species present within Sizewell Marshes SSSI (based on most recent desk-study and survey results) are set out in **Appendix 14A7 – Ornithology** of this volume**,** and include those set out within **Table 14.28** and **Table 14:29**. Although historically present, redshank, lapwing, teal and shoveler appear to no longer breed within Sizewell Marshes SSSI following national population declines (refer to **Appendix 14A7 – Ornithology** of this volume). The wetland habitats in the Sizewell Marshes SSSI may be functionally linked to the Minsmere-Walberswick SPA by providing additional supporting habitat for breeding and non-breeding waterbirds that are qualifying features of the SPA.

Table 14.28: Summary of species present at Sizewell Marshes SSSI within the breeding season

Species	Arcadis surveys (peak count)	Wood Group Surveys (peak count)	NGL (peak count, assumed to be within Sizewell Marshes SSSI)
Mute swan *(Cygnus olor)*	0	1 pair	7 (2005–06)
Greylag goose *(Anser anser)*	0	Present on large pool in reedbed	2 (2004–05)
Mallard *(Anas platyrhynchos)*	11 breeding territories	Up to 27 pairs	28 (2005–06)

Species	Arcadis surveys (peak count)	Wood Group Surveys (peak count)	NGL (peak count, assumed to be within Sizewell Marshes SSSI)
Gadwall	0	1 pair	11 (2007–08)
Bearded tit	0	0	one breeding territory (2007), breeding not confirmed
Kingfisher	1 pair	1 pair	1 pair (2014)
Cetti's warbler	4 breeding territories	4 breeding territories	11 breeding territories (2010)
Reed bunting *(Emberiza schoeniclus)*	2 breeding territories	4 breeding territories	8 (2013)

Table 14.29: Summary of species present within Sizewell Marshes SSSI during the Winter

Species	Arcadis surveys (peak count)	Wood Group surveys	SWT (peak count, assumed to be within Sizewell Marshes SSSI) brackets indicates year
Mute swan	7	Present	15 (2014)
Gadwall	29	Present	151 (2010)
Teal	22	Present	180 (2013)
Shoveler	5	-	26 (2013)
Mallard	46	Present	158 (2004–05)
Moorhen *(Gallinula chloropus)*	4	-	-
Coot *(Fulica atra)*	2	-	-
Bittern	Present	Present	1 (2014)
Grey heron *(Ardea cinerea)*	1	-	-
Little egret *(Egretta garzetta)*	1	-	-
Kingfisher	1	Present	present
Water rail *(Rallus aquaticus)*	4	0	4 (2013)
Jack snipe *(Lymnocryptes minimus)*	1	-	-

Species	Arcadis surveys (peak count)	Wood Group surveys	SWT (peak count, assumed to be within Sizewell Marshes SSSI) brackets indicates year
Snipe	18	Present	36 (2013)
Woodcock	4	0	5 (2010)

14.12.32 The construction works would lead to the permanent loss of 7.03ha of Sizewell Marshes SSSI to accommodate the SSSI crossing and the western part of the main platform. However, this is 6.7% of the designation as a whole, with 93.3% of Sizewell Marshes SSSI to be retained.

14.12.33 To mitigate for the loss of habitat within Sizewell Marshes SSSI (and provide alternative habitat for the species outlined in **Table 14.28** and **Table 14.29**), primary mitigation measures to create like for like replacement reedbed (5.4ha, including areas of open water) and ditch (2km) habitat have already been implemented at Aldhurst Farm, as outlined in **section 14.4** of this chapter. A further 1.2ha of wet reedbed habitat is proposed within the north-east of the site. A strategy to create fen meadow habitats at two offsite locations in Suffolk has also been developed. This new habitat, once fully developed, is likely to support a similar number of bird species as the same habitat type to be lost within Sizewell Marshes SSSI, albeit not adjacent to the SSSI and would provide long-term benefit during the operational phase. In addition, 2.9ha of the habitat loss is temporary (refer to **Table 14.27**) and would be restored following completion of construction.

14.12.34 The proposed development would also result in the permanent loss of 2.6ha of wet woodland from within Sizewell Marshes SSSI with a further 1.13ha of temporary loss. A total of 0.7ha of replacement wet woodland is proposed. In addition, new scrub and woodland planting would form part of the long-term restoration and management (as detailed within the **oLEMP** and provide alternative habitat for a number of the species associated with Sizewell Marshes SSSI.

14.12.35 The new reedbed and ditch habitats at Aldhurst Farm are located adjacent to the western edge of the Sizewell Marshes SSSI and given the close proximity of the new habitat the component bird assemblage from Sizewell Marshes SSSI can be expected to naturally colonise Aldhurst Farm from the areas of retained reedbed and ditch habitats. Monitoring to date indicates this expectation is being realised. In addition, a further 1.2ha of wet reedbed habitat will be created during the construction phase within the north eastern extent of the site which will also provide habitat suitable for use by the component bird assemblage from Sizewell Marshes SSSI.

14.12.36 The reedbed and ditch habitat creation undertaken at Aldhurst Farm has established and developed well and, as outlined in the **Appendix 14A7 – Ornithology** of this volume, is already supporting bird species characteristic of reedbed habitat including: wintering gadwall, shoveler, teal, mallard, mute swan, coot, moorhen, and water rail. In addition, wintering bearded tit and Cetti's warbler have been recorded and in 2019 a pair of marsh harrier made a breeding attempt.

14.12.37 The habitat enhancements and compensatory habitats described above would outweigh the permanent loss of 7.03ha of the Sizewell marshes SSSI in relation to the bird assemblage associated with the SSSI. Therefore, the impact of this permanent habitat loss on the Sizewell Marshes SSSI bird assemblage is considered to be of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird species listed on Schedule 1 of the W&CA

14.12.38 The following species protected under Schedule 1 of the W&CA (Ref 14.7) have been recorded as being present within the footprint of the site: wintering marsh harrier and breeding barn owl, hobby, peregrine, black redstart and Cetti's warbler.

Marsh harrier (wintering)

14.12.39 As outlined in the species accounts (refer to **Annex 14A7.5**) wintering marsh harrier forage over both the arable farmland and over reedbed and fen meadow habitat within Sizewell Marshes SSSI on a reasonably regular basis (72 flights were recorded during the monitoring undertaken in 2014/15). During the 2018 surveys, the Sizewell Land Management Annual Report (2018) states that a peak count of four marsh harrier was recorded in the survey area (Ref 14.71)). The permanent loss of 7.0ha of wetland habitat and the temporary loss of 45ha of arable habitat lasting for the duration of the construction phase, could potentially have a negative effect, by forcing wintering marsh harriers to forage over a wider area in the Winter, potentially reducing their Winter survival rate with subsequent effects for the breeding season. However, as outlined above, mitigation for the loss of reedbed and fen meadow habitat are already in place (at Aldhurst Farm and as part of the **Fen Meadow Strategy** (**Appendix 14C4** of this volume). In addition, as outlined in **section 14.4** of this chapter, and detailed in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume), compensation measures would also see additional, permanent foraging habitat for marsh harrier created adjacent to the site (across the northern part of the EDF Energy estate). Whilst this additional foraging habitat is designed primarily to reduce impacts on breeding marsh harriers, it would also provide additional foraging habitat for marsh harrier during the Winter months. For these reasons loss of habitat for wintering marsh harrier is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Barn owl

14.12.40 As detailed within the species accounts (refer to **Annex 14A7.6**) at least two pairs of breeding barn owl are present within the site using existing farm buildings or nest boxes. Surveys undertaken in 2018 recorded a pair of barn owls nesting in the Goose Hill Marshes box, raising three young (Ref 14.71). The site provides extensive suitable foraging opportunities and barn owls have regularly been recorded foraging widely over both wetland habitat and arable field margins within the site. Two pairs of barn owls equate to approximately 1.6% of the estimated Suffolk population of 125 pairs or 0.05% of the estimated UK population of 4,000 pairs (Ref 14.72). No direct loss of physical structures used for nesting is envisaged, but the loss of foraging habitat could have a negative effect on the local barn owl population.

14.12.41 The new reedbed habitat which has been already been created at Aldhurst Farm, the creation of additional improved foraging habitat for marsh harrier in the north of the EDF Energy estate and the further establishment of the reptile receptor habitats (as outlined in **section 14.4** of this chapter), would provide habitat likely to support a greater density of small mammals compared to the arable margins which the barn owls are currently utilising. Surveys during the Winter of 2018/19 recorded incidental records of barn owl pellets within the reptile receptor area, indicating barn owls are beginning to utilise this area for foraging. Additional new reedbed habitat to be created during the construction phase will also provide foraging opportunities for barn owls once established.

14.12.42 Therefore, although there would be a potential loss of up to 146ha of foraging habitat (assuming all improved, species-poor semi-improved, acid and neutral grassland, wetland and arable being suitable foraging habitat) due to land take associated with the construction works, the mosaic of habitat creation as part of the primary mitigation would provide alternative foraging locations in the vicinity of their current foraging range, which would mitigate for the loss of habitat within the site and benefit the local barn owl population in the long-term. In addition, (as detailed in tertiary mitigation in **section 14.4** of this chapter) additional barn owl boxes would also be erected in close proximity to these areas of habitat creation to provide additional nesting/roosting opportunities for the local barn owl population. For these reasons this loss of habitat for foraging barn owl is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Hobby

14.12.43 The species accounts (refer to **Annex 14A7.6**) indicates that up to two pairs of hobby may nest within mature woodland within the site and they have been recorded foraging widely over the wetland habitat within Sizewell Marshes SSSI. Habitat loss could, therefore, affect hobby in two ways, the potential loss of mature trees used for nesting and loss of foraging habitat. Hobby numbers have increased nationally by up to 16% between 1995 and 2010 with an estimated UK population of 1,000, to 2,000 pairs (Ref 14.73) and potentially up to 2,800 pairs (Ref 14.74). Their breeding range within the UK has increased dramatically, spreading west, north and east (Ref 14.73). Regionally, 23 pairs were located within Suffolk in 2017 (Ref 14.73). The presence of two breeding pairs at Sizewell would equate to 0.08% of the UK population and 8.7% of the known county population. Within Suffolk, hobby is described as a fairly common breeding migrant (Ref 14.75).

14.12.44 The Sizewell Land Management Annual Review 2018 (Ref 14.71), stated one breeding pair of Hobby was recorded every year from 2011 – 2016, although no breeding pairs of Hobby were recorded in 2017 or 2018. Hobby do not build their own nests but utilise old corvid nests. These nests can be found in a variety of woodlands from conifer plantations, deciduous woodland and isolated trees.

14.12.45 The majority of the mature woodland resource is being retained, with only (46ha) of all woodland within Goose Hill woodland lost. It is likely that the local corvid population will continue nesting in the vicinity of Goose Hill and thus providing hobby with nesting locations in the future. The loss of the habitat within Goose Hill plantation would not have a significant effect on the local hobby population, as they move to where corvids have previously nested. Likewise, there is a large resource of wetland habitat along the Suffolk coast that would offer extensive foraging habitat, as well as the new habitat creation at Aldhurst Farm. Given the increase in the national population of hobby, neither nest location or foraging habitat are likely to be limiting factors in the breeding success of the species. For these reasons, loss of habitat for nesting and foraging hobby would be considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Peregrine

14.12.46 The species account (refer to **Annex 14A7.6**) identified that peregrine forage across a range of habitats within and adjacent to the site. Peregrine are recorded nesting within the Sizewell A and B power station reactor buildings. Anecdotal evidence indicated that peregrines were present during the breeding seasons of 2014 to 2017, during which construction and demolition activity occurred at Sizewell A and B power stations. Peregrine were recorded during surveys in 2018 (Ref 14.71), however breeding was not confirmed. The current UK population estimate for peregrine is 1,500 pairs (Ref 14.75) and the UK population is increasing due to utilisation of urban high-rise buildings and nest boxes/ledges. Within Suffolk, peregrine is described as uncommon, but breeding peregrine have been present within the county since 2008 and in 2017 there were six confirmed pairs (Ref 14.76).

14.12.47 No structures known to be utilised by peregrine would be lost as a result of the proposed development. Although potential foraging habitat for this species would be lost, given the large resource of habitat along the Suffolk coast that would offer alternate foraging habitat, as well as the new habitat creation as part of the primary mitigation (see **section 14.4** of this chapter), loss of habitat would not have a significant effect on the local peregrine population. For these reasons, loss of habitat for foraging peregrine is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Black redstart

14.12.48 The species account (refer to **Annex 14A7.6**) confirms that between two and three pairs of black redstart breed each year within the existing Sizewell A and B power station complex and that they make some use of the power station infrastructure and adjacent coastal habitat for foraging. Black redstarts have declined nationally with an estimated UK breeding population of 19–44 pairs (Ref 14.77). Two pairs breeding at Sizewell equate to 10% of the UK population (assuming 19 breeding pairs). Within Suffolk, black redstarts are infrequent breeders. In 2008 and 2012, the existing Sizewell A and B power station complex had the only confirmed successful breeders in the County.

14.12.49 As the black redstart nests are located within the existing Sizewell A and B power station complex, no physical loss of nesting sites is envisaged.

14.12.50 In relation to foraging birds, the majority of sightings of black redstart have either been within the existing Sizewell A and B power stations or the coastal habitat in close proximity to the existing Sizewell A and B power stations. Although 7.0ha of coastal habitat would be temporarily lost as a result of the construction of the coastal defences, the majority of coastal habitat in the vicinity of the existing Sizewell A and B power stations would be retained, and following the construction of the hard sea defence structure the coastal vegetation would be reinstated and available for black redstart to utilise again.

14.12.51 The foraging habitat within the existing Sizewell A and B power stations would also be retained (approximately 21ha) and available for the birds to utilise during the construction phase. Furthermore, the transformation of existing habitats into 'brownfield areas' (favoured by black redstart), as the demolition of Sizewell A structures continues, is likely to create more foraging opportunities for black redstarts. This along with enhancement measures such as nest boxes and green roofs on construction site compounds could enhance the site for the local black redstart population during the construction phase.

14.12.52 Potential habitat loss impacts on black redstart are considered to be of very low magnitude which would result in a **negligible adverse** effect, which is considered to be **not significant**.

Cetti's warbler

14.12.53 The species account (refer to **Annex 14A7.6**) confirms Cetti's warbler is a breeding species within the site with up to 13 pairs recorded. The current UK population estimate of Cetti's warbler is 2,000 males (Ref 14.78). Within Suffolk, 138 singing males were reported. The 13 territories recorded within the survey area represents approximately 9% of the known Suffolk breeding population. In 2018 however, only one Cetti's warbler territory was recorded compared to 19 in 2017 (Ref 14.71). The 2018 report stated that the numbers of Cetti's warbler crashed on the Suffolk coast in the summer of 2018 due to severe winter weather although the population is likely to recover.

14.12.54 The only area where habitat suitable for this species would be lost is at Sizewell Marshes SSSI. Within this area to be impacted by land take, four Cetti's warbler territories have been recorded during the targeted surveys. The habitat creation as described for "*The bird assemblage associated with Sizewell Marshes SSSI*" above would also apply here. The impact of this non-reversible habitat loss on Cetti's warbler is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Birds of nature conservation importance (species within the footprint of the site)

14.12.55 The ornithology baseline (**Appendix 14A7 – Ornithology** of this volume) gives a detailed account of the wintering and breeding bird species likely to be present within the footprint of the site. Note that this excludes Sizewell Marshes SSSI which is dealt with separately above. The site supports a range of breeding species including 15 BoCC Red Listed species (Ref 14.36) and/or Section 41 of the NERC Act (Ref 14.10). However, only limited numbers of each species were recorded (see **Appendix 14A7 – Ornithology** of this volume).

14.12.56 The loss of (45ha) of arable farmland would constitute a temporary and reversible loss of nesting and foraging habitat that would last for the duration of the construction phase (9-12 years). The loss of (38ha) of conifer woodland would constitute a permanent loss of nesting and foraging habitat.

14.12.57 As detailed in **section 14.4** of this chapter, the creation of grassland and scrub habitat for the reptile receptor site (58ha), the marsh harrier habitat improvement area in the northern part of the EDF Energy Estate (approximately 48ha) and the creation of (approximately 49ha) of grassland and scrub within Aldhurst Farm would provide alternate nesting and foraging habitat for farmland bird species. Survey work during the Winter of 2018/19 within the reptile receptor area recorded the following anecdotal records: a single Dartford warbler (*Sylvia undata*) and regularly occurring meadow pipit (*Anthus pratensis*), skylark (*Alauda arvensis*) and song thrush (*Turdus philomelos*). This indicates that the habitat creation undertaken to date is already being utilised by a range of important species and would provide an alternative foraging resource for birds during the construction phase of the proposed development.

14.12.58 Taking these measures into account, the impact of habitat loss for the BoCC Red List (Ref 14.36) and Section 41 NERC Act (Ref 14.10) species within the site is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Disturbance/displacement effects on birds

14.12.59 Anthropogenic disturbance comprises noise, lighting and visual disturbance. To a certain extent, these three factors would act together.

Noise

14.12.60 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) outlines a body of evidence indicating that anthropogenic noise disturbance from busy roads, urban areas, and permanent industrial structures has been implicated as having detrimental impacts upon breeding bird populations. Noise has been associated with declining bird densities as a result of displacement from otherwise suitable habitat due to ecological sensitivities or intolerance to noise.

14.12.61 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) describes sensitivity thresholds at which the onset of disturbance may start to lead to potentially deleterious behavioural responses in birds and animals have been developed in respect of sudden impulsive noise levels using the noise measurement dBL_{Amax}[17]. Impulsive noises are considered more likely to lead to behavioural responses by birds, such as “escape behaviours” and the desertion or avoidance of areas, than are equivalent levels of chronic noise.

14.12.62 The duration of impulsive noise would continue for the duration of the construction phase with the early years likely to generate the most frequent impulsive nose levels (discussed in more detail below). The magnitude of effect would depend on the level (dBL_{Amax}) of impulsive noise, the frequency of impulsive noise events and the sensitivity of individual bird species to such noise events. If impulsive noise levels are sufficient to cause a displacement

[17] dBLAmax is the maximum level of a noise. In the context of a construction site, this usually refers to single loud noises, such as piling

of breeding and wintering species and occur for sufficient duration to prevent access to nesting and foraging habitat, then a significant effect could occur.

14.12.63 A sensitivity threshold of 70dBL_{Amax} has been determined for foraging marsh harrier and wintering wildfowl and wader species, with a value of 65 dB L_{Amax} assumed for breeding water-birds (but with the assessment based upon the slightly more precautionary 64 dB L_{Amax} threshold, in line with the outputs from the noise modelling). The evidence base for this, together with background noise modelling is presented in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume).

14.12.64 Background noise level monitoring has been undertaken at several locations in the vicinity of the site and the wider area used by breeding birds, these being:

- near the South Hide within the RSPB Minsmere Reserve;
- near Leiston Old Abbey in the Minsmere South Levels; and
- within the northern part of the site.

14.12.65 Background noise levels in these three locations were associated with sources such as occasional people walking past, agricultural activity, overhead aircraft, insects and birdsong and were often above 60dBL_{Amax} and occasionally close to, or above, 70dBL_{Amax} during daylight hours.

14.12.66 Whilst it is acknowledged that this sensitivity threshold has not been developed specifically for other bird species, for example breeding passerines, given the results of background noise monitoring, a sensitivity threshold for impulsive noise events for other bird species of 70dBL_{Amax} is still considered appropriate.

14.12.67 Modelling has been undertaken to determine the impulsive noise levels that could arise during the construction phase of the proposed development. For the purposes of this assessment, peak noise levels (dBLA_{max}) have been determined. Peak levels are the highest levels which might occur for a fraction of second during the noisiest component of an activity. In most instances for construction noise, the dBLA_{max} value represents sudden impulsive or impact sounds such as hammering.

14.12.68 Noise modelling was undertaken separately for each of the five construction phases, based upon the predicted worst-case scenario across the entirety of each phase:

- **Phase 1** – the first 2.5 years would involve activities such as the stripping of soils, overburden excavation, crag removal and overburden excavation from, water management zones;

- **Phase 2** – 1.5 to 3.5 years would involve activities such as backfilling using excavators and stockpiling with bulldozers;
- **Phase 3 and 4** – may extent to years 7 and 8 no earthworks anticipated; and
- **Phase 5** – is expected to extend over approximately 6 months and would involve restoration works, such as the removal of stockpiles.

14.12.69 The modelling assumes boundary treatments to reduce noise disturbance to adjacent designated sites or valuable habitats, such as a 5m fence, are already in place (as set out within **section 14.4** of this chapter).

14.12.70 As the modelling outputs show the predicted worst-case from the entire duration of that phase, the noise emissions predicted for each phase are likely to be overestimates (and hence precautionary), whilst the duration of the worst-case scenario would not extend over the entire phase.

14.12.71 The extent of this overestimation in the modelling predictions was investigated for the marsh harrier assessment and the results presented in the **Shadow HRA Report** (**Book 5, Report 5.10**). Therefore, when interpreting the noise modelling figures, it is important to consider the precautionary approach to the noise modelling, which is likely to result in an overestimation of the peak noise levels and their duration.

Lighting and visual

14.12.72 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) describes that artificial lighting may act as a potential source of visual disturbance to birds.

14.12.73 As detailed under primary mitigation (**section 14.4** of this chapter), lighting would be implemented in accordance with the **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**), which would meet the requirements set out in ILP guidance (Ref 14.41). Together with boundary treatments, such as fencing and existing screening from trees, this is likely to minimise lighting disturbance.

14.12.74 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) also indicates that the presence of construction personnel and to a lesser extent construction infrastructure (such as cranes) can be a source of visual disturbance to birds.

Disturbance/displacement impacts arising from noise, lighting and visual disturbance

14.12.75 This group of interrelated impacts is relevant to the following IEFs or IEF groups as follows:

- bird species associated with European sites;
- bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI;
- bird assemblage associated with Sizewell Marshes SSSI;
- bird species listed on Schedule 1 of the W&CA (Ref 14.7): (wintering marsh harrier, bearded tit, barn owl, hobby, peregrine, black redstart and Cetti's warbler) recorded within footprint of the site;
- birds of nature conservation importance (BoCC Red and Amber Listed (Ref 14.36) and Section 41 NERC Act (Ref 14.10) species) within the site; and
- kittiwake (breeding) Sizewell Rigs CWS.

Bird species associated with European sites: Minsmere-Walberswick SPA

14.12.76 This impact pathway is relevant to the following qualifying features of the Minsmere-Walberswick SPA:

- Bittern (breeding).
- Avocet (breeding).
- Shoveler (breeding and wintering).
- Gadwall (breeding and wintering).
- Teal (breeding).
- White-fronted goose (wintering).
- Marsh harrier (breeding).
- Hen harrier (wintering).
- Nightjar (breeding).
- Little tern (breeding).

14.12.77 The potential impact on each of these species is discussed in turn below.

Avocet

14.12.78 With regard to avocet, due to the distance of the SPA from the main development site there is little potential for noise and visual disturbance to impact avocets using habitats within the SPA itself. The main breeding areas of avocet within the SPA (i.e. the coastal lagoons) are more than 1 km from the main development site at the closest point. Although the Minsmere South Levels (which occur outside the SPA but are part of the Minsmere and Walberswick Heaths SSSI) comprise habitat that may be used by breeding avocet, and may be functionally linked with the SPA avocet population, numbers are small relative to the SPA population (with no recorded breeding since 2010). Also, the areas where avocet have nested on the Minsmere South Levels are beyond the extend of predicted noise and visual disturbance effects (**Figures 14B2.1** to **14B2.4** and **Figure 14B2.6**)

Bittern

14.12.79 The main breeding sites for bittern occur within the extensive area of reedbed habitat and open pool systems which is located immediately north of the Minsmere New Cut and represents some of the closest areas of the SPA to the main development site (at less than 1 km at the closest point). Although the Minsmere South Levels and Sizewell Marshes could be used as foraging habitat by breeding bitterns from the SPA during the breeding season, as well as by SPA birds outside the breeding season, evidence suggests this use is limited, refer to Figure 14A7_13 Bittern Survey Results.

Gadwall and shoveler (breeding and wintering)

14.12.80 The evidence relating to the effects of noise, visual and artificial lighting disturbance on these breeding waterbirds indicates that it is unlikely that noise and visual disturbance from the construction of the Sizewell C Project would affect gadwall and shoveler, either in terms of the breeding or wintering populations within the Minsmere-Walberswick SPA. This is because the potential visual impact zone and relevant noise contours do not extend onto the SPA (other than in the south-eastern extremity, which does not include suitable habitat – **Figures 14B2.1** to **14B2.5** and **Ornithology Synthesis Report** (**Appendix 14B2**) of this volume).

14.12.81 These species also breed and winter within the Minsmere South Levels and Sizewell Marshes, and the birds using these areas may be functionally linked to the SPA population. However, the predicted spatial extent of the potential disturbance and displacement effect is relatively limited on the Minsmere South Levels (and does not encroach on the main areas with open water bodies), whilst the breeding and wintering numbers of both of these species occurring within the Sizewell Marshes are relatively low (e.g. **Table 14.28** and **Table 14.29**).

Teal

14.12.82 On the basis of the evidence relating to the effects of noise, visual and artificial lighting disturbance on this breeding waterbird, it is considered unlikely that noise and visual disturbance from the construction of Sizewell C would affect teal which are breeding within the Minsmere-Walberswick SPA. This is because the potential visual impact zone does not extend onto the SPA (other than in the south-eastern extremity, which does not include suitable habitat). Teal are also essentially absent as a breeding species from the Minsmere South Levels and Sizewell Marshes, with no breeding records from the former area since at least 2010 and one record of a single breeding pair (in 2013) since 2011 for the latter area.

White-fronted goose

14.12.83 It is considered unlikely that noise and visual disturbance from the construction of the Sizewell C Project would affect wintering white-fronted geese when present within the Minsmere-Walberswick SPA.

14.12.84 The baseline survey data demonstrate that white-fronted geese make little diurnal use of the Minsmere South Levels and Sizewell Marshes, with the main daytime feeding area being at North Warren. However, birds are reported to often roost at night on the Minsmere-Walberswick SPA, and sometimes Minsmere South Levels, which are considerably closer to the main development site. Should any disturbance effects occur to these commuting birds, they would be likely to result in small deviations to the flight paths only, and are considered highly unlikely to prevent birds from using the roosting areas.

Marsh harrier

14.12.85 Disturbance effects on the Minsmere-Walberswick SPA breeding marsh harrier population may arise via visual and acoustic stimuli associated with the construction and decommissioning of the Sizewell C Project. Such stimuli could affect this SPA population as a result of disturbance to foraging birds.

14.12.86 Coastal grazing marsh, reedbed and agricultural land are likely to provide the three main foraging habitats for marsh harriers nesting at Minsmere. The extent of the assumed habitat loss to foraging marsh harrier as a result of noise and visual disturbance during the construction phase has been calculated as follows:

- The distribution and extent of the broad habitat-types surrounding the Minsmere marsh harrier nesting area were mapped, using available land classification information from existing mapped and aerial data.
- The total areas of coastal grazing marsh, reedbed and agricultural land were extracted from the mapped data for a series of 1km concentric radii centred on the Minsmere marsh harrier nesting area, out to a distance of 4km.
- The areas of coastal grazing marsh, reedbed and agricultural land assumed to be 'lost' to foraging marsh harrier (i.e. due to being within

either the 70dB LAmax footprint, Sizewell Marshes or else the 150m potential visual impact zone) were calculated for each of the 1km concentric radii and expressed as a percentage of the total habitat area.

14.12.87 On this basis, the percentage of each foraging habitat-type potentially 'lost' to marsh harriers at different distances from the nesting area as a result of construction-related disturbance (from both visual and noise stimuli) was estimated.

14.12.88 Determining the consequences of the potential loss of this area of foraging habitat on the marsh harrier population at Minsmere requires consideration of the potential foraging value of the habitat, the likely behavioural response of harriers to the loss of the habitat and the likely resulting effect on the population (productivity and mortality).

14.12.89 Increased noise and visual disturbance associated with construction activities at the main development site may cause marsh harriers from the Minsmere nesting area to be displaced (as a result of an assumed 'barrier effect') from parts of their existing foraging ranges (including the Sizewell Marshes and Minsmere South Levels).

14.12.90 Given that there is likely to be substantial overlap in the foraging ranges of marsh harriers breeding at Minsmere, the effective loss of habitat through displacement could affect all of the breeding population at Minsmere (i.e. approximately 50% of the SPA population). The aggregated figure for wetlands plus arable loss equates to approximately 20% of the foraging resource available to marsh harriers within 4km of the Minsmere nesting area.

14.12.91 The marsh harriers show substantial plasticity in foraging behaviour and can adapt to both changes in prey availability and habitat quality without showing marked reductions in breeding productivity. However, given the long-term duration (approximately 9-12 years) of the construction period, it is acknowledged that over this time period the potential loss of approximately 20% of foraging resource within 4km of Minsmere could conceivably affect the overall breeding productivity.

Hen harrier

14.12.92 Non-breeding hen harriers using habitats within the Minsmere-Walberswick SPA are unlikely to be affected by noise and visual disturbance from construction activities, given that potential visual impact zones do not extend onto the SPA (other than in the south-eastern extremity, which does not include suitable hen harrier habitat). The Minsmere South Levels and Sizewell Marshes also provide suitable foraging habitat for hen harrier, whilst the species will sometimes hunt over agricultural habitats. However, non-breeding hen harriers have been scarce within, or absent from, the SPA in recent years, and baseline surveys provide little evidence for any substantial use of habitats in close proximity to the main development site, where potential effects of noise and visual disturbance could occur.

Nightjar

14.12.93 The main breeding areas for nightjar within the Minsmere-Walberswick SPA are over 1 km from the main development site, where the predicted peak noise levels from construction activities are considerably below the noise threshold where disturbance could occur.

Little tern

14.12.94 The Minsmere little tern colony is the closest to the main development site. This colony on the scrape is located 500 – 700 m north of the Minsmere New Cut and slightly more than 1.5 km from the main development site at its nearest point. Given this separation, noise and visual disturbance from construction activities are unlikely to affect any nesting little terns when they are present at this colony, or at any other historical or current colony locations within the SPA.

14.12.95 The SPA little tern population could also be affected by noise and visual disturbance when away from the nesting colony and foraging in the marine environment. Such effects could occur as a result of direct disturbance to the birds themselves from increased vessel traffic or indirectly as a result of the effects of underwater noise on the fish prey species of little tern.

14.12.96 In relation to direct effects, increases in vessel traffic associated with the delivery of material to the BLF would represent only small increases in daily vessel movements within the waters around Sizewell, and little terns foraging offshore are considered to be relatively insensitive to such sources of anthropogenic disturbance.

14.12.97 The effects of underwater noise would be temporary, and the piling and dredging activities would also be of relatively short duration, with each activity being undertaken over a small number of days at most. In addition, mortality or recoverable injury of fish as a result of underwater noise would occur within very small parts of the little tern foraging range only.

Conclusion for the bird species associated with the Minsmere-Walberswick SPA

14.12.98 As a worst case, it is concluded that the impact of disturbance/displacement on the bird species which are qualifying features of the Minsmere-Walberswick SPA (with the exception of breeding marsh harrier) is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

14.12.99 With respect to breeding marsh harrier, it is concluded that the impact is of medium magnitude and would result in a **moderate adverse** effect, which is considered to be **significant**.

14.12.100 However, measures to improve foraging habitat for marsh harriers have been established on an area of 48.7 ha to the north of the temporary construction area (e.g. see **Figure 14B2.1** and **Ornithology Synthesis Report** (**Appendix 14B2**) of this volume). The establishment of this area of improved foraging habitat is considered likely to compensate for the potential loss of foraging habitat on the Sizewell Marshes, and with this compensation in place it is concluded that the impact of disturbance/displacement on the breeding marsh harrier population is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**. In August 2015 Natural England confirmed that the proposed marsh harrier mitigation land is likely to be acceptable 'in principle', despite not involving any wetland creation [at that time], provided it offered appropriate prey abundance and availability.

Bird species associated with European sites: Alde-Ore Estuary SPA and Ramsar site

14.12.101 This impact pathway is relevant to the following qualifying features of the Alde-Ore Estuary SPA and Ramsar site:

- Avocet (breeding and wintering).
- Marsh harrier (breeding).
- Little tern (breeding)
- Sandwich tern (breeding)
- Lesser black-backed gull (breeding)
- Redshank (wintering)
- Ruff (wintering)

14.12.102 The site is located 5km from the main development site, and well beyond the distance at which effects of noise and visual disturbance associated with the construction of the main development site could occur.

14.12.103 It is concluded that the impact of disturbance/displacement on qualifying features of the Alde-Ore Estuary SPA and Ramsar site is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird species associated with European sites: Sandlings SPA

14.12.104 This impact pathway is relevant to the following qualifying features of the Sandlings SPA:

- Nightjar (breeding).
- Woodlark (breeding).

14.12.105 The majority of the area of the Sandlings SPA (and hence of the breeding nightjar habitat within the SPA) is over 9 km from the main development site, and well beyond the distance at which effects of noise and visual disturbance associated with the construction of the main development site could occur.

14.12.106 The north-west extremity of a relatively small, discrete, block of the SPA approaches to within 0.7 km to the south of the main development site, with this discrete block likely to support approximately 3% of the SPA breeding nightjar population and approximately 9% of the SPA breeding woodlark population. As a consequence, this north-west extremity of this part of the SPA occurs within the potential visual impact zone but predicted noise levels during construction would remain below the threshold at which disturbance is predicted across its entirety (**Figures 14B2.1** to **14B2.4** and **Figure 14B2.6** and **Ornithology Synthesis Report** (**Appendix 14B2**) of this volume).

14.12.107 As a worst case, it is concluded that the impact of disturbance/displacement on qualifying features of the Sandlings SPA is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird species associated with European sites: Outer Thames Estuary SPA

14.12.108 This impact pathway is relevant to the following qualifying features of the Outer Thames Estuary SPA:

- Red-throated diver (wintering).
- Little tern (breeding).
- Common tern (breeding).

Red-throated diver

14.12.109 Disturbance from the construction activities which would occur in the marine environment may affect the Outer Thames Estuary SPA population of non-breeding red-throated diver. This could be either directly via increased vessel traffic or indirectly via the effects of underwater noise on their fish prey species.

14.12.110 In relation to vessel traffic during the construction period, most of the deliveries to the BLF would be likely to occur between 31st March and 31st October (see **Chapter 24: Marine Navigation** of this volume) Thus, the main period of increased vessel activity would have little overlap with the period of the year in which red-throated divers are present within the SPA, with April being the only month when the main period of BLF deliveries may coincide with a relatively high abundance of red-throated diver within the waters around Sizewell.

14.12.111 In relation to indirect effects, the different potential sources of underwater noise disturbance during construction (and as assumed for decommissioning) and the extent of their effects on the fish prey of red-throated divers are detailed as for the Minsmere-Walberswick SPA above.

Little tern

14.12.112 Of the little tern breeding colonies which contribute to the Outer Thames Estuary SPA little tern population, only those in (or close to) the Minsmere-Walberswick SPA have the potential to be affected by noise and visual disturbance from the construction, operation and decommissioning of the main development site. Currently, these colonies comprise a small proportion of the overall little tern population for which the Outer Thames Estuary SPA provides supporting habitat. The assessment undertaken for the Minsmere-Walberswick SPA little terns provided above applies here.

Common tern

14.12.113 Disturbance from construction and decommissioning activities could affect birds foraging in the marine environment either directly via increased vessel traffic or indirectly via the effects of underwater noise on their fish prey species. Predicted effects would represent small changes relative to the existing situation (in terms of vessel traffic), with just over two vessel movements on average per day during the common tern breeding period.

14.12.114 The different sources of underwater noise would produce effects which extend over small parts (up to 4%) of the common tern foraging ranges.

Conclusion for the Outer Thames Estuary SPA

14.12.115 As a worst case, it is concluded that the impact of disturbance/displacement on qualifying features of the Outer Thames Estuary SPA is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI

14.12.116 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) presents the noise contour modelling for Phases 1 to 5 of the construction period. During the whole of this period the majority of the Minsmere to Walberswick Heaths and Marshes SSSI north of the Minsmere New Cut would experience impulsive noise levels of less than 54dB L_{Amax} whilst the vast bulk of the area south of the Minsmere New Cut would experience impulsive noise levels substantially less than 70dB L_{Amax}.

14.12.117 Phase 1 would be the period in which noise encroachment would be greatest with the 70dB L_{Amax} contour encroaching on a small area in the southern corner adjacent to the site. In extent this is approximately 16.4ha (0.7% of the total 2,325.89ha) of the Minsmere to Walberswick Heaths and Marshes SSSI. During Phase 2, this reduces to 13.4ha (0.53%) with virtually no encroachment of the 70dB L_{Amax} contour during Phases 3, 4 and 5. In phases 1 and 2 less than 1% of the Minsmere to Walberswick Heaths and Marshes SSSI would be directly affected and the number of individual birds likely to be affected is considered to be small. Therefore, the duration of effect on the Minsmere to Walberswick Heaths and Marshes SSSI is expected to be for up to 2.5 years for Phase 1 and 1.5 to 3.5 years for Phase 2 from the start of the construction phase (i.e. medium-term) and would be reversible once the noisy elements of construction have ceased.

14.12.118 The primary mitigation measures (as set out within **section 14.4** of this chapter) to replace habitat lost within the Sizewell Marshes SSSI would also provide alternative habitats for the birds which might be displaced from parts of the Minsmere to Walberswick Heaths and Marshes SSSI which could be subject to noise disturbance during the construction phase of the proposed development.

14.12.119 In relation to visual impacts on birds within the Minsmere to Walberswick Heaths and Marshes SSSI, measures set out within the **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) would ensure minimal light-spill onto the adjacent habitats. Minsmere to Walberswick Heaths and Marshes SSSI is also divided into compartments and is well screened from the proposed construction site by existing trees and shrubs. This, as well as measures to prevent construction personnel and machinery from straying outside of the construction area, would ensure no significant impacts associated with visual disturbance to birds within the Minsmere to Walberswick Heaths and Marshes SSSI.

14.12.120 As less than 1% of the Minsmere to Walberswick Heaths and Marshes SSSI would be directly affected by the impact of impulsive noise levels arising from the construction of the proposed development; and lighting/visual effects would be minimised wherever possible, potential disturbance impacts are considered to be of very low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Bird assemblage associated with Sizewell Marshes SSSI

14.12.121 As outlined above, the noise contour modelling figures show that during Phases 1 and 2 of the construction the 70 dB L_{Amax} contour would encroach across approximately 57ha of Sizewell Marshes SSSI (55% of Sizewell Marshes SSSI total of 194.33ha). During Phases 3 and 4 this would reduce to approximately 14ha (13% of Sizewell Marshes SSSI). The 65dB L_{Amax} contour would encroach further in both cases.

14.12.122 As for Minsmere to Walberswick Heaths and Marshes SSSI, the duration of the effect on Sizewell Marshes SSSI is expected to be for up to 3.5 years from the start of the construction phase. The effect is medium-term and would be reversible once the noisy elements of construction have ceased. As more than 50% of the Sizewell Marshes SSSI would be directly affected, a large proportion of birds using Sizewell Marshes SSSI for breeding and foraging could potentially be affected by adverse noise impacts.

14.12.123 Primary mitigation measures, however, have been put in place to reduce or avoid potential disturbance impacts on birds associated with Sizewell Marshes SSSI. Boundary features and bunds are included within the construction masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats. In relation to visual impacts, measures set out within the **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) would ensure minimal light-spill onto the adjacent habitats in vicinity of the works associated with the SSSI crossing. Sizewell Marshes SSSI is itself divided into individual compartments by woodland and tree belts and some areas would be well screened in many locations from the proposed construction site by existing trees and shrubs. This, as well as bunding, fencing and screening would ensure no significant effects are associated with visual disturbance to birds within Sizewell Marshes SSSI.

14.12.124 Replacement habitat has already been created at Aldhurst Farm, as outlined in **section 14.4** of this chapter. This new habitat already supports a number of the relevant bird species and this would compensate to some extent for the potential disturbance effects on Sizewell Marshes SSSI and any related displacement associated with the construction phase.

14.12.125 With the mitigation measures in place as described above, impacts associated with construction noise would be minimised as far as possible. Sizewell Marshes SSSI supports a diverse bird assemblage but populations are relatively small (Ornithology Baseline Report, **Appendix 14A7** of this volume). Potential disturbance impacts are considered to be a short-term but of large magnitude. For any given species the impacts on a relatively small number of individuals associated with the SSSI would not result in a significant effect on any of the overall populations for any species. Therefore, in terms of the overall populations and species assemblage associated with the Sizewell Marshes SSSI a **minor adverse** effect is anticipated which is considered to be **not significant**.

Bird species listed on Schedule 1 of the W&CA (wintering marsh harrier, barn owl, hobby, peregrine, black redstart and Cetti's warbler) recorded within the site

14.12.126 As the effects of impulsive noise are likely to affect Schedule 1 of the W&CA (Ref 14.7) species in a similar manner, the Schedule 1 IEF's have been considered collectively to avoid excessive repetition of information.

14.12.127 The noise contour modelling figures show that during all phases of the construction the 70dBL_{Amax} contour would encroach upon the full footprint of the site and it is assumed that bird species protected under Schedule 1 of the W&CA (Ref 14.7) would be displaced from within the footprint of the site for the duration of the construction phase. For habitats located adjacent or in close proximity to the site, during Phase 1 and 2 of construction there would be some encroachment of the 70dBL_{Amax} contour. This includes retained woodland such as Ash Wood and Kenton Hills, the northern edge of the Aldhurst Farm site (only during WMZ establishment), and parts of the reptile receptor area. This encroachment reduces substantially during Phases 3 and 4 with minimal encroachment expected during Phase 5. The effect is medium-term and would be reversible once the early phases of construction have concluded.

Marsh harrier (wintering)

14.12.128 As outlined in the species accounts (refer to **Annex 14A7.5**) wintering marsh harrier forage over both the arable farmland and over reedbed and fen meadow habitat within Sizewell Marshes SSSI on a reasonably regular basis, and therefore could be displaced from such habitats during the construction phase through noise and lighting/visual impacts.

14.12.129 As outlined previously, primary mitigation for the loss of reedbed and fen meadow habitat are already in place). In addition, as outlined in **section 14.4** of this chapter and detailed in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) compensation measures would also see additional, permanent foraging habitat for marsh harrier created across the northern part of the EDF Energy estate. Additional reedbed habitat would also be created along the eastern edge of this area, although it is acknowledged that this will take some time to become fully established. Whilst this additional foraging habitat is primarily to compensate for impacts on breeding marsh harrier, it would also provide additional foraging habitat for marsh harrier during the Winter months, and thus provide alternative habitat for birds potentially displaced from within the site as a result of noise and lighting/visual effects. For these reasons, potential disturbance or displacement of wintering marsh harrier is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Barn owl

14.12.130 As discussed above, at least two pairs of breeding barn owl are present within the site, using existing farm buildings or nest boxes. Barn owl have also regularly been recorded foraging widely over both wetland habitat and arable field margins. Barn owl were confirmed to be breeding at Lower Abbey Farm, Upper Abbey Farm and Sizewell Marshes SSSI in 2015. The confirmed nest at Upper Abbey Farm is located within the proposed construction site. The confirmed nests at Lower Abbey Farm and Sizewell Marshes SSSI are located immediately adjacent to the proposed construction site. Additionally, surveys undertaken in 2018 recorded a pair of barn owls nesting in the Goose Hill box (at Goose Hill Marshes) raising three young (Ref 14.71). Foraging barn owl could be displaced from suitable foraging habitat within the majority of the site for the duration of the construction phase.

14.12.131 In relation to visual impacts on foraging barn owl, measures set out within the **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) would ensure minimal light-spill onto the adjacent habitat with night-time working being limited and ceasing at 22.00hrs.

14.12.132 As detailed above, new reedbed habitat which has been already been created at Aldhurst Farm, the creation of additional, improved habitats for use by marsh harrier and the creation of the reptile receptor habitat (as outlined in the primary mitigation in **section 14.4** of this chapter) would provide habitat suitable for foraging barn owls within the vicinity of the existing barn owl nest locations.

14.12.133 Therefore, although there is the potential to displace barn owls from within the site, the mosaic of habitat creation as part of the primary mitigation would provide alternative foraging locations in the vicinity of their current foraging range, within the wider EDF Energy estate, which would mitigate for the loss of habitat within the site and benefit the local barn owl population in the long-term. In addition, as detailed in the primary mitigation in **section 14.4** of this chapter, additional barn owl boxes would also be erected in close proximity to these areas of habitat creation to provide additional nesting/roosting opportunities for the local barn owl population. For these reasons, potential disturbance/displacement of foraging barn owl is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Hobby

14.12.134 The species accounts (refer to **Annex 14A7.6**) indicates that up to two pairs of hobby may nest within mature woodland within the site and they have been recorded foraging widely over the wetland habitat within Sizewell Marshes SSSI. The Sizewell Land Management Annual Review 2018 (Ref 14.71), stated that one breeding pair of Hobby was recorded every year from 2011 – 2016 within the survey area, however breeding Hobby was not recorded in 2017 or 2018.

14.12.135 Although hobby may be disturbed/displaced from potential nesting and foraging habitat within the site, as described above, suitable nesting locations are present throughout the wider landscape, and as such, any disturbance/displacements effects as a result of construction activities would not have a significant effect on the local hobby population. Likewise, there is a large resource of wetland and other suitable foraging habitat along the Suffolk coast that would offer alternate foraging habitat, as well as the new habitat creation at Aldhurst Farm. Hobby has undergone a large-scale expansion, consolidating their range in the south and expanding into the north, east and west, and undergoing a 16% population increase between 1995-2010 (Ref 14.73). Given the increase in the national population of hobby, it is considered that neither nest location or availability of foraging habitat are likely to be limiting factors in the breeding success of the species. For these reasons, potential disturbance effects on nesting and foraging hobby would be considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Peregrine

14.12.136 Peregrines forage across a range of habitats within and adjacent to the site and a pair has been regularly recorded nesting within the Sizewell A and B power station reactor buildings (**Annex 14A7.6**) In 2018, peregrine was recorded during surveys, however breeding was not confirmed (Ref 14.71). The nesting birds are habituated to the current background noise and disturbance from the existing power station operations. The nesting locations in the Sizewell A and B complex are more than 20m from the proposed construction site and would not be subject to physical disturbance effects from nearby construction activities. Nesting Peregrines are typically relatively tolerant of nearby disturbance, so long as the nesting location is sufficiently elevated and inaccessible to provide security to the nesting birds as would be the case at Sizewell.. There is the potential to disturb foraging peregrine through noise and lighting/visual effects; however, given the large resource of habitat retained within the EDF Energy estate and more widely along the Suffolk coast that would offer alternate foraging habitat, as well as the new habitat creation as part of the primary mitigation for the proposed development (see **section 14.4** of this chapter), potential disturbance/displacement impacts would not have a significant effect on the local peregrine population. For these reasons, potential disturbance/displacement is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Black redstart

14.12.137 The species account (refer to **Annex 14A7.6**) confirms that between two and three pairs of black redstart breed each year within the existing Sizewell A and B power station complex. The birds also make use of the existing power station infrastructure and adjacent coastal habitat for foraging and are habituated to the current background noise and disturbance from the existing power station.

14.12.138 The nest sites within the Sizewell A and B power station complex are more than 20m from the proposed construction site and would not be subject to increased disturbance effects from construction activities (over and above those normally experienced by the birds nesting in such locations). Similarly, the foraging habitat within the existing Sizewell A and B power stations would not be directly affected by the proposed works and would still be available for the birds to utilise during the construction phase. The Sizewell Land Management Annual Review in 2018 (Ref 14.71) does not include reference to black redstart, probably as the existing power station complexes are excluded from the survey areas.

14.12.139 There has been little research undertaken on the ecology of black redstart in the UK (Ref 14.79); however, it is known that brown field sites which include “wasteland” vegetation and stony ground as well as numerous vertical structures are preferred by black redstart (Ref 14.79). They are also known to favour inner city locations, in particular industrial sites, and land under construction in proximity to water with bare earth, which provides an abundance of invertebrates.

14.12.140 Whilst there may be some level of disturbance associated with construction activities (such as the installation of the coastal defences) the transformation of existing habitats into more brownfield areas as a result of the proposed development, as well as the ongoing demolition further Sizewell A structures, could create more foraging opportunities for black redstarts.

14.12.141 Potential disturbance impacts on black redstart are considered to be of low magnitude which would result in a **minor** adverse effect, which is considered to be **not significant**.

Cetti’s warbler

14.12.142 The species account (refer to **Annex 14A7.6**) confirms Cetti’s warbler is a breeding species within the site with up to 13 pairs recorded. Potential nesting and foraging locations could be disturbed within Sizewell Marshes

SSSI. In 2018, only one Cetti's warbler territory was recorded compared to 19 pairs in 2017 (Ref 14.71).

14.12.143 The impacts and mitigation as described for "*Bird assemblage associated with Sizewell Marshes SSSI*", provided above would also apply here. Therefore, with the primary mitigation measures in place, potential disturbance impacts on Cetti's warbler are considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Birds of nature conservation importance

14.12.144 This is a group of species of nature conservation importance which breed on site (or have done) and includes grey partridge, turtle dove, cuckoo, marsh tit, skylark, starling, song thrush, spotted flycatcher, house sparrow, yellow wagtail, linnet and yellowhammer. Several of these species are declining in Suffolk and may not still breed within the EDF Energy estate.

14.12.145 As the effects of impulsive noise are likely to affect individual species in a similar manner the component species of this IEF have been considered together.

14.12.146 The noise contour modelling figures show that during all phases of the construction, the 70dBL_{Amax} contour would encroach upon the full footprint of the site and it is assumed that most breeding and wintering birds would be displaced from within the majority of the site for the duration of the construction phase. The noise contour modelling is presented in the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume).

14.12.147 For habitats located adjacent or in close proximity to the site, during Phase 1 and 2 of construction there would be some encroachment of the 70dBL_{Amax} contour. This includes retained woodland such as Ash Wood and Kenton Hills and the northern edge of the wetland creation at Aldhurst Farm (during construction of the WMZ) and parts of the reptile receptor area. This encroachment reduces substantially during Phases 3 and 4 with minimal encroachment expected during Phase 5. As discussed above, the effect is expected to be at a peak for up to 3.5 years from the start of the construction phase. The effect is medium-term and would be reversible once the early phases of construction have concluded .

14.12.148 Although birds would be disturbed/displaced from the site, the creation of grassland and scrub habitat for the reptile receptor site (50ha), the marsh harrier improvement area (48ha) and the creation of (49ha) of grassland and scrub within Aldhurst Farm would provide alternate nesting and foraging habitat for the duration of the construction phase. As detailed above, survey work during the Winter of 2018/19 within the reptile receptor area recorded a range of BoCC Red and Amber Listed species (Ref 14.36), indicating that the habitat creation undertaken to date is already being utilised by a range of important species and would provide an alternative foraging resource for birds during the construction phase of the scheme.

14.12.149 Taking these measures into account, the impact of disturbance or displacement for the BoCC Red and Amber Listed (Ref 14.36) and Section 41 NERC Act (Ref 14.10) species within the site is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant**.

Kittiwake (breeding) Sizewell Rigs CWS

14.12.150 The is a colony of Kittiwake on the rig structures offshore of Sizewell, comprising approximately 200 nests. This site is one of only two kittiwake colonies between Yorkshire and Kent (the second colony being located on a wall at Ness Point, Lowestoft).

14.12.151 The noise contour modelling presented in the **Ornithology Synthesis Report** (**Appendix 14B2**) of this volume) suggest no encroachment of the 70dBL_{Amax} contour in the vicinity of the rig structure; and therefore potential disturbance effects are considered to be **negligible adverse** effect, which is considered to be **not significant**.

Disturbance due to increased recreational pressure

14.12.152 As outlined in both the **Plants and Habitats Synthesis Report** (**Appendix 14B1**) and the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) during the construction and operation of the site, patterns of recreational usage in the Sizewell area may alter. This would be as a result of the displacement of existing recreational users (due to perceptions of the intrusive nature of construction activities, actual increases in noise levels and visual disturbance, and alterations to the local PRoW network); and the influx of workers into the area. This change in the patterns of recreational activities, may increase levels of recreational disturbance to sites supporting bird species sensitive to an increase in recreational pressure.

14.12.153 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) presents a detailed evidence base indicating that an increase in recreational pressure can have a negative effect on bird species, affecting both breeding success, and in some cases lead to displacement and abandonment of nesting locations and incidental mortality. Of particular concern is the potential for an increase in sensitive areas of dogs being walked off the lead. As well as direct effects of recreational disturbance on birds, the potential also exists for indirect effects to arise associated with recreational disturbance on birds via the habitats on which they depend.

14.12.154 There is no automatic correlation between an increase in the number of recreational visits and the potential for bird species to be detrimentally affected. The magnitude of any effects of increased visitor usage would depend upon the behaviour of visitors and the pattern of recreational usage undertaken and the sensitivity of individual bird species. For example, a well-used site, with wide, clearly defined access tracks, in which visitors behave in a similar manner and remain on the path network, could potentially have the capacity to absorb many additional visits. In contrast, at sites with limited existing recreational use and poorly-defined path networks, it is more likely that increased disturbance (through an increase in visitor numbers) could have an ecological effect, as people may be less inclined to follow the poorly-defined path network and therefore wander into areas of sensitive habitat.

14.12.155 For example, the RSPB has indicated that disturbance to the core RSPB Minsmere Reserve is unlikely as dogs are not allowed and access is managed, but the outlying heath and grassland areas are more vulnerable to recreational disturbance and in particular ground nesting species such as stone curlew. An increase in recreational disturbance is likely to last for the duration of the construction phase. In the absence of mitigation, a significant effect could occur.

14.12.156 This impact is relevant to the following IEFs as follows:

- various bird species associated with European sites;
- breeding and wintering bird assemblage associated with the Minsmere to Walberswick Heaths and Marshes SSSI;
- breeding and wintering bird assemblage associated with the Alde – Ore Estuary SSSI;
- breeding and wintering bird assemblage associated with the Sandlings Forest SSSI and the other component SSSI of the Sandlings SPA; and
- breeding stone curlew.

14.12.157 As recreational disturbance is likely to act in a similar manner on the IEFs identified, the IEFs have been grouped together.

14.12.158 The majority of recreational visits to the Sizewell area are focused on woodland walks within Kenton Hills and Goose Hill or the beach and not to Sizewell Marshes SSSI. Currently access to Sizewell Marshes SSSI is restricted to a single permissive path around the edge, with signage and locked gates clearly indicating that the majority of Sizewell Marshes SSSI has no public access. In addition, Sizewell Marshes SSSI is very wet underfoot and this discourages casual access. Once construction of the site commences, it is considered likely that approximately 30% of recreational users would be displaced to alternative sites (see below) away from the Sizewell area. For these reasons, no increase in recreational disturbance to Sizewell Marshes SSSI and its associated bird assemblage is predicted.

Further information is presented in the **DCO Shadow Habitat Regulations Assessment Report** which considers recreational pressures in more detail, in the context of the European sites.

14.12.159 The recreational evidence base (presented and summarised in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) and the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) is a comprehensive body of evidence based on field surveys and questionnaires of people undertaking recreational activity. The Sizewell area, mainly the EDF Energy estate and the beach, received in the region of 500,000 recreational visits a year, with most visitors arriving by car. Of the respondents questioned, 29% indicated that they would avoid the Sizewell area during the construction phase and seek other locations in which to undertake recreation; a large number of the respondents, approximately 30% of the total, were also dog walkers. The results for the visitor survey at RSPB Minsmere Reserve were comparable, with approximately 30% of respondents indicating they would seek other locations in which to undertake recreation.

14.12.160 The overall conclusion from the evidence base or recreation is that designated sites already receive a large number of recreational visits. The construction of the proposed development would lead to the displacement of a proportion of individuals who currently undertake recreation activities within the EDF Energy estate and the beach. They would be displaced to adjacent designated sites, but the increase experienced by these adjacent sites would be small in the context of existing visitor numbers at most sites. In addition, this pressure would be diffuse and spread across a large number of potential access points.

14.12.161 Given the existing relatively high levels of recreational disturbance, as recognised in the Site Improvement Plans for the SPA's, and the inherent difficulties in assessing relatively small incremental changes that may be attributable to Sizewell C Project against this background, it is considered prudent to develop appropriate mitigation.

14.12.162 As outlined in the embedded mitigation in **section 14.4** of this chapter, acid grassland and scrub planting at Aldhurst Farm has created an additional 43 hectares of open space for informal recreation on the edge of Leiston including, within the southern fields, provision for walking dogs off the lead. The car park at Kenton Hills would be extended and access to the conifer plantation of Kenton Hills maintained throughout the construction phase to maintain or increase the usage of this area for dog walking .

14.12.163 In addition to this, local site-based measures would be developed as part of a Rights of Way and Access Strategy, in partnership with relevant stakeholders. This strategy would complement measures already outlined in the **Suffolk Coast Recreational Disturbance Mitigation Strategy (RAMS)** developed by Natural England and local planning authorities in Suffolk (Ref 14.80).

14.12.164 Considering the evidence base and mitigation measures discussed above, the impact of recreational pressure is considered to be of low magnitude which would result in a **minor adverse** effect, which is considered to be **not significant** for all five IEFs.

Inter-relationship effects

14.12.165 This section provides a description of the identified inter-relationship effects that are anticipated to occur on terrestrial ornithology receptors between the individual environmental effects arising from construction of the proposed development.

14.12.166 The main interrelationship effect identified is that some of the habitat creation that has already been undertaken or is in the process of being undertaken may be compromised initially by noise disturbance during the first two phases of the construction programme. This may prevent usage by breeding and foraging bird species temporarily for the first two to three years of construction.

14.12.167 This interrelationship would have the largest impact on the breeding bird assemblage of Sizewell Marshes SSSI, and Schedule 1 of the W&CA (Ref 14.7) and other notable bird species currently using the site. Overall this interrelationship effect would constitute a **minor adverse** effect, which is considered to be **not significant**.

ii. Operation

14.12.168 During operation, the only potential impact pathway on ornithological features would be associated with disturbance (noise, lighting and visual effects) from the completed development. Other impact pathways have been excluded as follows:

- Alteration of coastal processes. **The Coastal Process and Geomorphology Synthesis Repor**t (**Appendix 20A**) summarised in the Plants and Habitats Synthesis Report (**Appendix 14B1**), indicates that the operation of the proposed development is highly unlikely to significantly affect coastal processes. During the later stages of operation, coastal processes may expose the HCDF. However, embedded mitigation in the form of plan to monitor and mitigate these losses as well as measures implemented into the scheme design (see **Chapter 20 Coastal Geomorphology and Hydrodynamics**) would be undertaken to minimise losses and no substantive impacts on habitats, or their associated bird assemblages are considered likely.

- **Changes in water quality.** During the operational phase, an **Outline Drainage Strategy** (**Volume 2, Appendix 2A**) would be implemented to manage surface water run-off. These systems would be designed to discharge treated water to the surface water drainage network at greenfield run-off rates, thus no significant effects on water quality or bird species associated with wetland habitats are predicted (see **ES Volume 2, Chapter 19: Groundwater and Surface Water**).

- **Alteration of local hydrology and hydrogeology.** The hydrological modelling work summarised in the **Plants and Habitats Synthesis Report** (**Appendix 14B1** of this volume) indicates that the main hydrological impacts would be associated with the construction phase. No operational phase hydrological or hydrogeological impacts are anticipated.

- **Changes in air quality.** The air quality dispersal modelling work presented in the **Plants and Habitats Synthesis Report Appendix 14B1** of this volume) indicates that there will be no adverse effect on integrity of any of the European sites designated for bird populations is predicted.

- **Recreational pressure.** Once the proposed development is operational, access to the EDF Energy estate and the beach would return to conditions similar to the existing situation and no displacement of recreational users is expected. Recreational pressure would be regulated during the operational phase as detailed within the as detailed in the **Rights of Way and Access Strategy for the EDF Energy estate** (**Appendix 15I** of this volume).

14.12.169 Species with an asterisk(*) within **Table 14.25** are IEFs that have also been assessed through the HRA process. As some of the European sites and qualifying features are also considered relevant to the scope of the EIA (see **Table 14.23** and **Table 14.30**), potential impacts on the relevant species are assessed in this chapter. A summary of the evidence base on which these conclusions have been reached is provided within the **Ornithology Synthesis Report** (**Appendix 14B2** of this volume), with the **Shadow HRA Report** (**Book 5, Report 5.10**) providing the assessment of all European sites relevant to scope of the HRA for the Sizewell C Project. **Table 14.26** then provides a summary of the HRA conclusions for all IEFs identified in **Table 14.30**, potential disturbance/ displacement impacts during operation are considered to be of low magnitude which would result in a **minor positive** effect, which is considered to be **not significant**.

Table 14.30: Impact pathways which could be experienced by each IEF

IEF (including importance under CIEEM guidelines/EIA-specific methodology)	Disturbance effects (noise lighting and visual)
Bittern (breeding and wintering)* **International/High**	✓
Avocet (breeding and wintering)* **International/High**	✓
Redshank (wintering)* **International/High**	✓
Shoveler (breeding and wintering)* **International/High**	✓
Gadwall (breeding and wintering)* **International/High**	✓
Teal (breeding and wintering)* **International/High**	✓
White-fronted goose (wintering)* **International/High**	✓
Marsh harrier (breeding)* **International/High**	✓
Hen harrier (wintering)* **International/High**	✓
Nightjar (breeding)* **International/High**	✓
Woodlark (breeding and wintering)* **International/High**	✓
Red-throated diver (wintering)* **International/High**	✓
Little tern (breeding)* **International/High**	✓
Common tern (breeding)* **International/High**	✓
Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI (breeding/wintering) **National/High**	No operational phase impacts predicted
Bird assemblage associated with Sandlings Forest SSSI and component SSSI of the Sandlings SPA (breeding/wintering) **National/High**	No operational phase impacts predicted
Bird assemblage associated with Alde Ore Estuary SSSI (breeding/wintering) **National/High**	No operational phase impacts predicted

IEF (including importance under CIEEM guidelines/EIA-specific methodology)	Disturbance effects (noise lighting and visual)
Bird assemblage associated with Sizewell Marshes SSSI (breeding/wintering) **National/High**	✓
Kittiwake (breeding) Sizewell Rigs CWS. **Regional/High**	No operational phase impacts predicted
Marsh harrier (wintering) **High**	✓
Stone-curlew (Schedule 1 species) **Regional/High**	Potential beneficial habitat creation in accordance with oLEMP. No other operational phase impacts predicted
Barn owl (Schedule 1 species) **Local/Low**	✓
Hobby (Schedule 1 species) **County/Medium**	✓
Peregrine (Schedule 1 species) **County/Medium**	✓
Black-redstart (Schedule 1 species) **County/Medium**	✓
Cetti's warbler (Schedule 1 species) **County/Medium**	✓
Other birds of nature conservation importance within the site **County/Medium**	✓

Table 14.31: Summary of HRA assessment and EIA conclusions (for species assessed in both)[18]

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
Bittern (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Avocet (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Redshank (wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Shoveler (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Gadwall (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Teal (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
White-fronted goose (wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

[18] The Table only includes those species assessed within the HRA; to provide an alignment with the corresponding ES conclusions.

IEF	Potential impact	HRA Assessment Conclusion	EIA Conclusion
Marsh harrier (breeding) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Hen harrier (wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Nightjar (breeding) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Woodlark (breeding and wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Red-throated diver (wintering) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Little tern (breeding) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).
Common tern (breeding) **International/High**	Disturbance effects (noise, lighting and visual)	No adverse effect on integrity for any European site for which this species is a qualifying interest feature.	Minor adverse (no significant effect).

14.12.170 To maintain consistency with the construction phase assessment, the operational phase assessment has also been undertaken by impact rather than IEF.

Disturbance/displacement effects on birds

14.12.171 This impact is relevant to the following IEFs:

- various bird species associated with European sites;
- bird assemblage associated with Sizewell Marshes SSSI (breeding/wintering);
- bird species listed on listed on Schedule 1 of the W&CA (Ref 14.7): wintering marsh harrier, barn owl, hobby, peregrine, black redstart and Cetti's warbler recorded within site; and
- birds of nature conservation importance (BoCC Red and Amber Listed and Section 41 NERC Act species) recorded within the site.

Bird species associated with European sites

14.12.172 This impact pathway is relevant to the qualifying features of the Minsmere-Walberswick SPA, Sandlings SPA and Outer Thames Estuary SPA.

14.12.173 Noise levels associated with the operation of the Sizewell C Project are unlikely to differ substantially from the existing baseline situation. This is also considered to be the case for visual disturbance, except in relation to artificial lighting.

14.12.174 Operational lighting of the Sizewell C power station platform and a small number of other areas would increase light levels and could cause light intrusion into adjacent habitats. However, no part of the site would be subject to ambient light levels above 30 lux, and there would be no lighting between the Upper Abbey Bridleway and Goose Hill.

14.12.175 It can be concluded for all European sites considered in the EIA, that light spillage would not affect any areas used by the breeding or non-breeding populations of the European sites.

14.12.176 It is concluded that the impact of disturbance due to noise and visual effects during the operational phase for all European sites is of low magnitude and would result in a **minor adverse** effect, which is considered to be **not significant**.

Assessment for other IEFs

14.12.177 As operational phase disturbance/displacement is likely to act in a similar manner on the four EFs identified, the IEFs have been grouped together.

14.12.178 The **Ornithology Synthesis Report** (**Appendix 14B2** of this volume) indicates that disturbance from noise can be ruled out as an operational impact pathway as the noise environment is unlikely to differ substantially from the existing background levels to which birds are already habituated in the vicinity of the existing operational Sizewell B power station.

14.12.179 During the operational phase, lighting would be present at various locations including: perimeter lighting on fences at the main platform and within the main platform; at the location of the SSSI crossing and adjacent land; the car park (within former Goose Hill area); the roundabout on Abbey Road; the proposed sub-station south of the access road, between Leiston Old Abbey and the Upper Abbey Bridleway and the Back-up Emergency equipment Store and Back-up Generator buildings next to Upper Abbey Farm. Ambient light levels, however, would be consistent with the background pre-construction light levels to which birds are already habituated. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) has been produced which identifies measures to minimise spillage of light onto adjacent habitats (including Sizewell Marshes SSSI). This, together with boundary treatments such as fencing, re-instatement of hedgerows and existing screening from trees/shrubs, would ensure no operational phase lighting impacts.

14.12.180 Any bird populations displaced from within the site during the construction phase as a result of disturbance would be expected to return to retained habitats once the power station is operational or even during the latter, less noisy construction phases. Bird populations at Aldhurst Farm and the across the reptile receptor habitats are expected to be maintained during the operational phase.

14.12.181 Following the completion of construction and removal of the temporary construction area, what is currently arable land within the EDF Energy estate would be restored to habitats characteristic of the Suffolk Sandlings. The **oLEMP** would also include coastal vegetation establishment as well as new areas of woodland, hedgerows and scrub planting. This landscape scale restoration would provide a mosaic of habitat suitable for a range of bird species throughout the year and could lead to a net positive benefit for birds in the wider landscape.

Inter-relationship effects

14.12.182 This section provides a description of the identified inter-relationship effects that are anticipated to occur on birds between the individual environmental effects arising from the operational phase of the proposed development.

14.12.183 No inter-relationship effects are anticipated as a result of the operational phase.

d) Mitigation and monitoring

i. Mitigation

14.12.184 Primary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter. As the assessment concluded no significant adverse effects when considering the primary mitigation measures, no further secondary mitigation measures for the terrestrial ornithology assessment are required to reduce or avoid a significant effect, for either the construction or operational phase.

ii. Monitoring

14.12.185 The following monitoring would take place for birds during the construction and operation phases of the proposed development:

- Monitoring of the marsh harrier habitat improvement area and the retained areas of the Sizewell Marshes SSSI (including breeding and wintering surveys) during construction (as detailed in the **Marsh Harrier Mitigation Area Feasibility Report** (**Appendix 14C5**) of this volume).
- Monitoring programme to determine usage of new barn owl boxes (as detailed within the **oLEMP**.
- Monitoring programme for recreational users during construction and operation (as detailed in the Rights of Way and Access Strategy for the EDF Energy estate **Chapter 15, Appendix 15I** of this volume).

e) Residual effect

14.12.186 **Table 14.32** and **14.33** present a summary of the ornithological assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

14.12.187 Given the scale of the proposed development, there is the potential for in-combination effects from individual elements of the proposed development acting together. Cumulative effects arising from the proposed development and the associated development elements of Sizewell C Project together with other development proposals acting in combination with Sizewell C Project, are discussed in **Volume 10: Cumulative and Transboundary** and in the **Shadow HRA Report (Book 5, Report 5.10)**.

Table 14.32: Summary of effects for the construction phase for terrestrial ornithology

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Direct land-take resulting in habitat loss and fragmentation.	Bird assemblage associated with Sizewell Marshes SSSI.	Establishment of new reedbed and ditches at Aldhurst Farm (completed in 2016) has provided replacement for the land-take of these habitats within Sizewell Marshes SSSI and would provide alternative breeding and foraging opportunities for species associated with Sizewell Marshes SSSI. The additional reedbed habitat to be created at the north eastern extent of the site will also provide further habitat. Phased vegetation clearance programme, taking into consideration seasonal nesting bird constraints.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: wintering marsh harrier.	The marsh harrier habitat improvement strategy would include establishing and enhancing habitat within the northern part of the EDF Energy estate for marsh harriers. Habitat creation at Aldhurst Farm, and the creation of the reptile receptor habitat would also provide alternative foraging areas for wintering marsh harrier.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: barn owl.	Habitat creation at Aldhurst Farm, habitat enhancement and establishment for marsh harrier and the creation and ongoing habitat establishment of the reptile	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
		receptor habitat would also provide alternative foraging areas for barn owl. Barn owl boxes would be installed within the new reptile receptor area to provide additional nesting/roosting opportunities for the local barn owl population.			
	Schedule 1 species: hobby.	Habitat creation at Aldhurst Farm and the new reedbed within the northern part of the EDF Energy Estate would provide alternative foraging areas for foraging hobby.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: peregrine.	Habitat creation at Aldhurst Farm and more widely across the EDF Energy Estate would provide alternative foraging areas for foraging peregrine.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: black redstart.	None required.	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
	Schedule 1 species: Cetti's warbler.	Same as for "Bird assemblage associated with Sizewell Marshes SSSI".	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Birds of nature conservation importance (BoCC Red and Amber Lists and Section 41 NERC Act species) recorded within the site.	Habitat creation at Aldhurst Farm, and the establishment of the marsh harrier habitat improvement areas, and the creation and ongoing habitat establishment of the reptile receptor habitat would also provide alternative foraging and nesting areas for birds of conservation concern. In addition, the reedbed and wet woodland habitats to be created at the north eastern extent of the site will also provide further habitats	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Impact: Disturbance effects on birds.	Bird assemblage associated with Minsmere-Walberswick SPA, Ramsar	The Rights of Way and Access Strategy for the EDF Energy estate (see **Chapter 15, Appendix 15I** of this volume) would detail measures to be implemented to minimise the displacement of people away from the proposed development area and to nearby European sites to minimise disturbance to ground-nesting bird species and trampling of vegetation. The creation of additional marsh harrier habitats would reduce impacts upon the local marsh harrier population. Site boundaries would be carefully designed in sensitive locations, specifically in close proximity to designated sites to minimise noise, lighting and visual disturbance as best practicable. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B)** has been developed to reduce/avoid visual impacts where possible.	Minor adverse (not significant).	Improvement of foraging habitat undertaken on a 48.7 ha parcel of land to the north of the main development site to compensate for potential loss of foraging habitat within the Sizewell Marshes.	Minor adverse (not significant).
	Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SSSI.	Boundary treatments are included within the construction masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) has been developed to reduce/avoid visual impacts where possible. The primary mitigation measures to replace habitat lost within the Sizewell Marshes SSSI would also provide alternative habitat for birds associated with the 1% of	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
		the Minsmere to Walberswick Heaths and Marshes SSSI which could be subject to noise and visual/lighting disturbance during the construction phase of the proposed development.			
	Bird assemblage associated with Sizewell Marshes SSSI.	Boundary treatments are included within the construction masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) has been developed to reduce/avoid visual impacts where possible. The primary mitigation measures to replace habitat lost within the Sizewell Marshes SSSI would also provide alternative habitat for birds associated with Sizewell Marshes SSSI which could be subject to noise and visual/lighting disturbance during the construction phase of the proposed development.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: wintering marsh harrier.	The marsh harrier habitat improvement strategy includes establishing and enhancing habitat within the northern part of the EDF Energy estate for breeding/wintering marsh harrier. Habitat creation at Aldhurst Farm and the creation and ongoing habitat establishment of the reptile receptor areas would also provide alternative foraging areas for wintering marsh harrier. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) has been	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
		developed to reduce/avoid visual impacts where possible. Boundary treatments are included within the construction masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats.			
	Schedule 1 species: barn owl.	Habitat creation at Aldhurst Farm, habitat enhancement and establishment for marsh harrier and the creation of the reptile receptor habitat would also provide alternative foraging areas for barn owl. Barn owl boxes would be installed within the new reptile receptor area to provide additional nesting/roosting opportunities for the local barn owl population. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) has been developed to reduce/avoid visual impacts where possible. Boundary treatments are included within the construction masterplan to minimise noise, lighting and visual disturbance to adjacent designated sites or valuable habitats.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: hobby.	Habitat creation at Aldhurst Farm and the new reedbed within the northern part of the EDF Energy Estate would provide alternative foraging areas for foraging hobby.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Schedule 1 species: peregrine.	Habitat creation at Aldhurst Farm and more widely across the EDF Energy Estate would provide alternative foraging areas for foraging peregrine.	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
	Schedule 1 species: black redstart.	None required.	Minor positive (not significant).	None required.	Minor positive (not significant).
	Schedule 1 species: Cetti's warbler.	Same as for "Bird assemblage associated with Sizewell Marshes SSSI".	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Birds of nature conservation importance (BoCC Red and Amber Lists and Section 41 NERC Act species) recorded within the site.	Habitat creation at Aldhurst Farm and the establishment of the marsh harrier habitat improvement areas and the creation and ongoing habitat establishment of the reptile receptor habitat would also provide alternative foraging and nesting areas for birds of conservation concern.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Kittiwake (breeding) Sizewell Rigs CWS.	None required.	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
Disturbance due to increased recreational pressure.	Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SPA, Ramsar	The Rights of Way and Access Strategy for the EDF Energy estate (see **Chapter 15, Appendix 15I** of this volume) defines measures to be implemented to minimise the displacement of people away from the proposed development area and to nearby European sites to minimise disturbance to ground-nesting bird species and trampling of vegetation. The provision of recreational facilities would also reduce the use of local ProW which could result in disturbance and increases in habitat trampling.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Breeding and wintering bird assemblage associated with the		Minor adverse (not significant).	None required.	Minor adverse (not significant).

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
	Minsmere to Walberswick Heaths and Marshes SSSI.	The **Recreational Management and Monitoring Strategy** would ensure no impacts on protected sites and associated bird species.			
	Breeding and wintering bird assemblage associated with the Alde – Ore Estuary SSSI.				
	Breeding and wintering bird assemblage associated with the Sandlings Forest SSSI and the other component SSSI of the Sandlings SPA.				
	Breeding stone curlew.				

Table 14.33: Summary of effects for the operational phase for terrestrial ornithology

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
Impact: Disturbance/displacement effects on birds.	Bird assemblage associated with Minsmere to Walberswick Heaths and Marshes SPA, Ramsar	Habitat creation at Aldhurst Farm, the new habitat creation at the north eastern extent of the site, and the creation and ongoing habitat establishment of the reptile receptor habitat would provide foraging areas for these IEFs in addition to the overall development landscape design defined in the **oLEMP**.	Minor positive (not significant).	None required.	Minor positive (not significant).
	Bird assemblage associated with Sizewell Marshes SSSI.				

Impact	IEF	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
	Bird species listed on listed on Schedule 1: wintering marsh harrier, barn owl, hobby, peregrine, black redstart and Cetti's warbler recorded within site.	Barn owl boxes would be installed within the new reptile receptor area to provide additional nesting/roosting opportunities for the local barn owl population. A **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**), re-instatement and creation of new hedgerows and existing screening from trees/shrubs, would minimise operational phase lighting/visual impacts.			
	Birds of nature conservation importance (BoCC Red and Amber Listed and Section 41 NERC Act species) recorded within the site				

14.13 Bats

a) Current baseline

14.13.1 A detailed description of the bat baseline of the site is provided in **Appendix 14A8 – Bats** of this volume although a summary of the baseline conditions is provided below. At least ten species of bat have been recorded within the site boundary: barbastelle (*Barbastella barbastellus*); serotine (*Eptesicus serotinus*); Daubenton’s bat (*Myotis daubentoni*); Natterer’s bat (*Myotis nattereri*); Leisler’s bat (*Nyctalus leisleri*)[19]; noctule (*Nyctalus noctula*); Nathusius’ pipistrelle (*Pipistrellus nathusii*); common pipistrelle (*Pipistrellus pipistrellus*); soprano pipistrelle (*Pipistrellus pygmaeus*); and brown long-eared bat (*Plecotus auritus*).

14.13.2 The site supports: maternity colonies of barbastelle, Natterer’s bat, brown long-eared bat and soprano pipistrelle; non-breeding roosts of the breeding species and also noctule and common pipistrelle; and hibernation roosts for the majority of these species. The site boundary and ZoI consists of a mosaic of habitats suitable for commuting and foraging bats.

14.13.3 A number of roosts have been identified at Upper Abbey Farm including a brown long-eared bat maternity roost, a Natterer’s bat mating roost, hibernating barbastelle, Daubenton’s bat, Natterer’s bat and probable brown long-eared bat, as well as occasional common pipistrelle, soprano pipistrelle and barbastelle roosts. Brown long-eared bat roosts have also been identified at Ash Wood Cottages and Lower Abbey Farm, with occasional roosting by common pipistrelle also identified in buildings at Lower Abbey Farm. A high proportion of bat boxes installed in Kenton Hills have shown signs of use by bats, including Natterer’s bat, noctule and soprano pipistrelle roosts. A Natterer’s bat roost is present within Leiston Old Abbey, immediately adjacent to the site boundary. Additional bat roost potential has been identified within Lower Abbey Farm, Plantation Cottage and the Laboratory, off Lover’s Lane[20]. Activity suggests serotine and Leisler’s bat are unlikely to be roosting within the site, although potential roosts have been noted for barbastelle in Goose Hill and Broom Covert, for noctule in The Grove, the eastern end of Goose Hill and Leiston Old Abbey and *Myotis* spp., at The Grove, Leiston Abbey and within bat boxes in Kenton Hills.

14.13.4 Several locations on and close to the site boundary have significant numbers of trees with roosting potential for bats, including Fiscal Policy woodland, Ash Wood, the northern edge of Kenton Hills, Goose Hill and The Grove. In

[19] The identification of Leisler’s bat from echolocation calls can be extremely difficult due to the considerable overlap in the characteristics of the two Nyctalus spp. (noctule and Leisler’s bat) as well as overlap between the calls of Leisler’s bat and serotine. Therefore, this identification cannot be confirmed.

[20] A number of buildings identified for building inspections have not yet been assessed due to a lack of access permission.

addition, Minsmere and Ash Wood are considered to be key roost areas for barbastelle due to the high number of potential tree roosts present, as well as the presence of a number of identified roosts.

14.13.5 Not all trees with roosting potential were fully surveyed for bats during baseline surveys. Tree roost potential assessments were conducted on trees likely to be impacted by the works to inform the potential for impacts upon bats roosting within trees. Within this assessment groups of trees are treated collectively as a 'roost resource', with the potential impacts informed by the known roosts and the number of roosting features present within each woodland informing the baseline assessment.

14.13.6 Clear evidence of commuting activity within the site boundary is limited, although west-east commuting at the crossroads of Fiscal Policy and Kenton Hills has been noted for common pipistrelle, soprano pipistrelle, "big bat" spp.[21] and *Myotis* spp. and north-south commuting on the Upper Abbey Farm bridleway (bridleway 19) for common pipistrelle, soprano pipistrelle, *Myotis* spp., and potentially barbastelle. An additional period of barbastelle commuting has been noted at MS20[22] with individuals commuting over the reedbeds both to the south (in the direction of Sizewell Marshes SSSI and Grimseys and to the north (towards Goose Hill)).

14.13.7 Activity surveys found barbastelle to be widespread and the species has been recorded within almost all habitats present within the site boundary, while common and soprano pipistrelle were the most frequently recorded species. Activity levels in open areas were low while higher levels of activity were recorded at Goose Hill, Upper Abbey Farm bridleway, Leiston Old Abbey woodland, Ash Wood, Nursery Covert, Fiscal Policy woodland and the northern edge of Kenton Hills.

14.13.8 Radio-tracking surveys have identified an interchange of bats between Minsmere and the EDF Energy estate as well as the use of the EDF Energy estate by bats throughout the bat active season.

14.13.9 All bat species in the UK are protected under Schedule 5 of the W&CA (Ref 14.7) and Schedule 2 of the Conservation of Habitats and Species Regulations (Ref 14.4). Five species (barbastelle, brown long-eared, lesser horseshoe, noctule and soprano pipistrelle bat) are listed as priority species on the Suffolk BAP (Ref 14.20); these and two species not normally present in Suffolk (greater horseshoe and Bechstein's bat) are priority species in England under Section 41 of the NERC Act (Ref 14.10). Details of the assessments undertaken in the **Appendix 14A8 – Bats** of this volume are

[21] 'Big bat' is a group classification consisting of noctule, Leisler's bat and serotine. These species are often grouped due to the similarities and overlapping characteristics of their echolocation calls making species-specific identifications difficult and unreliable.

[22] A static detector position. See Figure 14.1.18 in Annex 14A8.1 for its location

provided in **Table 14.34**. Justification for the scoping in of these bat species is provided in full detail in **Appendix 14A8 – Bats** of this volume.

Table 14.34: Assessment of bat populations within the ZoI

Species	Importance under CIEEM guidelines (Ref 14.24)	Importance under EIA-specific methodology
Barbastelle	National	High
Natterer's	County	Medium
Leisler's bat and Nathusius' pipistrelle	Local (District)	Low
Noctule and serotine	Local (ZoI)	Low
Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle	Local (ZoI)	Low

14.13.10 The IEFs taken forward for a detailed assessment are:

- IEF: Barbastelle;
- IEF: Natterer's bat;
- IEF: Leisler's bat and Nathusius' pipistrelle;
- IEF: Noctule and serotine; and
- IEF: Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle.

b) Future baseline

14.13.11 In the absence of the construction and operation of the proposed development, it is considered that the habitats would continue to be used largely in their current form.

14.13.12 The impacts that climate change may have on UK species are summarised in Report Cards published by the Living with Environmental Change Network (Ref 14.59). Climate change is likely to affect the distribution of bat species, but the overall effects are uncertain (warmer weather may be favourable, but unpredictable wetter, cooler springs may have the opposite effect, as may warmer conditions during hibernation). Changes in ground water levels, notably any lowering exacerbated by climate change may affect the surrounding wetter habitats, including the grazing marsh and wet woodland. This is likely to make habitats less suitable for invertebrates, and therefore less productive. Changes in climate may also affect the distribution of disease, impacting survival rates and/or productivity. These changes would occur over relatively long periods of time, regardless of the proposed development. Therefore, the future baseline is expected to be a broad continuation of the existing ecological conditions as described above and within **Appendix 14A8 – Bats** of this volume.

c) Assessment

i. Construction

14.13.13 During the construction phase of works, the main impact pathways would be associated with:

- direct land take resulting in habitat loss;
- habitat fragmentation; and
- disturbance effects on species population (comprising light, noise and visual effects).

14.13.14 Incidental mortality to bat species has been excluded as a construction impact pathway. Construction works would entail the movement of plant and other vehicles around the proposed development site. However, as traffic would be travelling at relatively low speeds, and primarily within areas that would be lit, the likelihood of incidental mortality from vehicles is considered negligible and would not be significant. Similarly, impacts resulting from vibration have been excluded (though impacts resulting from noise are considered below). The only construction-related vibration which could affect bats in roost sites would be piling, which is proposed along the western edge of the main platform and at the BLF. As neither of these locations is in close proximity to areas where roosts have been identified, the likelihood of vibration impacts is considered negligible.

14.13.15 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by individual bat species or groups of species have been identified and are detailed within the subsequent sections.

IEF: Barbastelle

14.13.16 During construction, the main impact pathways experienced by barbastelle would be associated with:

- habitat loss;
- habitat fragmentation; and
- disturbance from lighting and noise.

14.13.17 The characterisation of the above impacts is described in detail below.

Habitat loss – roosts

14.13.18 From the suite of surveys undertaken to date, no barbastelle roosts that have been identified will be directly lost to the development. However, as outlined above, not all trees to be removed have been fully surveyed for roosting potential. Therefore the groups to be removed are treated as a 'roost resource', considering that bats usage of trees can be transient and varies throughout the year.

14.13.19 This impact assessment is based on impacts on the overall roost resource, not on confirmed occupation of individual trees, in accordance with relevant guidance (Ref 14.38), which states *"from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence*."

14.13.20 The construction of the proposed development will not result in direct loss of identified roosts, but will result in the loss of habitats confirmed as suitable for roosting barbastelle, although there would be losses of tree groups or areas considered to be a 'roost resource' which are likely to support roosting bats, including barbastelle. Measures to ensure that any new or previously unidentified roosts within this resource are identified and mitigated are proposed within this **ES** (Doc Ref. Book 6) and the associated Bat Mitigation Strategy (**Appendix 14C1A** of this volume). This includes the provision of bat roosting boxes, the number of which are to be provided will be based upon the number of potential roosting features lost due to the tree removal.

14.13.21 The potential for temporary functional loss of roosts, i.e. abandonment as a result of disturbance, is covered as a separate impact within this section (i.e. noise or lighting disturbance).

14.13.22 While buildings are occasionally used, barbastelle is primarily a tree-roosting species outside of the hibernation period (a wider range of roost locations, including caves and other underground structures, buildings and trees are used during hibernation (Ref 14.81, Ref 14.82)). No buildings or underground sites suitable for use by hibernating barbastelle would be demolished during the establishment of the temporary construction site.

14.13.23 **Table 14.35** details the type and extent of woodland loss that would occur during the establishment of the site.

Table 14.35: Loss of woodland habitat

Woodland habitat type	Extent of temporary habitat loss	Extent of permanent habitat loss
Conifer plantation	0ha	38.1ha
Mixed plantation	10.3ha	0ha
Semi-natural broadleaved woodland (including wet woodland)	1.1ha	7.2ha
Broadleaved plantation	n/a	1.3ha

14.13.24 These woodland areas differ in the extent to which they contribute to the potential barbastelle roost resource (see **Appendix 14A8 – Bats** of this volume). The preferred tree species used by barbastelle during the field surveys (as in other studies) was Oak (47% of identified roosts) and roost features used by barbastelle included raised, lifted or loose bark (71% of identified roosts). Such features were predominantly found in broadleaved mature woodlands such as Ash Wood, or individual broadleaved trees such as along the edge of Kenton Hills. Conifer plantation, such as that principally present within Goose Hill, is therefore sub-optimal for roosting barbastelle, providing limited availability of suitable roost features. **Table 14.36** presents a high-level assessment of the number of trees with medium, high or very high roosting potential likely to be impacted by the removal of woodland areas across the site. These tree numbers are taken from surveys conducted on the site reported in **Appendix 14A8 – Bats** of this volume. It is considered that these are sufficient to assess the likely impact upon roost resources within this **ES** (Doc Ref. Book 6).

Table 14.36: Summary of tree roost potential in areas where tree removal may be required

Name of Zone	Potential			Total
	Medium	High	Very High	
Stonewall Belt	6	0	1	7
Fiscal Policy woodland*	99	204	7	126
Tree line which extends north into the arable field north from Kenton Hills	9	4	0	13
Woodland on the eastern edge of Sizewell Marshes SSSI*	3	2	6	11
Goose Hill	38	13	0	51
Upper Abbey Farm Bridleway*	14	2	0	16

* These areas have only partial removal of the tree resource present

14.13.25 Of the trees to be lost, a number of trees were identified as having moderate or higher suitability for roosting bats (current surveys suggest <100). Some of these trees would provide suitable conditions for hibernating (as well as day-roosting) barbastelle.

14.13.26 The importance of individual trees to barbastelle is not well-understood. Like other tree-roosting bat species, barbastelle regularly switch roosts (Ref 14.83), on average changing roost location every two days (Ref 14.84). In addition, barbastelle do not demonstrate high roost fidelity and trees used in one year are not necessarily used in subsequent years (in the surveys to inform the baseline, only two trees were identified as used more than once). This may in part be due to the frequently ephemeral nature of their preferred roost features, raised/lifted/loose bark, or changes to these features such that they no longer provide the required conditions. The consequence of this is that while a large roost tree resource is likely to be required to support barbastelle populations (Ref 14.84), specific individual trees within that resource would vary in their importance between seasons/years.

14.13.27 The transient nature of barbastelle tree roosts was shown within the studies used to inform this **ES** (Doc Ref. Book 6), where barbastelle were found to move roosts within a year and between years. During the radio tracking surveys utilised to inform this assessment, only two of the trees identified as barbastelle roosts were confirmed to be used in more than one season by tagged barbastelle (though re-use of any of these trees by untagged bats cannot be ruled out) and tagged bats were distributed between a number of day roosts on any one night (between three and six). In addition, each used between one and five roost sites during the periods they were tracked.

14.13.28 The tree resource used by barbastelle in this study was focussed on the EDF Energy estate in early Summer, but extended to include areas to the north, notably the RSPB Minsmere Reserve. Radio-tracked barbastelle were found, on average, to travel 1km when switching roost location (Ref 14.85) but travelled considerably further (a maximum distance of (at least) 9.1km was travelled in a single night). This is by no means unusual (Ref 14.86) and means that barbastelle would have a low sensitivity to the loss of individual roosts.

14.13.29 In anticipation of tree removal to facilitate the Sizewell C development, 45 bat boxes suitable for barbastelle have already been erected in the wider Sizewell estate, as compensation. The locations of these is presented in the associated Bat Mitigation Strategy (**Appendix 14C1A** of this volume). These bat boxes will provide a roost resource for barbastelle should roosts be removed as a component of the site clearance. These bat boxes are in addition to those that will be erected based upon the loss of roosting features and any requirements for licensing.

14.13.30 Avoiding woodland loss (particularly of woodlands that support trees likely to be of high value to barbastelle) has been embedded into the construction design and areas contributing to the wider barbastelle roost resource (i.e. identified roosts and the surrounding trees) have been retained as far as possible. However, a small proportion of trees identified as suitable for supporting roosting bats within the EDF Energy estate (some but not all of which would be potentially suitable for barbastelle) would be lost.

14.13.31 Measures to ensure that no roosts are present within these features prior to felling and suitable mitigation and compensation is outlined in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.32 Given the extent of the tree roost resource within the construction boundary that would be lost, the presence of alternative suitable roost habitat within the Core Sustenance Zone (CSZ) (6km) (Ref 14.38) of barbastelle, and the proposed bat box provision this loss is considered unlikely to substantially reduce the overall tree roost resource available to the barbastelle population.

14.13.33 Overall, the impact of potential roost loss on the barbastelle population would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat loss – foraging

14.13.34 The establishment of the proposed development would result in direct habitat loss, which is likely to result in the direct loss of foraging habitat (the temporary functional loss of foraging habitat, i.e. avoidance and/or displacement as a result of disturbance, is covered as a separate impact).

14.13.35 **Table 14.37** summarises the habitat types that would be lost and the proportion of the total area lost within the wider EDF Energy estate that these habitats types account for. These habitat types vary in their value to barbastelle, which primarily forage within broadleaved woodland landscapes and along waterways, although unimproved grassland, field margins and hedgerows can also provide valuable foraging resources (Ref 14.81).

Table 14.37: Habitat loss and value to barbastelle

Habitat Type	Area/ length to be permanently lost	Proportion of total EDF Energy estate area/length lost	Proportion of CSZ (6km radius)[23]	Value to barbastelle in this study
Arable, improved and amenity grassland.	123.3ha	33.9%	1.1%	Limited value.

[23] Assumes whole area within main development site boundary is within CSZ (11,310ha) of each bat.

Habitat Type	Area/ length to be permanently lost	Proportion of total EDF Energy estate area/length lost	Proportion CSZ (6km radius)[23]	Value to barbastelle in this study
Semi-improved grassland.	36.3ha	9.7%	0.3%	Areas around Black Walks, including semi-improved grassland habitat showed high levels of activity indicative of movement north.
Plantation woodland (inc. coniferous and mixed).	39.4ha	10.5%	0.4%	Goose Hill rides were used by foraging barbastelle. Kenton Hills was of value during early parts of the active season with the northern track particularly used.
Semi-natural broadleaved woodland.	7.2ha	1.9%	0.1%	Stonewall Belts recorded consistent moderate activity throughout the active season and The Grove was identified as important for barbastelle, particularly early in the active season.
Water (running).	670m	N/A	Unknown	Limited value.
Swamp and marsh.	4.3ha	1.3%	0%	Although used for foraging, activity was reduced in the marshy areas to the south.
Hedgerows.	0m	N/A	Unknown	Limited use of linear features such as hedgerows was identified for barbastelle.
Scrub, bracken and ruderals.	1.2ha	0.3%	<0.1%	Limited value.
Dune and shingle.	1.2ha	0.3%	<0.1%	Limited value.

Habitat Type	Area/ length to be permanently lost	Proportion of total EDF Energy estate area/length lost	Proportion of CSZ (6km radius)[23]	Value to barbastelle in this study
Built-up and hard standings.	0ha	0.0%	0%	Negligible value.
Total habitat areas excluding arable, improved and amenity grassland.	**89.6ha**	**23.9%**	**0.8%**	**See above.**

14.13.36 The majority of land to be lost is arable, which is of sub-optimal value for foraging barbastelle and was used to a limited extent in the surveys of the EDF Energy estate (see **Appendix 14A8 – Bats** of this volume). While there is evidence that that barbastelle can forage in more open landscapes (Ref 14.86, Ref 14.87) arable land is likely to provide limited prey availability. Similarly, while grassland habitats can also be used by barbastelle, studies have found a preference for areas of unimproved grassland (Ref 14.81, Ref 14.88) rather than improved grasslands (Ref 14.87), a conclusion supported by the surveys of the EDF Energy estate (**Annex 14A8.6**). Barbastelle are, therefore, considered to have a low sensitivity to the loss of arable and improved grassland.

14.13.37 The total habitat loss accounts for 2.7% of the barbastelle CSZ[24]. If arable, improved and amenity grassland and built-up habitats are discounted as being of lower value (as demonstrated by survey data), the loss of the more valuable habitats (89.6ha) amounts to 24% of land within the EDF Energy estate and 0.8% of land within the barbastelle CSZ.

14.13.38 CSZs are an average measure, calculated from the distance that barbastelle travel, on average, from their roosts (Ref 14.88), and do not take into account habitat quality. The proportion of habitat to be lost can also be compared to the home ranges of individuals tracked at Sizewell (see **Appendix 14A8 – Bats** of this volume). Using cluster analyses (the technique that generates the smallest likely home ranges), mean home ranges for breeding females ranged from 60ha (pre-breeding) to 286ha (post-breeding). If all of the more valuable habitat (i.e. excluding arable/improved grassland) were to be lost was from those home ranges, this would comprise 149% to 31% of those individuals' home ranges. This would be considered to be a medium to high magnitude of impact.

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[24] Although the barbastelle ZoI was increased to 10km based on the results of radio-tracking surveys within the main development site when discussing habitat extent and value it is considered more appropriate to address this in relation to the CSZ for barbastelle of 6km.

14.13.39 The construction of the proposed development therefore has the potential to reduce the overall foraging resource available to barbastelle. The impact of this habitat loss would occur over the duration of the construction period (9-12 years).

14.13.40 In addition to the future proposals, and as detailed under primary mitigation (**section 14.4** of this chapter) approximately 154ha of habitat creation has already been undertaken on the wider EDF Energy estate as advanced mitigation or compensation for the anticipated effects of the Sizewell C Project, comprising:

- **Aldhurst Farm** – west of the site consisting of 49ha of acid grassland and scrub, 5ha of reedbeds and 2km of ditches;
- **Marsh harrier habitat improvement area** – north of the site consisting of 48ha of grassland including hedgerows and rough grassland, reedbed and 0.7ha of wet woodland ; and
- **A reptile receptor area at Sizewell Gap** – south of the site consisting of 58ha of acid grassland.

14.13.41 The locations of these areas are presented within the Bat Mitigation Strategy (**Appendix 14C1A** of this volume).

14.13.42 Although these areas have not been specifically designed for bats and therefore may not provide optimal foraging conditions for barbastelle, they do represent a resource of equivalent or greater foraging value than currently provided by the majority of habitats present within the site boundary. These habitats are within the CSZ of barbastelle (and are similar to those used at Minsmere).

14.13.43 The habitats being lost with the establishment of the proposed development consist largely of areas of sub-optimal foraging habitat for barbastelle which are a small proportion of individual home ranges and barbastelle captured within the EDF Energy estate are using a range of habitats within the wider landscape. Given these factors and that additional habitats of equivalent or greater foraging value are being developed and that barbastelle are known to travel considerable distances to forage, the habitat loss is considered unlikely to significantly reduce the overall foraging resource available for barbastelle.

14.13.44 Overall, the impact of foraging habitat loss on the barbastelle population would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (due to habitat loss)

14.13.45 The establishment of the proposed development would result in direct habitat loss, which could result in the isolation of areas currently used by barbastelle. This effect would be temporary and reversible but would persist for the duration of the ten-year construction period.

14.13.46 Barbastelle is a fast-flying species (Ref 14.89), regularly travelling considerable distances between roosting and foraging locations (Ref 14.81). While barbastelle have been found to travel across large open spaces (Ref 14.88, Ref 14.89), thereby indicating a reduced sensitivity to gaps in the landscape compared to other bat species (Ref 14.90), linear features and landscape-scale connectivity are still considered to be important requirements within a barbastelle's range (Ref 14.91).

14.13.47 Within the EDF Energy estate, barbastelle was found to use a wide range of habitats throughout their active season (see **Appendix 14A8 – Bats** of this volume). Few definitive commuting routes have been identified and there is little evidence that areas of open arable habitat acted as a barrier to barbastelle movement. It is considered that this is likely to be due to the presence of a mosaic of habitats in close proximity to each other, reducing the distance needing to be crossed between areas of suitable habitat, in the context of the existing baseline conditions with low levels of both noise and light.

14.13.48 During the surveys, although *specific* routes did not appear to be in regular use, significant levels of barbastelle activity were recorded between locations on a number of occasions. Details of these are provided in **Table 14.38**.

Table 14.38: Areas of significant barbastelle movement

Location	Timing	Significance
Ash Wood; The Grove; Goose Hill; Sizewell Marshes SSSI.	Pre-lactation period.	Regular flights from Ash Wood through Goose Hill to the sheltered eastern section of the Sizewell Marshes SSSI, north of Grimsey.
Ash Wood; Plantation Cottages woodland; Leiston Old Abbey woodland.	Post-birthing period.	Movement of the majority of roosts from Ash Wood to Plantation Cottage woodland before moving to Leiston Old Abbey woodland. Notable movement between roosts at Plantation Cottage woodland and Leiston Old Abbey woodland.
Kenton Hills.	Throughout active season.	Activity indicative of a commuting route along the track at the northern edge of Kenton Hills.
Black Walks; The Grove.	Throughout active season.	Considerable activity appearing to represent north-south flight paths along linear features.

14.13.49 Given the movements identified it is considered that barbastelle would have a low sensitivity to habitat fragmentation in this location. In addition, key commuting routes identified for barbastelle and other species are retained as is identified within the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.50 With the exception of much of Goose Hill, the areas detailed in **Table 14.38** would be retained during construction. However, the habitat removal would disrupt identified flight lines between areas to the north (Ash Wood, The Grove, Black Walks and Plantation Cottages) and south (Leiston Old Abbey, Sizewell Marshes SSSI, Kenton Hills and Grimseys). In particular, the proximity of Upper Abbey Bridleway (retained but breached by three haul routes) to construction, the use of the Upper Abbey Bridleway/Fiscal Policy junction as a haul route, and the loss of much of the Goose Hill conifer plantation to temporary construction works could create a barrier to the movement of barbastelle.

14.13.51 In response to these habitat fragmentation impacts, barbastelle would be likely to undertake a more circuitous route around the site to access areas of foraging and/or roosting habitat north and south of the site. Any increases in flight distances would have energy expenditure implications, although the distances involved would be within commuting distances seen in other studies (Ref 14.86), and less than the maximum distances travelled in this study by one breeding female (9.1km, in August). However, the mean (2.3km) and maximum recorded (3.1km) distances travelled at more energetically expensive times of the year were much lower compared to later in the active season (August: mean 4.4km). This could mean that, rather than travel further, the roosts of breeding females in the earlier part of the Summer would be displaced, making more use of habitats to the north (the RSPB Minsmere Reserve) as they currently do later in the year, or to the south (where activity levels are currently much lower throughout the year).

14.13.52 To mitigate for the impacts of severance on bats including barbastelle, the SSSI crossing, linking Goose Hill to the main platform, would be designed to promote connectivity between habitats to the north and south of the construction footprint. The crossing has been designed to include an oversized culvert of suitable dimensions for use by bats to enable east-west movement whilst planting along the embankment margins would help to facilitate north-south movements. Details on the design of the culvert are presented in the Bat Mitigation Strategy (**Appendix 14C1A** of this volume), along with locations of the dark corridors informed by the lighting studies. Further detail of the lighting impact to bats is presented in subsequent sections of this **ES** (Doc Ref. Book 6).

14.13.53 Temporary works areas, currently comprising predominantly arable fields, would, following completion of the construction phase be converted to acid grassland, in accordance with the **oLEMP**, reversing the temporary loss of connectivity.

14.13.54 The potential increase in energy expenditure described above, associated with longer flight distances, may result in a loss of fitness, potentially decreasing reproductive success. Alternatively, displacing individuals from their existing home ranges may result in additional competition, similarly decreasing fitness during the construction period (9-12 years). Any reduction in fitness is likely to be experienced to a greater degree by females, as males regularly travel greater distances than females and males have naturally lower energetic requirements (Ref 14.91).

14.13.55 Given the length of the construction phase and the time required for habitat restoration following construction, there is the potential for these factors to result in population decreases which, in combination with stochastic events such as poor Spring weather, could increase the vulnerability of the population to localised extinction.

14.13.56 Overall, the impact of habitat fragmentation on the barbastelle population would have a **moderate adverse** effect, which is considered to be **significant**. However, this is only during the construction phase of the development, and once the construction is completed, and habitat reinstated, this is considered to be **not significant**.

Disturbance from noise

Potential Impact Pathways

14.13.57 This section considers the potential impacts from noise upon barbastelle bats resulting from the development, within the construction phase, including information on bat hearing, how bats might be disturbed, and lessons from other projects and proposed parameters for disturbance. Where this information applies to all bat species considered within the **ES** (Doc Ref. Book 6), this information is not repeated for each bat species or groups of bat species.

14.13.58 When determining the potential impact upon bats from noise, it is important to distinguish the noise that bats can hear (i.e. at which frequencies they are sensitive to noise). Bats can hear sounds at different frequencies to humans, and this varies between species, however the frequencies that bats can hear are generally 'high frequency'. For example, the brown long-eared bat, likely to be the UK species with the most sensitive hearing, indicates that they have good auditory sensitivity (less than 10 decibel (dB) Sound Pressure Level) in the range 7-55 kilohertz (kHz), with other species likely to have auditory thresholds a little higher than this: perhaps 10 kHz for *Myotis* and *Nyctalus* species. As such, the frequency of noise likely to impact bats the most is 'high-frequency', which for the purposes of this **ES** (Doc Ref. Book 6) is noise at over 8kHz.

14.13.59 This section of the **ES** (Doc Ref. Book 6) considers the potential impact from noise on bats in the construction phase of the development. It is assessed that the impact from the operational phase of the project of the site will be negligible. This is concluded from the studies presented within the noise chapter of this **ES** (Doc Ref. Book 6) (**ES Volume 2 Chapter 11: Noise and Vibration**). The noise studies predicted a rating level (free-field external) from the operational phase of proposed Sizewell C power station including routine testing of backup generators post-outage at all receptors across the site of below 45dB (this is an 'A-rated' figure, which is based upon what humans can hear, but is considered indicative of the low level of noise, including high frequencies that bats may hear). The calculated noise levels from the operation of Sizewell C are presented in **Table 14.39** below. It is assessed that this noise level is below the figure that would a cause significant effect to bats. As such, operational noise effects in relation to the main development site are not considered further.

14.13.60 The only other potential operational change in noise impacts upon bats is considered to be the from the main vehicular access to the site and the rail route extension. Impacts from these works are discussed in the **ES** (Doc Ref. Book 6) chapter relating to this component of the works (**ES Volume 9 Chapter 4: Noise and Vibration**).

Table 14.39: Predicted rating levels (free-field external) from the operational phase of proposed Sizewell C power station - Day

Receptor	Predicted (Free-Field) Sound Rating Level at ground floor (L_{Ar} dB)	Typical background sound level Day (L_{A90} dB)	L_{Ar} minus L_{A90} dB	Magnitude of Change
Abbey Farm.	31	29	+2	Low
Abbey Road Leiston.	27	40	-13	Very low
Ash Wood Cottages.	35	40	-5	Very low
Barley Rise.	34	45	-11	Very low
Common Cottages.	32	35	-3	Very low
Crown Lodge.	29	45	-16	Very low
Halfway Cottages.	31	45	-14	Very low

Receptor	Predicted (Free-Field) Sound Rating Level at ground floor (L_{Ar} dB)	Typical background sound level Day (L_{A90} dB)	L_{Ar} minus L_{A90} dB	Magnitude of Change
Home Farm.	37	43	-6	Very low
Keepers Cottage.	38	35	+3	Low
King Georges Avenue, Leiston.	35	45	-10	Very low
Leiston Abbey.	28	38	-10	Very low
Lovers Lane/Sandy Lane junction.	34	45	-11	Very low
Old Abbey.	31	43	-12	Very low
Old Abbey Farm.	31	43	-12	Very low
Plantation Cottages.	32	29	+3	Low
Potters Farm.	29	35	-6	Very low
Potters Road.	26	35	-9	Very low
Reckham Lodge.	36	35	+1	Low
Rosery Cottage.	40	45	-5	Very low
Round House.	30	35	-5	Very low
Sizewell Village.	34	43	-9	Very low
The Studio.	34	35	-1	Very low
Valley Road North.	30	40	-10	Very low
Vulcan Arms.	38	43	-5	Very low

14.13.61 The construction of the proposed development will result in an increase in noise within the site boundary and adjacent areas. Noise disturbance will arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. The level (intensity) timing and duration of high frequency noise will be variable, depending on the nature of the construction activity. It is expected that noise levels will decrease over the course of the overall construction programme, with Phase 1 having the highest predicted noise levels.

14.13.62 There is the potential for impacts on upon bats, particularly barbastelle resulting from construction related noise, due to the location of the proposed development between woodland areas which are of importance to this species, and also due to the scale and duration of the construction phase.

14.13.63 High frequency noise from construction activities could affect bats, particularly barbastelle in the following ways:

- disturbance to roosting bats in adjacent areas of woodland or buildings causing delayed emergence, increased activity within the roost or, at higher intensity, roost abandonment (Ref 14.41);
- disturbance to foraging bats, through a masking effect impacting the ability of bats to echolocate and/or catch prey (Ref 14.92, Ref 14.93).
- disturbance to commuting bats, through displacement of bats from perceived 'noisy' areas and avoidance of these aversive stimulus (Ref 14.94).

Setting Thresholds for impacts

14.13.64 This section of the **ES** (Doc Ref. Book 6) outlines the thresholds utilised to assess likely impacts in relation to bats and noise. Within this section the assessment is split into impacts upon bat species whilst a) roosting and b) commuting and foraging.

14.13.65 Bats use ultrasonic frequencies to produce a range of echolocation calls, used for foraging, commuting and for social interaction. Bat typically use sound frequencies outside the human range of hearing and are most responsive to frequencies at and above 8kHz (this is towards the end of human hearing). Consequently, standard noise assessments based on human hearing range (known as A-weighted, refer to Chapter 11 of this volume) may not adequately predict impacts on bats.

14.13.66 There is little evidence available, within the scientific literature, on how bats respond to high frequency noise. In particular, noise thresholds which bats can tolerate, and levels which may cause disturbance to roosts, foraging or commuting activities (as outlined above).

14.13.67 A published audiogram (Ref 14.95) for the brown long-eared bat, indicates that they have good auditory sensitivity (less than 10 decibel (dB) Sound Pressure Level in the range 7-55 kilohertz (kHz), with a region of extremely low thresholds (i.e. greatest sensitivity) between 8-20 kHz. Brown long-eared bats hunt by ‘passive listening’ i.e. picking up the sounds of its insect prey directly, in contrast to echolocating species which detect prey by listening to high-frequency echoes of its own calls. Although, barbastelle do not use a typical passive-listening foraging strategy, they do produce very low amplitude calls in order to remain undetected by moths and therefore may be affected in a similar way.

Assessment of impact threshold for roosting bats

14.13.68 There is limited evidence within the literature on tolerance levels of bats to withstand high levels of noise, or on noise thresholds which can cause roost disturbance and/or abandonment. Anecdotal evidence does exist of bats roosting within structures with considerable background noise. For example, bats of different species have been found roosting in various motorway and trunk road bridges; where it is assumed, they would likely experience high levels of noise. An explanation for these bats' ability to cope with this level of background noise is that they typically roost inside the structure of the bridge where high frequency components of traffic noise will be strongly attenuated (Ref 14.96). There are no measures of high-frequency noise at these structures.

14.13.69 Research undertaken has typically simulated high level noise in laboratory and 'natural' environments to investigate the effects on bats. In the majority of these studies traffic noise has been used to represent high levels of noise, however, a few studies have also used other stimuli e.g. such as drill rigs, gas compressor station noise and music concerts, to mimic high levels of anthropogenic noise. Anecdotal evidence exists of bats roosting within structures with considerable background noise and being habituated to these 'noisy' environments. Examples include bats roosting in various motorway and trunk road bridges such as a maternity roost of Daubenton's bats roosting within the central expansion joint of the M60; maternity roosts of Soprano pipistrelle roosting within electrical substation transformer buildings, these buildings are typically exposed to noise at 65+ dB, and soprano pipistrelles and Natterer's bats roosting within church organ pipes and an active bell frame. However, there is insufficient empirical evidence to define a particular threshold for noise disturbance for bats and in particular roosting bats.

14.13.70 There are no known studies of barbastelle responses to noise. A literature review returned information on other bats. A study undertaken of bat behaviour reported that brown long-eared bats did not leave their roosts earlier, or move roosts during a music festival (Ref 14.97). The closest tree roost experienced noise levels at around 40 dB at 8 kHz. In the same festival study a year earlier, common pipistrelle bats remained in their maternity roost a 'few dozen metres' from a stage, experiencing noise levels between 65 and 99 dB at frequencies 4-8 kHz, suggesting that they either could not hear these frequencies, or were not sufficiently disturbed by them to leave their roosts.

14.13.71 Research (Ref 14.96) on the greater mouse-eared bat *Myotis myotis* showed that these bats were able to tolerate roosting locations with considerable anthropogenic noise such as church towers close to the belfry and within road and railway bridges.

14.13.72 Torpid bats appear to be more tolerant of high levels of anthropogenic noise (Ref 14.98). This study (conducted on greater mouse-eared bats) measured how bats responded to the playback of a variety of noises sources and recorded skin temperature as a measure of sensitivity to noise. Recordings of colony activity and vegetation movement (recordings taken 10cm from a tree with maximum wind speeds of 2.77 and 4.07 meter per second (ms^{-1})) had the strongest effects on torpid bats, increasing their skin temperature. Torpid bats had the weakest responses to traffic noise treatments (lowest increases in skin temperature during exposure to treatment); suggesting that traffic noise was a less disturbing stimuli to bats in torpor. Importantly, there was evidence to suggest that torpid bats rapidly habituated to repeated and prolonged noise exposure; and this habitation was more pronounced than to colony or vegetation noise.

14.13.73 When determining a potential threshold for noise disturbance; noise assessments need to be inferred from the evidence outlined within the literature and based upon frequencies audible to bats. It is reasonable to assume that the impacts of noise are likely to differ between species and activities and therefore have been separated into roosting and foraging/commuting activities for determining disturbance.

14.13.74 For the Sizewell C project, it is possible to utilise bat survey data from the Hinkley Point C (HPC) construction site (a new nuclear power station under construction which also had the potential to impact upon bats due to noise). Capture of data on high frequency noise generated by the Hinkley Point works was undertaken by Sharps Redmore in February 2019 to inform the impact assessment for Sizewell C. Over a two-week survey period, the night-time readings were between 40-60 dB, with spikes of noise of over 65dB.

14.13.75 However, an impact upon bats was not explicitly evident. Bat boxes were erected in adjacent areas to the Hinkley Point C construction site and were monitored between 2012 and 2018. In all years, bats were recorded utilising these boxes, although common pipistrelle and soprano pipistrelles were the most frequently recorded species, five other species were also recorded during the monitoring period. These included Nathusius' pipistrelle, Natterer's bat, brown long-eared, noctule and Leisler's bat.

14.13.76 Foraging activity across the HPC site was also monitored along a retained commuting route which passes through the active site and an alternative commuting route located to the south (which was exposed to lower levels of high frequency noise). Barbastelle were more frequently recorded along the commuting route to the south, however, it is unclear if this is related singularly to noise levels at the construction site or whether it is a combination of factors e.g. light disturbance and/ or the presence of high quality alternative habitat existing to the south. Again, common/soprano pipistrelle activity appeared to be unaffected by the construction noise, and common pipistrelle activity was recorded at similar levels across the site. For big bat species and *Myotis* species activity was variable, however, these species were recorded using both commuting routes throughout 2012 – 2018. Brown long-eared bats were only recorded along the commuting route to the south in low numbers during the monitoring period. This species is an under-recorded species due to the quiet nature of their calls, and like Barbastelle it is not possible to determine if the low brown long-eared activity recorded is due solely to the noise levels experienced across the site, or whether it is a result of a combination of factors. This evidence suggests that the bats using Hinkley were able to habituate to the noise, and this level of noise (40 – 60 dB of high frequency noise with peaks in the region of 65dB) did not greatly affect bat roosting and/or foraging activity in the species recorded.

14.13.77 In addition, studies assessing the impact of noise on bats report a range of results. studies have found that noise between 40 – 65 dB impacted the foraging efficiency of bats, and ‘degraded’ the foraging area immediately adjacent to the noise source. In one study (Ref 14.96), bats were subjected to traffic noise at 50 dB, and this noise reduced the foraging efficiency of bats within 50% of the trails. However, it was noted that bats did not avoid these ‘high’ noise areas and were still able to detect and localise prey, implying that bats quickly adapt to non-natural noise. A further study (Ref 14.99) compared bat activity at gas compressor sites (‘high’ noise sites) with ‘quieter’ well sites. These well sites were typically subjected to noise between 53 – 68 dB. The study found overall there was reduced activity at the louder gas compressor sites than the well sites. Of particular interest, the results showed that there was 70% reduction in activity of bats with low frequency echolocation calls (<35kHz), whereas the assemblage of bats using high frequency echolocation (>35 kHz) were not affected by the noise. These studies suggest that although noise between 40 – 60 dB may impact bats; bats are able to tolerate noise within this range and continue to use sites.

14.13.78 Studies which have measured effects of noise over 65 dB have found that bats typically avoid habitats exposed to this level of noise. One study (Ref 14.123) recorded the response of Daubenton’s bats when subject to simulated traffic noise at amplitude of 76 dB Sound Pressure Level. The results indicated that bats avoided the high noise, reacting to it as an adverse stimulus. In a field experiment conducted in the US, drill rig noise between 55 – 79 dB was played at a number of ‘treatment’ locations and bat activity of six species was compared between these sites and control sites. The study found that the drill rig noise had a negative effect on overall bat activity during the study period. Unlike previous evidence outlined above, bat activity was reduced for both low frequency echolocating bats (<35kHz) and high frequency echolocating bats (>35kHz), suggesting that noise levels exceeding 65 dB has a negative impact for a broad spectrum of bat species. Further evidence from Shannon et al. (2015) synthesis indicates that traffic noise exceeding 80 dBA did reduce the foraging efficiency of bats.

14.13.79 A Dutch study recorded common pipistrelle remaining in a maternity roost in close proximity to the music stage. This roost was subject to noise between 65 – 99 dB at frequencies 4-8 kHz. Explanations for this may be that common pipistrelles are considered to be less sensitive to anthropogenic disturbance and therefore were not sufficiently disturbed to leave the roost, or that they could not hear these frequencies.

14.13.80 The evidence outlined above suggests that bats are able to quickly adapt when exposed to a range of 'high-level' noise. No empirical evidence exists outlining a threshold for noise disturbance of bats, in particular, noise levels which may cause roost abandonment. However, based on the above, it can be inferred that noise at or exceeding 70 dB negatively impacts bats, with a range of potential impacts from exposure below this level.

Potential Roosting Disturbance

14.13.81 On the basis of the evidence outlined above, the following is inferred:

- Areas subject to noise levels at or below 40dB (at 8 kHz) are not likely to have any effect on roosting bats.
- There is no clear evidence indicating noise thresholds on roosting bats. however, from the research undertaken, noise levels up to and including 60dB are not likely to have a significant adverse impact on roosting bats;
- While there is no clear consensus, there is the potential that noise exceeding 60dB (at 8kHz) may have an effect upon bats (i.e. may delay emergence and/or cause abandonment of roosts). Therefore, noise modelling above 60dB has been applied as an indicative threshold for potential disturbance within this assessment.

Foraging and commuting bats

14.13.82 Literature regarding noise impacts on barbastelle is not available. However, there are studies on noise impacts on other bat species from which potential impacts to barbastelle can be inferred.

14.13.83 Gleaning bat species, which employ a passive-listening foraging strategy, are more likely to be susceptible to masking (Ref 14.99) from traffic noise reducing foraging efficiency. Gleaning bats, such as brown long-eared and greater mouse-eared bats hunt using prey-generated sounds, which could be masked by anthropogenic noise. A study on greater mouse-eared bats subjected to playback recordings of traffic, originally avoided foraging in areas where the traffic noise was being played. However, in treatments where the noise was unavoidable, the bats were able to forage, albeit at a reduced efficiency (Ref 14.62).

14.13.84 Additional studies (Ref 14.96 and Ref 14.100) have tested bats foraging capability in response to high frequency noise (50 dB) across distances. In general, high frequency noise degrades foraging areas immediately adjacent, e.g. 7.5-15m, from the noise source, such as traffic, and therefore reduced foraging efficiency. Noise was likely to impact bats up to 60m from the source of the high frequency noise, although the level and intensity of noise would decrease with distance. However, bats were still able to detect and localise prey within 50% of the experiments suggesting that bats are able to adapt to non-natural noise.

14.13.85 A specific study (Ref 14.94) was undertaken to determine how noise affected foraging efficiency in echolocating bats. This study used noise sequences derived from traffic to create noise files which either overlapped or did not overlap with the echolocation calls of Daubenton's bats. These traffic sequences were played at an amplitude of around 76 dB Sound Pressure Levels with the instant amplitude ranging from 68-84 dB Sound Pressure Level. Results indicated that bats avoided the high frequency noise, reacting to it as an aversive stimulus, that reduced foraging efficiency, and the effect was apparent at sound levels around 68 – 84 dB Sound Pressure Level.

14.13.86 Other evidence indicates that only traffic noise exceeding 80 dBA Sound Pressure Level reduced the foraging efficiency of gleaning bats (Ref 14.101) and that echolocating bats were at a lower risk of direct impacts from anthropogenic noise e.g. traffic, as they were able to shift their call frequency and amplitude in response to the noise, therefore not reducing activity levels (Ref 14.96, Ref 14.99, Ref 14.100 and Ref 14.102).

Potential Foraging/ Commuting Disturbance

14.13.87 The majority of studies of noise disturbance on bats relate to traffic noise. From these studies the following is inferred:

- Areas subject to noise levels at or below 50dB (at 8 kHz) are not considered likely to have any effect on foraging and/or commuting activities.
- Noise levels between 50-65dB (at 8 kHz) may have the potential to affect foraging and commuting bats. However, the literature is varied and there is evidence to suggest that bats will become habituated to noise within these parameters significant as several studies have shown the ability of bats to habituated to noise within these parameters and tolerate even higher noise levels.
- The evidence suggested that noise exceeding 65dB (at 8 kHz) may disturb bats, result in noise avoidance and/or reduced foraging efficiency. This level of noise will be used a threshold for potential disturbance within this assessment.

14.13.88 In summary, for the purposes of this assessment, 65dB is the level at which impacts to barbastelle whilst foraging will be considered

Assessment of noise levels resulting from the construction phase of the development

14.13.89 Noise modelling was used to assess the likely noise level increase at sensitive locations across the development during the peak noise periods of the works. Within this **ES** (Doc Ref. Book 6) chapter, high-frequency noise modelling is utilised to inform the impact assessment.

14.13.90 During the construction phase, Phase 1 has the highest predicted noised levels. The modelling indicates that the highest levels of noise will be generated for a relatively short period during Phase 1 and then noise levels would decrease for the remainder of Phase 1 and 2. Noise would continue to decrease over Phase 3 and 4. Phases 1 and 2 of construction are programmed to take place in years 1 – 4 of construction, representing up to four active seasons for bats. Later phases of construction would be centred on the main platform, and consequently, priority areas such as Ash Wood and Upper Abbey Farm, will experience lower levels of construction noise during these phases (as noise levels associated with use of the accommodation campus adjacent to Upper Abbey Farm will be greatly lower than during construction).

14.13.91 In summary, the geographic extent and intensity of construction noise will vary through the 9-12-year construction period. Phases 1 and 2 of construction, involving soil stripping and earthworks (refer to **Chapter 2** of this volume for more detailed definitions) producing construction noise over a wider area than subsequent phases. As such, the ‘peak noise period in Phase 1 and 2 is utilised in this assessment. High frequency noise (8 kHz and above) has been modelled for Phases 1 and 2 of construction, at predicted noise levels of 60-65+ dB (at 8 kHz and above) as a worst-case scenario. Impacts resulting from later phases of construction are inferred, based on the results of these and the comparison of dBA noise modelling across all phases.

14.13.92 The high frequency noise modelling utilised to inform the assessment assumes the installation of a 5m noise barrier along site boundaries (as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume) but no other boundary treatments such as buffer zones or soil bunds. Current proposals presented in **Chapter 11** of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, primarily to mitigate noise impacts on marsh harriers to the north and an earth bund along the north of Kenton Hills. However, it should be noted that barbastelle roosts were almost always more than 6m above ground level, and sometimes up to 20m above ground level, so are not likely to be screened from the construction area by these boundary treatments. For this reason, the modelling has used a height of 10m above ground level for the assessment.

Roosts

14.13.93 Barbastelle are considered to be the most vulnerable and sensitive bat species within the site, therefore impact assessment had focussed on barbastelle.

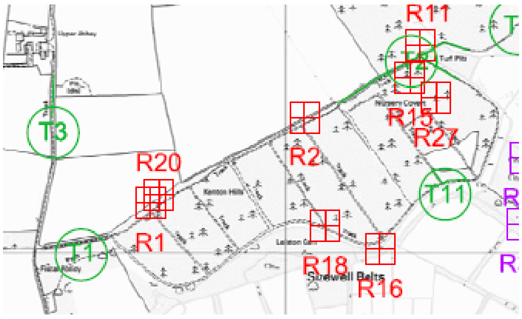
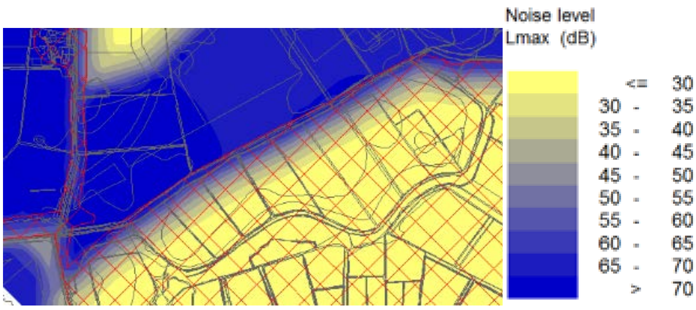
14.13.94 Based on locations of identified barbastelle roosts and areas with a significant roost resource (i.e. trees with potential to be used as roosts), modelling of high frequency noise predicts a dB level above 60 in the following locations, during Phase 1, as presented within **Table 14.40** below. This table subdivides the roosts which are considered to be at risk of experiencing noise levels above 60dB and those which are not. These are also split out into roosts which are with then RLB and outside of the RLB. The locations of these roosts are presented overlaid on the proposed construction works in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. These roosts are also overlaid on the noise contours calculated for the construction phase of the development as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. Four barbastelle roost areas were identified that may experience noise disturbance above 60dB. Two within the site boundary and two in the wider area.

Table 14.40: Barbastelle roosts with Predicted noise levels above 60dB (during construction phase)

dB at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 60 dB	None	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – woodland resource and confirmed tree roosts beyond site boundary
Above 60 dB	**Upper Abbey Farm**	**Ash Wood** – (southern, western & northern boundaries) woodland resource and confirmed roosts
	Kenton Hills – (northern boundary) woodland resource and confirmed tree roosts	**Grimseys** – (south eastern corner) woodland resource

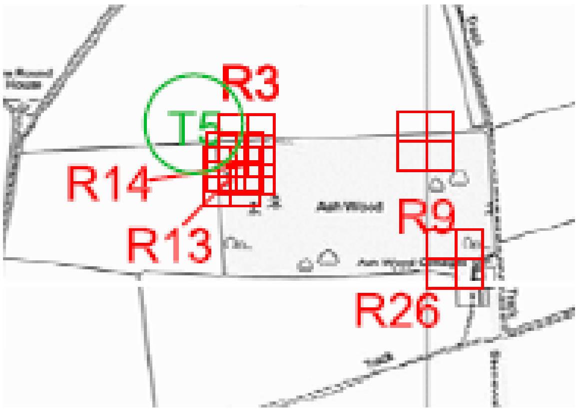
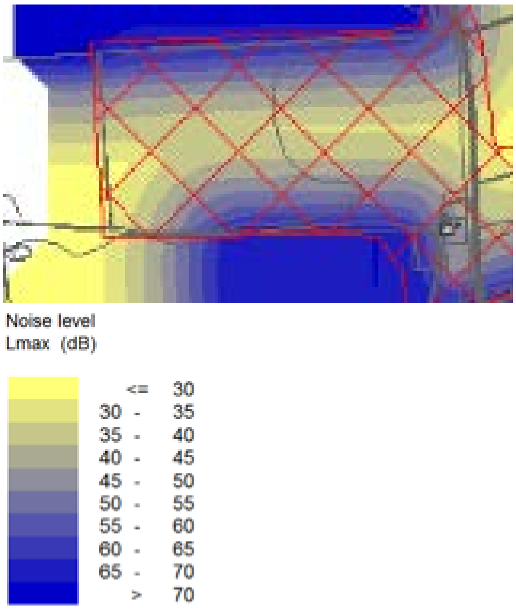
14.13.95 Within the Kenton Hills area, four known barbastelle roosts and multiple potential tree roosts will experience noise levels above the 65dB threshold, namely roosts R1, R2, R11 and R150 . Excerpts from figures presenting the location of these roosts is presented in **Table 14.41** below, along with the source of this information.

Table 14.41: Noise in relation to barbastelle roosts in the vicinity of Kenton Hills

Excerpt presenting roost location and noise information	Location of source information in the ES
	Bat roost location data excerpt from data within the bat baseline data section of the ES (Doc Ref. Book 6) (Vol 2, Chapter 11, Appendix 14A8)
	Noise model output provided by Sharps Redmore

14.13.96 Within Ash Wood, five known barbastelle roosts and multiple potential tree roosts will experience noise levels above the 65dB threshold, namely roosts R3, R9, R14 and R26. Excerpts from figures presenting the location of these roosts is presented in **Table 14.42** below, along with the source of this information.

Table 14.42: Barbastelle roosts within the vicinity of Ash Wood

Excerpt presenting roost location and noise information	Location of source information in the ES
	Bat roost location data excerpt from data within the bat baseline data section of the **ES** (Doc Ref. Book 6) (Vol 2, Chapter 11, Appendix 14A8)
	Noise model output provided by Sharps Redmore

14.13.97 Within the Grimseys area, no known barbastelle roosts will experience noise levels above the 60dB threshold, however a number of potential roosting areas will experience an increase in noise above this level.

Commuting and foraging

14.13.98 **Table 14.43** below presents potential key commuting and foraging areas (for barbastelle) where modelling of potential high frequency noise is at 65 dB and above (noise modelling data and results presented the Bat Mitigation Strategy **Appendix 14C1A** of this volume).

Table 14.43: Barbastelle foraging/ commuting areas with predicted noise levels

dB at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 65 dB	None	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – remaining woodland complex approximately 50m beyond development site boundary
		The Grove – commuting route north from Goose Hill.
Above 65 dB	**Upper Abbey Bridleway and Fiscal Policy Junction** – north-south commuting route	**Leiston Old Abbey** – woodland foraging area
	Black Walks – north-south commuting route between Ashwood & Minsmere	**Ash Wood** – woodland foraging area
	Kenton Hills – (northern boundary) east-west commuting and foraging area.	
	Goose Hill – eastern boundary used as commuting and foraging area.	
	Stonewall Belt – north-south commuting route between Ashwood & Hilltop Covert	
	SSSI crossing – north-south commuting route & foraging area	

14.13.99 In summary, eight foraging and commuting areas have the potential to experience noise levels above 65dB. Most of Upper Abbey bridleway will be subject to noise levels above 65 dB (at 8kHz and above) during Phases 1 and 2 of construction (years 1 - 4, therefore four active seasons for bats). With regards to Kenton Hills, noise levels will drop fairly rapidly with distance from the construction site, much of Kenton Hills will remain undisturbed. Black Walks adjoins a borrow pit area and will therefore only be affected during Phases 1 and 2 of construction.

14.13.100 Of the potential alternative commuting routes, The SSSI crossing will be subject to high levels of construction noise during Phase 1 (above 65 dB at 8 kHz and above), however, this is likely to reduce to noise levels below the identified threshold level (at up to 50 dB at 8 kHz and above) for the remainder of the construction period. Similarly, the eastern edge of Goose

Hill will be subject to high levels of noise (above 65 dB at 8 kHz and above) during construction of the Water Management Zone in this area during Phase 1, but noise levels will reduce to 30 dB (at 8 kHz and above) or less during the remaining phases. The northern, western and southern edges of Ash Wood would be subject to construction noise above 60 dB (at 8 kHz and above in Phases 1 and will likely reduce to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

14.13.101 The foraging habitat around Leiston Old Abbey would be subject to continuing construction noise beyond Phases 1 and 2, due to construction and operation of the Green Rail Route and main vehicular access to the site, however, this is likely to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

Assessment

14.13.102 A precautionary assessment is made that without mitigation, construction site noise at 60 dB or above (at 8 kHz and above) has the potential to affect barbastelle roosts and noise at 65 dB or above has the potential to affect barbastelle commuting routes and foraging areas. The extent to which this will occur depends on the time of year, the intensity of the noise, its duration and location. Barbastelle bats are only likely to be affected during the active season, and if noise exceeds the respective threshold for roosting and foraging/commuting. The duration of construction noise, both in terms of individual noise events and the proportion of the construction period during which noise will be produced in areas close to those used by bats is also variable.

14.13.103 Given the complexity of these interactions, it is assumed on a precautionary basis that roosting barbastelle may be disturbed in roosts located on the southern, western and northern boundaries of Ash Wood, at Upper Abbey Farm and the northern boundary of Kenton Hills during Phases 1 and 2 of construction, and from a small area at the southern end of Grimseys during Phases 1 – 2 of construction. However, the majority of roosts confirmed by radio-tracking would be unaffected by construction site noise, this is not likely to significantly affect the availability of roost sites for this population.

14.13.104 It is assumed on a precautionary basis that commuting and foraging barbastelles may avoid Upper Abbey bridleway and Stonewell Belt, or have reduced foraging efficiency within these areas, if any night works producing significant noise are underway in Phases 1 and 2 of construction. However, the noise modelling conducted, as outlined in this **ES** (Doc Ref. Book 6) (Vol 2, Chapter 11) shows that noise levels to the level that a significant effect is foreseen are unlikely in these locations. This assessment utilises noise estimates at LAeq (A rated equivalent sound levels i.e. what humans can hear) but is considered a useful indicator of the likely noise creating activities in an area. The noise modelling modelled a location adjacent to Upper Abbey

Bridleway (referred to as 'Round House') and a location to the immediate north of Stonewall Belt (referred to as 'Ash Wood Cottage). In both of these locations, the modelled LAeq (A rated equivalent sound level) at night time is lower than 60db. As a result no significant impact in these areas is foreseen. The data used to inform this assessment is shown below in **Table 14.44**.

Table 14.44: Night-time noise data for the construction period, for selected modelled receptors

Receptor		Predicted Night-Time Average MDS Construction Noise Level, dB $L_{Aeq,T}$	
Ref	**Name**	**GRR and Associated Activities Only**	**GRR, Excavation, All Associated Activities**
4	Ash Wood Cottage.	51	51
20	Round House.	55	55

14.13.105 Bats' commuting and foraging along Black Walks and the northern edge of Kenton Hills and within Ash Wood may be affected by construction noise at 65dB (at 8+ kHz) or higher, but the likely effect of this would be to displace bats further into these woodland areas, rather than to cause fragmentation. Potential alternative commuting routes via the SSSI crossing and eastern edge of Goose Hill would likely only be affected during Phase 1. Therefore effects in these areas are not considered significant.

14.13.106 Overall, high levels of construction noise is predicted to be restricted to Phases 1 and 2; during these phases these noise levels have the potential to temporarily disturb bats in roosts, commuting routes and foraging areas, potentially displacing bats. There is also potential for fragmentation of habitat to occur, due to noise disturbance, particularly during Phase 1 when construction works will take place close to Upper Abbey Bridleway and at the SSSI crossing, but fragmentation is unlikely to occur as a result of noise in later phases of construction.

14.13.107 As detailed under primary mitigation (**section 4.12** of this chapter), alternative roosts and foraging areas to mitigate effects of significant construction noise on roosting and foraging bats are proposed, these are located in undisturbed locations.

14.13.108 New roosts have been erected across the site and further roosting provision would be installed. These would include the provision of an additional structure either a dedicated bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm in an area relatively remote from construction noise (presented in the Bat Mitigation Strategy), and 45 tree mounted bat boxes already erected in retained woodlands across the EDF Energy estate, also presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume**,** as compensation. These new roosts will provide an abundance of new roost provision. Barbastelle bats are known to frequently change roosts as a component of natural behaviour (Ref 14.103), and it is considered that the provision of these roosts provides adequate alternative roosting provision should roosts be impacted by adverse noise levels at existing roost locations.

14.13.109 Alternative foraging and commuting areas are also being provided. The ‘marsh harrier habitat improvement area as well as the multiple reptile receptor sites would provide extensive new areas of foraging habitat. Furthermore, detailed monitoring of known roost locations and key foraging/commuting routes during Phase 1 and 2 would be undertaken to establish the extent of any disturbance and quantify any potentially negative impacts e.g. roost abandonment. A description of the monitoring proposed and the potential further mitigation required is presented in Sections 14.13.511 and 14.13.512 and the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

14.13.110 In line with the mitigation hierarchy, all appropriate measures have been employed to avoid impacts and safeguard roosting, commuting and foraging barbastelle bats. Within the development, a suite of noise mitigation measures are proposed, the benefits of some of which (the earth bunds etc.) were not possible to incorporate within the impact assessment. The noise levels which exceed the calculated thresholds are likely to do so irregularly, and very rarely at night, and it is not possible to estimate with absolute certainty whether construction noise would (or would not) trigger an offence under the relevant wildlife legislation.

14.13.111 Natural England guidance states that an EPS derogation licence should only be obtained as a ‘last resort’ where all other alternative ways of avoiding impacts on the species have been discounted” (Ref 14.124). Multiple approaches to reduce impacts from noise have been incorporated, as outlined above and in the Bat Mitigation Strategy Appendix 14C1A. In addition, Natural England does not generally grant ‘precautionary licences’ (i.e. as insurance against potential impacts). As no direct impacts to know roosts are currently foreseen with the information currently known, it is not appropriate to commit to the requirement of an EPS licence. An approach is proposed that will mean that a licence will not initially be required to facilitate the works (although this would be reviewed throughout the process). An appropriate approach to safeguarding bats and ensuring legal compliance is proposed.

14.13.112 This approach is based upon the mitigation measures outlined in the Bat Mitigation Strategy Appendix 14C1A, combined with following a non-licenced method statement, which endeavours to reduce any impacts as far as is practicable. This method statement is presented in **Appendix 14C1B** of this volume. It should be noted however that as further information is obtained (for example through further tree assessments), the assessment of impacts to roosts may need to be updated. This may trigger the need for an EPS licence.

14.13.113 In addition, there would be monitoring of the noise levels to key areas of the site for bats throughout the construction phase to determine if disturbance levels are actually likely to exceed a threshold for which a licence required. This would be achieved through monitoring throughout the construction process. This will allow the potential impacts to barbastelle to be monitored and preventative measures taken if requires. The monitoring will assess two key indicators:

- The noise levels actually produced by the works (monitoring as outlined in **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration**);
- The bats usage of roosts and foraging and commuting areas, as compared to the base line surveys (as reported in **ES** (Doc Ref. Book 6) **Appendix 14A8** of this volume).

14.13.114 If noise levels are deemed to be at a level that an offence is considered likely, or observed impacts to bats indicate an impact to roosting, further mitigation would be focussed on the bat population, which could include further roost provision. If necessary, this is a juncture at which a EPS derogation licence may be triggered.

14.13.115 Overall, once the embedded mitigation and construction monitoring and mitigation approach outlined above is implemented, alongside the associated enhancements outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, the impact of construction noise on the barbastelle population is assessed to have a **minor adverse** effect which is considered to be **not significant**.

Disturbance from lighting

14.13.116 Construction lighting of the proposed development would increase light levels and could cause light intrusion into adjacent habitats. An increase in light levels and light spillage could impact barbastelle through:

- Disturbance to roosting bats in adjacent areas of woodland causing delayed emergence or roost abandonment (Ref 14.41);
- Impacts on foraging activity through displacement from lit areas (Ref 14.104) and/or effects on prey behaviour and availability (Ref 14.92 and Ref 14.93); and
- Impacts on commuting activity through displacement of bats from lit areas (Ref 14.91).

14.13.117 In Wiltshire, barbastelle has been recorded foraging and roosting on the fringe of urban areas, commuting across and foraging in extensive open landscapes has been referenced in consultation with Natural England and even in the centre of a small town on a well-lit site (Ref 14.105). Barbastelle have additionally been known to forage around mercury vapour streetlighting (Ref 14.104). However, barbastelle is more commonly considered to be a light-adverse species (Ref 14.106), and the "Sizewell population" is located in a predominantly dark rural location. Given this, it is considered that barbastelle within the ZoI would have a sensitivity to lighting impacts.

Roosts

14.13.118 Thirteen barbastelle tree roosts have been identified on the edge of, or in close proximity to, the site boundary; of these 12 were recorded in use during the early Summer months (June/July) and therefore have the potential to have been used as maternity roosts (see **Appendix 14A8 – Bats** of this volume). Of particular importance are Ash Wood, Kenton Hills and Nursery Covert which are currently unlit.

14.13.119 During construction, Ash Wood would be bordered to the north, west and south-west by stock-piling areas, anticipated to have no ambient lighting levels, though task-specific (directional) lighting levels up to 50 lux would be required when night works are taking place in this area. South of Ash Wood, temporary construction areas are anticipated to have ambient lighting levels of 5 to 20 lux, with task-specific (directional) lighting levels from 100 to 200 lux. No additional lighting would be located within or to the east of Ash Wood (**Volume 2, Appendix 2B: Lighting Strategy for Construction and Operational Sites**).

14.13.120 An area (approximately 30m wide at its narrowest point) without fixed lighting would be present adjacent to the northern edge of Kenton Hills and Nursery Covert. Within this band, a 5m bund would aid in the screening of light spill. The new railway line adjacent to the bund would receive lighting levels between 10 and 20 lux (under either a rail-led or integrated road-rail strategy), while, as detailed above, lighting within temporary construction areas adjacent to the railway line would have ambient light levels of 5 to 20 lux and task-specific lighting of up to 200 lux. No additional lighting would be present within or to the south of Kenton Hills or Nursery Covert (**Volume 2 Appendix 2B: Lighting Management Plan**).

14.13.121 It is not possible to accurately predict the impact from lighting once the mitigation measures proposed (as outlined in The Bat Mitigation Strategy **Appendix 14C1A** of this volume) are applied. As such, a suite of monitoring measures is proposed throughout the construction phase. These are outlined in the Bat Non-licenced Method Statement (**Appendix 14C1B** of this volume).

14.13.122 **Volume 2 Appendix 2B: Lighting Management Plan** evidences the foreseen light levels at key ecological locations across the site. The modelling results at these locations are presented in the appropriate sections below.

14.13.123 To date, identified barbastelle tree roosts have largely been located within 50m of woodland edges, thereby increasing their sensitivity to surrounding conditions.

14.13.124 The impacts of lighting need to be considered across the whole roost resource: i.e. in all areas where trees have been identified as having the potential to support roosts. As a minimum, an increase in light levels in these areas is likely to result in a delayed emergence time although barbastelle (which switch roosts frequently) are considered more likely to abandon roosts that are affected by light-spill.

14.13.125 The construction phase therefore has the potential to reduce the overall roost resource available to barbastelle. The impact of this lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and would be reversible following completion of the construction phase.

Foraging

14.13.126 **Table 14.45** summarises the key barbastelle foraging areas that would be retained but that may experience lighting disturbance from the construction lighting, along with details of the likely surrounding construction phase lighting levels.

Table 14.45: Retained barbastelle foraging areas and associated construction lighting levels

Foraging Area	Nature of Works and Anticipated Lighting Levels
Black Walks.	Outside of the site boundary but to the west adjacent to the proposed stock piling area anticipated to have no ambient lighting but task specific lighting levels of 5-50 lux.
The Grove.	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Upper Abbey Bridleway.	Within the site boundary in an area of no fixed lighting. Runs between stock piling areas (no ambient lighting, task-specific lighting of 5-50 lux), temporary construction areas (ambient lighting of 5-20 lux, task-specific lighting up to 200 lux), temporary accommodation campus (5-75 lux) and site entrance (ambient lighting of 5-50 lux, task-specific of up to 100 lux) resulting in variable lighting levels ranging from no change to 200 lux. Dark buffer zones up to 30m wide between indicative footprints of light sources on either side are proposed at the locations where the bridleway is crossed by haul roads.

Foraging Area	Nature of Works and Anticipated Lighting Levels
Eastern Goose Hill.	Within the site boundary within the temporary construction area. Habitat in this location suitable for barbastelle would largely be lost during establishment of the proposed development. Ambient lighting levels would range from 5-20 lux with task-specific lighting up to 200 lux.
Track on northern edge of Kenton Hills.	Outside the site boundary but adjacent to temporary construction area and railway areas. An area without fixed lighting approximately 30m wide and containing a five-metre bund would provide some screening from lighting with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
Peripheral ride through Kenton Hills.	Outside the site boundary and not immediately adjacent to lit areas. An area without fixed lighting and a five-metre bund would be present between this location and the site.
Broom Covert.	Outside the site boundary and not adjacent to lit areas. Approximately 700m from the nearest area of additional lighting. Unlikely to experience a substantive change in lighting levels.

14.13.127 In addition to the potential avoidance of lit areas by barbastelle, any delay in emergence (as detailed above) could impact foraging success as individual bats could miss the peak nocturnal insect numbers that typically occur at or soon after dusk. This could result in a reduced period in which foraging can occur or reduced prey availability (Ref 14.41) both of which could affect individual fitness.

14.13.128 Lighting can also impact prey behaviour, with evidence indicating that nocturnal insects would move towards areas of artificial lighting potentially reducing prey densities in unlit areas that would be used by bats (Ref 14.41). There is evidence that streetlights might negatively affect moths (the preferred prey of barbastelle) (Ref 14.107). More subtle impacts of lighting on invertebrates include affecting the time of emergence (affecting seasonal food availability/biomass) and even breeding behaviour/success (Ref 14.108). There is, therefore, the potential for artificial lighting to not only impact prey availability within the site boundary, but also within adjacent habitats and, in doing so, further impede foraging.

14.13.129 The construction phase therefore has the potential to reduce the overall foraging resource available to barbastelle bats. The impact of lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase.

Commuting

14.13.130 As detailed in **paragraphs 14.13.45** *et seq*., the construction of the proposed development could result in the isolation of areas currently used by barbastelle. The fragmentation effect would be exacerbated by artificial lighting, which has been shown to create a barrier to crossing for some bat species (**Annex 14A8.6**), likely to include barbastelle.

14.13.131 **Table 14.38** details identified areas of significant barbastelle movement. As detailed above, with the exception of Goose Hill, these areas would be retained. **Table 14.46** summarises the anticipated lighting within or adjacent to these areas.

Table 14.46: Retained areas of significant barbastelle movement and anticipated lighting levels

Foraging Area	Nature of Works and Anticipated Lighting Levels
Ash Wood; The Grove; Goose Hill; Sizewell Marshes SSSI.	Ash Wood, The Grove and Sizewell Marshes SSSI would not be directly lit. Most of the Goose Hill plantation would be lost to the temporary construction area, with the compound lit up to 200 lux. Ash Wood would be surrounded by lit areas on up to three sides, as although no ambient lighting is proposed in the stock-piling area to the north, west and south-west, task-specific lighting of up to 50 lux may be required during active working in that area. The Grove would not be located adjacent to any lit areas and Sizewell Marshes SSSI would be adjacent to the main construction area at its eastern extent, an area lit up to 200 lux.
Plantation Cottages woodland; Leiston Old Abbey woodland.	Plantation Cottages woodland is not located adjacent to any lit areas. Leiston Old Abbey is located adjacent to the proposed site entrance which would be lit to a maximum of 100 lux, although an area of no fixed lighting is located between the two areas.
Kenton Hills.	Outside the site boundary but adjacent to temporary construction area and railway areas. An area of no fixed lighting containing a five-metre bund would provide some screening from lighting with adjacent areas lit up to 200 lux.
Black Walks; The Grove.	Both areas are located outside of the site boundary and would not be directly lit. Black Walks is in close proximity to a stock piling area that would be lit up to 50 lux during active working in that area (but not otherwise lit) while The Grove is located at a distance to the site.

14.13.132 The SSSI crossing, linking Goose Hill to the main platform, at the south-eastern corner of Goose Hill, would be designed to promote connectivity between habitats to the north and south of the construction footprint. It would be bordered to the north and south by the temporary construction area and the main platform respectively, where lighting may be up to 200 lux, and the crossing itself would be subject to ambient lighting of 5-20 lux. Task-specific lighting of up to 200 lux may be required in the short-term during construction of the SSSI crossing.

14.13.133 The **Lighting Management Plan** (**Volume 2, Appendix 2B**) includes modelling of the impact of lighting at key commuting and foraging areas for bats. This shows that at three key locations for foraging and commuting bats (along the bridleway by Upper Abbey Farm, along the northern edge of Kenton Hills and at the proposed SSSI Crossing, the light levels can be controlled to below 1lux. This is evidenced in the table below (**Table 14.47**) which shows the predicted light levels at these locations.

Table 14.47: Modelled lighting levels at key locations for bats

Key Location for bats	Average Illuminance (lux)	Minimum Illuminance (lux)	Maximum illuminance (lux)
Horizontal illuminance at ground level on the bridleway (commuting and foraging area)	0.003 lux	0.001 lux	0.005lux
Vertical illuminance on the hedgerow east side of the bridleway from ground level to 20m above ground level directed towards the campus	0.096 lux	0.001 lux	0.18 lux
Horizontal illuminance Kenton Hill south of proposed 5m bund	0.00 lux	0.00 lux	0.003 lux
Horizontal luminance on SSSI	0.68 lux	0.00 lux	18.4 lux

14.13.134 The construction phase therefore has a low potential to limit the ability of barbastelle to move across the landscape by creating a barrier, adding to the fragmentation effect described above. The impact of this lighting disturbance would occur over the duration of construction (9-12 years). This impact would be temporary and reversible following completion of the construction phase.

Assessment

14.13.135 Without mitigation, construction lighting has the potential to affect roosts and foraging areas and increase the impact of fragmentation resulting in a high magnitude of impact. As detailed under primary mitigation (**section 4.1** of this chapter), a detailed lighting strategy would be implemented, in accordance with the **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**), which would meet the requirements set out in ILP guidance (Ref 14.41).

14.13.136 As a precaution, additional roosts have been erected to offer alternative roosting locations for bats as compensation. These consist of 45 bat boxes of a design preferred by barbastelle, which have already been installed within: Sandypytle Plantation (10); The Grove (15); St. James Covert (10); Reckham Pits (5) and Leiston Carr (5)). Provision of a bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm is also proposed. The locations of these areas are presented in the Bat Mitigation Strategy (**Appendix 14C1A** of this volume).

14.13.137 In addition, control measures, including directional lighting, light attenuation and monitoring are proposed as outlined in the bat non-licensed method statement (**Appendix 14C1B** of this volume).

14.13.138 Given the construction phase duration and the likely sensitivity of barbastelle, there is the potential for artificial lighting to disrupt roosting and foraging behaviour and exacerbate habitat fragmentation within the site and in the immediate surroundings.

14.13.139 Overall, once mitigation is applied, the impact of lighting on the barbastelle population would have a **minor adverse** effect which is considered to be **not significant**.

IEF: Natterer's bat

14.13.140 During construction, the main impact pathways experienced by this IEF would be associated with:

- habitat loss;
- habitat fragmentation (including connectivity); and
- disturbance from lighting and noise.

14.13.141 The characterisation of the above impacts is described in detail below.

Habitat loss – roosts

14.13.142 The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of as-yet unidentified tree roosts within the tree roost resource (the temporary functional loss of roosts (i.e. abandonment as a result of disturbance) is covered as a separate impact).

14.13.143 Natterer's bat maternity roosts are primarily located within trees or bat boxes, although buildings, particularly those close to woodland, are also used. Hibernation roosts are primarily located underground (Ref 14.81) and such sites are often used as swarming sites to mate (Ref 14.109 and Ref 14.110). No buildings or underground sites suitable for use by breeding or hibernating Natterer's bat would be lost due to site clearance (though historic roosts at Upper Abbey Farm may be disturbed, see below). This section therefore focusses on tree loss.

14.13.144 **Table 14.35** details the type and extent of woodland loss that would occur during the establishment of the proposed development. No identified Natterer's bat tree roosts identified to date have been located within areas of woodland to be lost. However, as outlined above, not all trees to be removed have been fully surveyed for roosting potential. Therefore, the trees and tree groups to be removed are treated as a 'roost resource', considering that bat usage of trees can be transient and varies throughout the year.

14.13.145 This impact assessment is based on impacts on the overall roost resource, not on confirmed occupation of individual trees, in accordance with relevant guidance (Ref 14.38), which states *"from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence*."

14.13.146 As with other tree-roosting bat species, Natterer's bat regularly switch roosts, on average every two to five days (Ref 14.81), although there appears to be higher inter-annual roost fidelity than recorded with some other tree-roosting species such as barbastelle (Ref 14.110). Colonies often comprise a complex of roost sites within which numbers are continually varying and, as such, a large roost resource is required to support Natterer's bat populations, in particular maternity colonies (Ref 14.81). This behaviour is similar to that of barbastelle and the impacts are likely to be similar. The Natterer's bat population within the ZoI is considered to have a medium sensitivity to loss of tree roosts.

14.13.147 The principle of avoidance of tree loss has been embedded into the proposed construction layout and areas contributing to the wider Natterer's bat roost resource (including identified roosts and the surrounding trees) have been retained as far as possible. Conifer plantation, such as that principally present within Goose Hill, is sub-optimal for roosting Natterer's, providing limited availability of suitable roost features. Given the limited extent of suitable tree roost resource loss and the presence of alternative suitable roost habitat within the Natterer's bat CSZ, it is considered unlikely that the establishment of the site would significantly reduce the overall tree roost resource available for Natterer's bat.

14.13.148 Table 14.36 presents a high-level assessment of the number of trees with medium, high or very high roosting potential likely to be impacted by the removal of woodland areas across the site. These tree numbers are taken from surveys conducted on the site reported in **Appendix 14A8 – Bats** of this volume. It is considered that these are sufficient to assess the likely impact upon roost resources within this **ES** (Doc Ref. Book 6).

14.13.149 Of the trees to be lost, a number of trees were identified as having moderate or higher suitability for roosting bats (current surveys suggest <100).

14.13.150 Measures to ensure that no roosts are present within these features prior to felling and suitable mitigation and compensation is outlined in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) **Appendix 14C1A** of this volume).

14.13.151 For each tree to be removed, there will be provision of new roosting features (bat boxes erected on retained trees). This provision is specified within the Bat Mitigation Strategy (**Appendix 14C1A** of this volume). Provision of a bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm is also proposed, as presented in the Bat Mitigation Strategy.

14.13.152 Overall, the impact of roost loss on the Natterer's bat population would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat loss – foraging

14.13.153 The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of foraging habitat (the temporary functional loss of foraging habitat (i.e. avoidance and/or displacement as a result of disturbance) is covered as a separate impact).

14.13.154 **Table 14.48** summarises the habitat types due to be lost and the proportion of the total area lost within the wider EDF Energy estate boundary that these habitats types account for. These areas differ in their value to Natterer's bat, which use a wide range of habitats. While a loose association with woodland habitats has been identified, Natterer's bat also use open parkland and large gardens. As a species adapted to foraging within woodland, they can forage extremely close to vegetation, but they may also forage over more open areas, such as grassland habitats, with flight paths low to the ground allowing prey to be gleaned from surfaces. Waterways are also used (Ref 14.38 and Ref 14.109). Natterer's bat therefore have a low sensitivity to habitat loss.

Table 14.48: Habitat loss and value to Natterer's bat

Habitat Type	Area/ length to be lost	Proportion of total EDF Energy estate area/ length lost	Proportion of CSZ (4km radius)	Value to Natterer's bat in this study
Arable, improved and amenity grassland.	123.3ha	33.9%	2.5%	Limited value.
Semi-improved grassland.	36.3ha	9.7%	0.7%	Few records for this habitat, likely to be of limited value.
Plantation woodland (inc.	39.4ha	10.5%	0.8%	Goose Hill is considered to be of particular value later in the season. The

Habitat Type	Area/ length to be lost	Proportion of total EDF Energy estate area/ length lost	Proportion of CSZ (4km radius)	Value to Natterer's bat in this study
coniferous and mixed).				track along the northern edge of Kenton Hills is regularly used by commuting and foraging Natterer's bat.
Semi-natural broadleaved woodland.	7.2ha	1.9%	0.1%	Consistent activity has been recorded throughout the active season at Stonewall Belts.
Water (running).	670m	N/A	Unknown	Few records for this habitat, likely to be of limited value.
Swamp and marsh.	4.3ha	1.3%	0.1%	Few records for this habitat, likely to be of limited value.
Hedgerows.	0m	N/A	Unknown	Few records for this habitat, likely to be of limited value.
Scrub, bracken and ruderals.	1.2ha	0.3%	<0.1%	Few records for this habitat, likely to be of limited value.
Dune and shingle.	1.2ha	0.3%	<0.1%	Few records for this habitat, likely to be of limited value.
Built-up and hard standings.	0ha	0.0%	<0.1%	Negligible value.
Total habitat areas excluding arable, improved and amenity grassland.	**89.6ha**	**23.9%**	**1.8%**	**See above.**

14.13.155 As for barbastelle, arable, improved and amenity grassland and built-up areas are of sub-optimal value for forging Natterer's bat (being more open and providing limited prey) (Ref 14.111). The total habitat loss within the site boundary accounts for 4.2% of the Natterer's bat CSZ. If arable, improved and amenity grassland and built-up habitats are discounted as being of lower value, the loss of the more valuable habitats (89.6ha) amounts to 24% of land within the EDF Energy estate and 1.8% of land within the Natterer's bat CSZ.

14.13.156 CSZs are an average measure, calculated from the distance that bats travel, on average, from their roosts, and do not take into account habitat quality.

Insufficient Natterer's bats were radio-tracked at Sizewell to enable home-ranges of resident individuals to be determined, but literature suggests a home range of about 12km^2 (1,200ha) during the Summer (Ref. 14.1). Within this, a scatter of core areas amounting to between 1.5 and 2km^2 (150–200ha) within the overall range can provide over 80% of a colony's foraging requirements (Ref. 14.1). If a similar figure is applied to the colony resident within the Sizewell estate, the habitat to be lost amounts to 60–45% of the estimated core areas. This impact is therefore of a low magnitude.

14.13.157 The establishment of the proposed development therefore has the potential to reduce the overall foraging resource available to Natterer's bat. The impact of this habitat loss would occur over the duration of the construction period (9-12 years).

14.13.158 The mitigation areas created at Aldhurst Farm, the marsh harrier habitat improvement area and the reptile receptor area at Sizewell Gap are located within the CZS for Natterer's bat. These areas, while not specifically designed for Natterer's bat, would provide a resource of equivalent or greater foraging value than that currently provided by the majority of habitats present within the site boundary. The locations of these areas is presented in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.159 Given that the habitats being lost consisting largely of sub-optimal (arable) foraging habitat, the evidence that Natterer's bat would use a wide range of habitats, the presence of suitable alternate foraging habitat within the Natterer's bat Zol and the establishment of habitat areas at Aldhurst Farm, the marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap, this loss is considered unlikely to significantly reduce the overall foraging resource available for Natterer's bat.

14.13.160 Overall, the impact of foraging habitat loss on the Natterer's bat population would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.13.161 The establishment of the proposed development would result in direct habitat loss, which could result in the isolation of areas currently used by Natterer's. This effect would be temporary and reversible but would persist for the duration of the ten-year construction period.

14.13.162 Natterer's bat is a slow, low-flying but manoeuvrable species, adapted to flight within woodland canopies which are a structurally (and acoustically) complex environment (Ref 14.38 and Ref 14.109). Consequently, it is assumed this species relies more on linear connectivity than barbastelle, though the importance of linear connections is uncertain (Ref. 14.1).

Natterer's bat has been shown to use a wide range of habitats within the site boundary throughout their active season (see **Appendix 14A8 – Bats** of this volume) although limited evidence of specific regular commuting routes was found. Natterer's bat is considered to have a medium sensitivity to the impact of habitat fragmentation.

14.13.163 The most well-defined commuting route identified is located west-east along the track running at the northern edge of Kenton Hills. These movements are likely to include bats commuting from the west (Leiston Abbey or Leiston Old Abbey woodland), with movements also continuing north along the Upper Abbey Bridleway. These areas would be physically retained during construction although they are likely to experience indirect disturbance impacts (the impact pathways associated with these effects are discussed in detail in the relevant sections below).

14.13.164 More broadly, habitat loss during construction would result in a more open landscape than is currently present and, as for barbastelle, flightlines between north and south would be disrupted. Natterer's bat has been recorded using habitats across the EDF Energy estate from The Grove (to the north) and Sizewell Marshes SSSI (to the south). Given the likely reliance of Natterer's bat on linear features, the open landscape and the establishment of the temporary construction area through the centre of the EDF Energy estate is likely to act as a long-term barrier to movement.

14.13.165 It is not certain that all individuals would regularly undertake the more circuitous route around the site that would be required to access habitats to the north and south. As a result, the colony may be displaced to one side of the site, limiting access to a proportion of their retained habitat and areas of habitat enhancement (or divided into sub-groups). In the short term, increased competition may be experienced between individuals, which may result in increased energy expenditure and a subsequent reduction in productivity. This impact is considered to be of medium magnitude.

14.13.166 Although movement through the proposed development site is likely to be restricted by the proposed works, particularly the presence of the temporary construction area, it is considered unlikely that fragmented populations would experience genetic isolation as mating primarily occurs at swarming sites considered to be absent from the ZoI.

14.13.167 To mitigate for the impacts of severance on bats including Natterer's bat, the SSSI crossing, linking Goose Hill to the main platform, is designed to promote connectivity between habitats to the north and south of the construction footprint. The crossing has been designed to include a culvert of suitable dimensions for use by bats to enable east-west movement whilst planting along the embankment margins would help to facilitate north-south movements. The details of this culvert are presented in the Bat Mitigation Strategy (**Appendix 14C1A** of this volume).

14.13.168 Lighting around key areas is also designed to ensure that connectivity is maintained. This is evidenced in a subsequent section of this **ES** (Doc Ref. Book 6).

14.13.169 Although the construction phase would last for a period of 9-12 years, Natterer's bat is a generalist species and are widely distributed throughout Suffolk (Ref. 14.112). Therefore, while these impacts have the potential to increase the vulnerability of the Natterer's bat population locally, it is considered that the habitat fragmentation effects of the site are unlikely to result in population decline.

14.13.170 Overall, the impact of habitat fragmentation on the Natterer's bat population would have a **minor adverse** effect, which is considered to be not **significant**.

Disturbance from noise

14.13.171 This section of the **ES** (Doc Ref. Book 6) discusses the potential impacts from noise upon Natterer's bats resulting from the development, within the Construction Phase. Potential impact pathways and the consideration of what bats can hear are presented in the barbastelle section above and are not repeated here.

14.13.172 It is assessed that the impact from the operation of the site will be negligible, the rationale for this is also presented within the barbastelle section above. The only other potential operational change in noise impacts upon bats is considered to be the from the main vehicular access to the site and the rail route extension. Impacts from these works are discussed in the **ES** chapter relating to this component of the works (**ES (Doc Ref. Book 6) Volume 9 Chapter 6.10: Noise and Vibration**).

14.13.173 The construction of the proposed development will result in an increase in noise within the site boundary and adjacent areas. Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. The level (intensity), timing and duration of high frequency noise will be variable, depending on the nature of the construction activity. It is expected that noise levels will decrease over the course of the overall construction programme, with Phase 1 having the highest predicted noise levels.

14.13.174 There is potential for impacts on Natterer's bats resulting from noise associated with construction due to the location of the proposed development between woodland areas which are of importance to this species, and also due to the scale and duration of the construction phase.

14.13.175 Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. Natterer's bats could be affected in the following ways:

- disturbance to roosting bats in adjacent areas of woodland or buildings causing delayed emergence, increased activity within the roost or, at higher intensity, roost abandonment;
- disturbance to foraging bats, through a masking effect impacting the ability of bats to echolocate and/or catch prey; and
- disturbance to commuting bats, through displacement of bats from perceived 'noisy' areas.

14.13.176 Similar to barbastelle, Natterer's bats' hearing is likely to be most sensitive to frequencies at and above the upper end of the human hearing range (8 kHz and above). Natterer's bats do not employ passive listening during foraging and may therefore be less susceptible to masking effects of construction noise.

14.13.177 The evidence available, as outlined within the barbastelle assessment in Section 14.13.16, indicates that roosting Natterer's bats could reasonably be expected to tolerate noise levels up to 60 dB at (8 kHz and above), without showing evidence of disturbance, and this therefore represents a precautionary threshold for assessment of potential noise impacts for roosting Natterer's bats. It is assumed that hibernating bats will not be disturbed by high frequency noise.

Setting Thresholds for impacts

14.13.178 This section of the **ES** (Doc Ref. Book 6) outlines the thresholds utilised to assess likely impacts in relation to noise. Within this section the assessment is split into impacts upon bat species whilst a) Roosting and b) commuting and foraging. The source data used for this assessment is that used for barbastelle is not repeated here.

Assessment of impact threshold for roosting bats

14.13.179 As with barbastelle, there is limited evidence within the literature on tolerance levels of Natterer's bats to withstand high levels of noise, or on noise thresholds which can cause roost disturbance and/or abandonment. Therefore, an assessment is made from a range of published sources, outlined fully in the barbastelle section. Bats use ultrasonic frequencies to produce a range of echolocation calls, used for foraging, commuting and for social interaction. Bat typically use sound frequencies outside the human range of hearing and are most responsive to frequencies at and above 8kHz (this is towards the end of human hearing).

14.13.180 There is little evidence available, within the scientific literature, on how bats respond to high frequency noise. In particular, noise thresholds which bats can tolerate, and levels which may cause disturbance to roosts, foraging or commuting activities (as outlined above). The same source data was utilised as reported in the barbastelle section of this **ES** (Doc Ref. Book 6), and is not repeated here.

Potential Roosting Disturbance

14.13.181 On the basis of the evidence outlined the following is inferred:

- Areas subject to noise levels at or below 40dB (at 8 kHz) are not considered to have any effect on roosting bats, 100% of roosts within the wider study area are subject to an existing background level of noise above 40dB (assessed using data in the noise chapter of this **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration.**
- Noise levels between above 60dB (at 8 kHz) may have the potential to affect roosting bats. However, the limit evidence is conflicting regarding roosting bats and noise. Several studies have shown the ability of bats to be habituated to noise within these parameters and tolerate even higher noise levels so noise levels up to and including 60dB are not considered likely to have a significant adverse impact;
- Again, the literature is limited, but noise exceeding 60dB (at 8 kHz) may delay emergence and/or cause abandonment. This level of noise will be used a threshold for potential disturbance within this assessment.

14.13.182 The evidence available indicates that roosting Natterer's bats could reasonably be expected to tolerate noise levels of 60 dB (at 8 Khz and above) without showing evidence of disturbance, and this therefore represents a precautionary threshold for assessment of potential noise impacts on roosting Natterer's bats. It is assumed that hibernating bats will not be disturbed by high frequency noise.

Potential Foraging/ Commuting Disturbance

14.13.183 Literature regarding noise impacts on Natterer's bats is not available. However, there are studies on noise impacts on other bat species from which potential impacts to Natterer's can be inferred. The majority of noise disturbance studies on bats relate to traffic noise. Some evidence relates to echolocating bats e.g. Daubenton's bats, a similar species (i.e. both are *Myotis* bats), however, none specifically have been conducted in relation to Natterer's bats. Based on the evidence outlined within the barbastelle section above, the following is inferred:

- Areas subject to noise levels at or below 50dB (at 8 kHz) are not considered likely to have any effect on foraging and/or commuting activities;

- Noise levels between 50-65dB (at 8 kHz) may have the potential to affect foraging and commuting bats. However, the literature is varied and there is evidence to suggest that bats will become habituated to noise within these parameters significant as several studies have shown the ability of bats to habituated to noise within these parameters and tolerate even higher noise levels;

- The evidence suggested that noise exceeding 65dB (at 8 kHz) may disturb bats, result in noise avoidance and/ or reduced foraging efficiency. This level of noise will be used a threshold for potential disturbance within this assessment.

Assessment of noise levels resulting from the construction phase of the development

14.13.184 Noise modelling was used to assess the likely noise level increase at sensitive locations across the development during the peak noise periods of the works. Within this **ES** (Doc Ref. Book 6) chapter, high-frequency noise modelling is utilised to inform the impact assessment. This is detailed in full in the barbastelle section above.

14.13.185 High frequency noise modelling for construction Phases 1 and 2 assumes a 5m noise barrier along site boundaries but no other boundary treatments such as buffer zones or soil bunds are included within the modelling. Proposals presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, and an earth bund located along the north of Kenton Hills. However, it should be noted that Natterer's bats roost and forage more than 5m above ground level, and if doing so are not likely to be screened from the construction area by these boundary treatments. As for barbastelle, the modelling has used a height of 10m above ground level for the assessment.

Roosts

14.13.186 Based on locations of identified Natterer's bat roosts and areas with a significant roost resource (i.e. trees with potential to be used as roosts), modelling of high frequency noise predicts a dB level above 60 in the following locations, during Phase 1, as present within Table 14.49 below. The locations of these roosts are presented the Bat Mitigation Strategy **Appendix 14C1A** of this volume. This table subdivides the roosts which are considered to be at risk of experiencing noise levels above 60dB and those which are not. These are also divided into roosts which are within and outside the draft order limits. The locations of these roosts are presented on the proposed construction works and overlaid on the noise contours calculated for the construction phase of the development as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.49: Natterer's roost locations with predicted noise levels

dB at 8 kHz	Within Order Limits	Outside Order Limits
Below 60 dB	None	**Kenton Hills/ Fiscal Policy complex/ Nursery Covert** – woodland resource & confirmed maternity roost; 50m beyond site boundary
		Sandypytle Plantation – unknown roost type
Above 60 dB	**Upper Abbey Farm** – Building 1 & 11 confirmed day, mating and hibernation roosts	**Ash Wood** – (southern, western & northern boundaries) woodland resource
	Kenton Hills/ Fiscal Policy/ Nursery Covert complex – woodland resource	**Leiston Old Abbey** – confirmed roosts

14.13.187 There is considerable variation between these areas in the duration of noise impacts predicted, both as individual noise events (associated with a particular construction activity) and their duration within the construction period. Several of these areas will also be at risk of fragmentation, disturbance through lighting etc. (considered elsewhere in this chapter).

14.13.188 In summary, four Natterer's roost areas were identified which may experience disturbance above the 60dB precautionary limit, but there are likely to be additional roosts within trees that have the potential to support roosting Natterer's bats.

Commuting and foraging

14.13.189 Based on identified commuting and foraging areas for Natterer's bat, modelling of high frequency noise (at 65 dB and above) predicts impacts on Natterer's bats in the following locations, during Phase 1, as presented within **Table 14.50** below. The locations referred to in this section are presented the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.50: Natterer's foraging/ commuting areas with predicted noise levels

dB)at 8 kHz and above	Within Order Limits	Outside Order Limits
Below 65 dB	N/A	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – remaining woodland complex approximately 50m beyond development site boundary
		The Grove – commuting route north from Goose Hill.
Above 65 dB	**Upper Abbey Bridleway and Fiscal Policy Junction** – north-south commuting route	**Leiston Old Abbey** – woodland foraging area
	Black Walks – north-south commuting route between Ashwood & Minsmere	
	Kenton Hills - (Northern boundary) east-west commuting and foraging area.	
	Goose Hill – (eastern boundary) used as commuting and foraging area.	
	Stonewall Belt – north-south commuting route between Ashwood & Hilltop Covert	
	SSSI crossing – north-south commuting route & foraging area	

14.13.190 In summary, seven key Natterer's foraging and commuting areas were identified that were considered to have the potential to experience noise above 65dB. The sections below describes key impacts to these areas and the disturbance these areas are likely to receive.

14.13.191 A number of areas will receive impacts from the construction and operation of the Green Rail Route. The impacts from the Green Rail Route are discussed in **Volume 9 Chapter 7** of the **ES** (Doc Ref. Book 6).

14.13.192 Most of Upper Abbey bridleway will be subject to noise levels above 65 dB (at 8kHz and above) during Phases 1 and 2 of construction (years 1 – 4, therefore four active seasons for bats).

14.13.193 With regards to Kenton Hills, noise levels will drop fairly rapidly with distance from the construction site, much of Kenton Hills will remain undisturbed. Black Walks adjoins a borrow pit area and will therefore only be affected during Phases 1 and 2 of construction.

14.13.194 Of the potential alternative commuting routes, The SSSI crossing will be subject to high levels of construction noise during Phase 1 (above 65 dB at 8 kHz and above), however, this is likely to reduce to noise levels below the identified threshold (at 8 kHz and above) for the remainder of the construction period. Similarly, the eastern edge of Goose Hill will be subject to high levels of noise (above 65 dB at 8 kHz and above) during construction of the Water Management Zone in this area during Phase 1, but will however, noise levels will reduce to receive less than 30 dB (at 8 kHz and above) or less during the remaining phases. construction noise thereafter. The northern, western and southern edges of Ash Wood would be subject to construction noise above 65 dB (at 8 kHz and above) in Phases 1 and will likely reduce to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

14.13.195 The foraging habitat around Leiston Old Abbey would be subject to continuing construction noise beyond Phases 1 and 2, due to construction and operation of the Green Rail Route and main vehicular access to the site, however, this is likely to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

Assessment

14.13.196 A precautionary assessment is made that without mitigation, construction site noise at 60 dB has the potential to impact roosts and at 65 dB or above (at 8 kHz and above) has the potential to affect commuting routes and foraging areas. The extent to which this will occur depends on the time of year, the intensity of the noise, its duration and location. Natterer's bats are only likely to be affected during the active season, and if noise exceeds the respective thresholds for roosting and foraging/commuting. The duration of construction noise, both in terms of individual noise events and the proportion of the construction period during which noise will be produced in areas close to those used by bats is also variable.

14.13.197 Given the complexity of these interactions, it is assumed on a precautionary basis that roosting Natterer's bats may be disturbed in roosts located at Upper Abbey Farm, the northern edge of Kenton Hills/ Fiscal Policy/Nursery Covert and woodland within Leiston Abbey during Phases 1 and 2 of construction.

14.13.198 It is assumed on a precautionary basis that commuting and foraging Natterer's bat may avoid Upper Abbey bridleway when night works producing significant noise were underway in Phases 1 and 2 of construction. Bats' commuting and foraging along Black Walks, the northern edge of Kenton Hills and Ash Wood may be affected by construction noise at 65 dB or higher, but the likely effect of this would be to displace bats further into these woodland areas, rather than to cause fragmentation. Potential alternative commuting routes via the SSSI crossing and eastern edge of Goose Hill would likely only be affected during Phase 1.

14.13.199 Overall, high levels of construction noise will be restricted to Phases 1 and 2; during these phases these noise levels have the potential to temporarily disturb bats in roosts, commuting routes and foraging areas, potentially displacing bats. Overall, the proposed development therefore has the potential to temporarily displace bats from roosts, commuting routes and foraging areas at times when high levels of noise are produced, but for most of these areas except Kenton Hills/Fiscal Policy/Nursery Covert construction noise will be restricted to Phases 1 and 2 of construction. There is also potential for habitat fragmentation to occur, due to noise disturbance, particularly during Phase 1 when construction works will take place close to Upper Abbey Bridleway and at the SSSI crossing, but fragmentation is unlikely to occur as a result of noise in later phases of construction.

14.13.200 As detailed under primary mitigation (**section 4.12** of this chapter) and the Bat Mitigation Strategy **Appendix 14C1A** of this volume, alternative roosts and foraging areas to mitigate effects of significant construction noise on roosting and foraging bats are proposed, these are located in undisturbed locations.

14.13.201 New roosts have and will be erected across the site. These include a new structure (either bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm) in a location which would remain relatively quiet during construction and bat boxes, the number of which will be calculated to be adequate for the foreseen tree loss as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. These new roosts would provide an abundance of new roost provision. Bats are known to frequently change roosts as a component of natural behaviour (Ref 14.38 and Ref 14.109), and it is considered that the provision of these roosts provides adequate alternative roosting provision should roosts be impacted by adverse noise levels.

14.13.202 Alternative foraging and commuting areas are also being provided. The marsh harrier habitat improvement area as well as the multiple reptile receptor sites will provide extensive new areas of foraging habitat, these are shown in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. Furthermore, detailed monitoring of known roost locations and key foraging/commuting routes during Phase 1 and 2 would be essential to establish disturbance and potentially negative impacts e.g. roost abandonment. A description of the monitoring proposed and the potential further mitigation required is presented in Sections 14.13.511 - 14.13.512.

14.13.203 In line with the mitigation hierarchy, all appropriate measures have been employed to avoid impacts and safeguard roosting, commuting and foraging Natterer's bats. Within the development, a suite of noise mitigation measures are proposed, the benefits of some of which (the earth bunds etc.) were not possible to incorporate within the impact assessment. The noise levels which exceed the calculated thresholds are likely to do so irregularly, and very rarely at night, and it is not possible to estimate with absolute certainty whether construction noise would (or would not) trigger an offence under the relevant wildlife legislation.

14.13.204 Natural England guidance states that, an EPS derogation licence should only be obtained as a 'last resort' where all other alternative ways of avoiding impacts on the species have been discounted" (Ref 14.124). Multiple approaches to reduce impacts from noise have been incorporated, as outlined above and in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. In addition, Natural England does not generally grant 'precautionary licences' (i.e. as insurance against potential impacts). As no direct impacts to know roosts are currently foreseen with the information currently known, it is not appropriate to commit to the requirement of an EPS licence. An approach is proposed that will mean that a licence will not initially be required to facilitate the works (although this would be reviewed throughout the process). An appropriate approach to safeguarding bats and ensuring legal compliance is proposed within the Bat Mitigation Strategy **Appendix 14C1A** of this volume and Bat Method Statement **Appendix 14C1B** of this volume.

14.13.205 This approach is based upon the mitigation measures outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, combined with following a non-licenced method statement, which endeavours to reduce any impacts as far as is practicable. This method statement is presented in **Appendix 14C1B** of this volume**.** It should be noted however that as further information is obtained (for example through further tree assessments), the assessment of impacts to roosts may need to be updated. This may trigger the need for an EPS licence.

14.13.206 In addition, there will be monitoring of the actual noise impacts to key areas of the site for bats throughout the construction phase to determine if disturbance levels are actually likely to exceed the threshold for which a licence would be required. This would be achieved through monitoring throughout the construction process of key roosting areas and commuting and foraging areas. This will allow the potential impacts to Natterer's bats to be monitored and preventative measures taken if requires. The monitoring will assess two key indicators:

- The noise levels actually produced by the works (monitoring as outlined in **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration**);
- The bats usage of roosts and foraging and commuting areas, as compared to the base line surveys (as reported in **ES** (Doc Ref. Book 6) **Appendix 14A8** of this volume).

14.13.207 If noise levels are deemed to be at a level that an offence is considered likely, or observed impacts to bats indicate an impact to roosting, further mitigation would be focussed on the bat population, which could include further roost provision. If necessary, this is a juncture at which a EPS derogation licence may be triggered.

14.13.208 Overall, once the embedded mitigation and construction monitoring and mitigation approach outlined above is implemented, alongside the associated enhancements outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, the impact of construction noise on the Natterer's population is assessed to have a **minor adverse** effect which is considered to be **not significant**.

Disturbance from lighting

14.13.209 As detailed under barbastelle, construction lighting would increase light levels and could cause light intrusion into adjacent habitats. *Myotis* spp. including Natterer's bat are considered to be light-adverse species (Ref 14.41), typically not emerging until late dusk, on average 75 minutes after sunset and returning to roost an hour or more before sunrise (Ref 14.38). Increases in light levels therefore have the potential to impact Natterer's bat roosting, foraging and commuting activity.

Roosts

14.13.210 **Table 14.51** summarises the identified Natterer's bat roosts within and in close proximity to the site boundary and the anticipated surrounding light conditions.

Table 14.51: Retained Natterer's bat roost locations and associated construction lighting levels

Roost Area (roost type)	Nature of Works and Anticipated Lighting Levels
The Grove (unknown).	Outside of site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Sandypytle Plantation (unknown).	Outside site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Kenton Hills (Inc. maternity roost within bat box).	Outside the site boundary but adjacent to temporary construction area. An area of no fixed lighting approximately 30m wide containing a five-metre bund would provide some screening from lighting, with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
Upper Abbey Farm (maternity, mating, hibernating and occasional) – building roost(s).	Located within the site boundary as part of the site entrance complex. This area would have ambient lighting levels of 10-50 lux with task specific lighting up to 100 lux. To the north and west the temporary accommodation campus would be lit up to 75 lux. An area without fixed lighting would be present immediately to the east along the Upper Abbey Bridleway separating the buildings from the

Roost Area (roost type)	Nature of Works and Anticipated Lighting Levels
	stock-piling area that would be lit up to 50 lux during active working but would not have any ambient lighting.
Leiston Abbey (Inc. maternity).	Outside the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Ash Wood (possible roost location).	Outside the site boundary but immediately adjacent to stock-piling areas to the north, west and south-west, lit up to 50 lux during active working, but without ambient lighting. To the south the temporary construction area would have lighting up to 200 lux.

14.13.211 As detailed under barbastelle, construction lighting has the potential to reduce the overall roost resource available to Natterer's bat. The impact of this lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase. The impact of lighting on Natterer's roosts is considered to be of low magnitude with Natterer's bat having a medium sensitivity to this impact.

14.13.212 During construction, Ash Wood would be bordered to the north, west and south-west by stock-piling areas, anticipated to have no ambient lighting levels, though task-specific (directional) lighting levels up to 50 lux would be required when night works are taking place in this area. South of Ash Wood, temporary construction areas are anticipated to have ambient lighting levels of 5 to 20 lux, with task-specific (directional) lighting levels from 100 to 200 lux. No additional lighting would be located within or to the east of Ash Wood (**Volume 2 Appendix 2B: Lighting Strategy for Construction and Operational Sites**).

14.13.213 An area (approximately 30m wide at its narrowest point) without fixed lighting would be present adjacent to the northern edge of Kenton Hills and Nursery Covert. Within this band, a 5m bund would aid in the screening of light spill. The new railway line adjacent to the bund would receive lighting levels between 10 and 20 lux (under either a rail-led or integrated road-rail strategy), while, as detailed above, lighting within temporary construction areas adjacent to the railway line would have ambient light levels of 5 to 20 lux and task-specific lighting of up to 200 lux. No additional lighting would be present within or to the south of Kenton Hills or Nursery Covert (**Volume 2 Appendix 2B: Lighting Management Plan**). The modelling presented in the barbastelle section above demonstrates that the impact of lighting on these areas is minimal as evidenced in **Table 14.47**).

14.13.214 It is not possible to accurately predict the impact from lighting once the mitigation measures proposed (as outlined in The Bat Mitigation Strategy **Appendix 14C1A** of this volume) are applied. As such, a suite of monitoring measures is proposed throughout the construction phase. These are outlined in the Bat Non-licenced Method Statement (**Appendix 14C1B** of this volume).

Foraging

14.13.215 **Table 14.52** summarises the key Natterer's bat foraging areas that would be retained but that may experience lighting disturbance from the proposed development, along with details of the likely surrounding construction phase lighting.

Table 14.52: Retained Natterer's bat foraging areas and associated construction lighting levels

Foraging area	Nature of Works and Anticipated Lighting Levels
The Grove.	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Sizewell Marshes SSSI.	Outside of the site boundary with Kenton Hills acting as a barrier to the majority of light associated with the temporary construction area to the north. Adjacent to the proposed development at the eastern extent, an area that would be lit up with ambient lighting of 5-20 lux and task-specific lighting up to 200 lux.
Goose Hill (wet grassland at eastern end).	Within the site boundary within the temporary construction area. Habitat in this location suitable for Natterer's bat would largely be lost during the establishment of the proposed development. Lighting levels would range from 5-200 lux.
Leiston Old Abbey woodland.	Leiston Old Abbey is located adjacent to the proposed site entrance which would be lit to a maximum of 100 lux, although an area of no fixed lighting is located between the two areas.
Upper Abbey Bridleway.	Within the site boundary in an area of no fixed lighting. Runs between stock piling areas (no ambient lighting, task-specific lighting of 5-50 lux), temporary construction areas (ambient lighting of 5-20 lux, task-specific lighting up to 200 lux), temporary accommodation campus (5-75 lux) and site entrance (ambient lighting of 5-50 lux, task-specific of up to 100 lux) resulting in variable lighting levels ranging from no change to 200 lux. Dark buffer zones up to 30m wide between indicative footprints of light sources on either side are proposed at the locations where the bridleway is crossed by haul roads.
Track on northern edge of Kenton Hills.	Outside the site boundary but adjacent to temporary construction area and railway areas. An area without fixed lighting approximately 30m wide and containing a five-metre bund would provide some screening from lighting with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
Peripheral ride through Kenton Hills.	Outside the site boundary and not immediately adjacent to lit areas. An area without fixed lighting and a 5m bund would be present between this location and the proposed development.

14.13.216 As detailed under barbastelle, construction lighting could result in the direct avoidance of foraging sites by Natterer's bat, as well as having a variety of indirect impacts by affecting invertebrate prey. As a light-adverse species, Natterer's bat is likely to actively avoid lit areas; and therefore, would not be able to take advantage of invertebrate prey attracted to such areas. However, as a generalist, gleaning predator (often picking prey directly from surfaces), Natterer's bat may be better able to take advantage of the range of prey species remaining in unlit areas.

14.13.217 Therefore, while the construction phase has the potential to reduce the overall foraging resource available to Natterer's bat, changes in prey distribution as a result of lighting are likely to have a more limited impact on Natterer's bat compared to other, more specialist species, such as barbastelle who predate primarily on moths (Ref 14.41). The impact of this lighting disturbance would be of a medium magnitude with Natterer's bat having a low sensitivity. It would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following the completion of the construction phase.

Commuting

14.13.218 The most well-defined Natterer's bat commuting route has been identified along the track at the northern edge of Kenton Hills, with activity indicating that this activity is likely to include bats commuting from the west (Leiston Abbey or Leiston Old Abbey woodland), with foraging/commuting activity continuing north along the Upper Abbey Bridleway. These areas would be retained during the construction phase and are either located outside of the site boundary or within areas with no fixed lighting.

14.13.219 The **Lighting Management Plan** (**Volume 2, Appendix 2B**) includes modelling of the impact of lighting at key commuting and foraging areas for bats. This shows that at three key locations for foraging and commuting bats (along the bridleway by Upper Abbey Farm, along the northern edge of Kenton Hills and at the proposed SSSI Crossing, the light levels can be controlled to below 1lux. This is evidenced in **Table 14.36** which shows the predicted light levels at these locations.

14.13.220 The impact of lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase. This impact is considered to be of medium magnitude with Natterer's bat having a medium sensitivity.

Assessment

14.13.221 Details of the primary mitigation (**section 14.4** of this chapter) include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).

14.13.222 Given the duration of the construction phase, there is the potential for artificial lighting to reduce the ability of the light-averse Natterer's bat to use and move between habitats within the site and the immediate surroundings.

14.13.223 It is not possible to accurately predict the impact from lighting once the mitigation measures proposed (as outlined in The Bat Mitigation Strategy **Appendix 14C1A** of this volume) are applied. As such, a suite of monitoring measures is proposed throughout the construction phase. These are outlined in the Bat Non-licenced Method Statement (**Appendix 14C1B** of this volume).

14.13.224 In addition, control measures, including directional lighting, light attenuation and monitoring are proposed as outlined in the bat non-licensed method statement (**Appendix 14C1B** of this volume).

14.13.225 Overall, the impact of lighting on the Natterer's bat population would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Leisler's bat and Nathusius' pipistrelle

14.13.226 Leisler's bat is considered uncommon but widespread nationally and rare within Suffolk. Nathusius' pipistrelle is considered to be uncommon to rare, albeit widespread, nationally and rare within Suffolk (see **Appendix 14A8 – Bats** of this volume). These species have been grouped due to their shared "edge-of-range" status or rarity within the EDF Energy estate and shared CSZ and ZoI of 3km.

14.13.227 During construction, the main impact pathways experienced by Leisler's and Nathusius' pipistrelle bat would be associated with:

- habitat loss;
- habitat fragmentation (including connectivity); and
- disturbance from lighting and noise.

14.13.228 The characterisation of the above impacts is described in detail below.

Habitat loss – roosts

14.13.229 No roosts which have been identified to date will be lost to the development. The construction of the proposed development would result in direct habitat loss, which would result in the direct loss of 'potential roosts' (the temporary functional loss of roosts (i.e. abandonment as a result of disturbance) is covered as a separate impact).

14.13.230 Leisler's bat is primarily a tree-roosting species, preferring naturally developing features (i.e. knot holes, rot holes and lightning strike features) to others such as woodpecker holes. However, in the UK, most identified maternity roosts have been located in buildings. Bat boxes are also used, most frequently outside of the maternity period. Preferred hibernation roosts are unclear; however, tree roosts may be used (Ref 14.38).

14.13.231 Little is known of Nathusius' pipistrelle roosts in the UK; however, they are considered to primarily roost in trees, including for hibernation, although buildings are known to be used by maternity colonies (Ref 14.38). Only five maternity roosts are known in Great Britain, and this species was only recently categorised as a resident (Ref 14.109).

14.13.232 No tree roosts for these species have been identified within the site boundary and, while both species would roost in buildings, no buildings within the site boundary are known to support either species and no indication of a roost of either species (from activity records) has been identified in the vicinity. However, as outlined above, not all trees to be removed have been fully surveyed for roosting potential. Therefore, the trees and tree groups to be removed are treated as a 'roost resource', considering that bats usage of trees can be transient and varies throughout the year.

14.13.233 This impact assessment is based on impacts on the overall roost resource, not on confirmed occupation of individual trees, in accordance with relevant guidance (Ref 14.38), which states *"from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence*."

14.13.234 **Table 14.35** details the type and extent of woodland loss that would occur during the establishment of the site. No confirmed tree roosts for these species were identified within areas of woodland to be lost. Of the trees to be lost, a relatively small number of trees have been identified as having moderate or higher suitability for roosting bats. Some of these trees may be suitable for roosting Leisler's bat and/or Nathusius' pipistrelle. The impact of this habitat loss would occur over the duration of the construction period (9-12 years). The loss of these elements of the tree woodland resource would effectively be permanent.

14.13.235 Activity findings indicate Leisler's bat is almost certainly only present within the EDF Energy estate, and likely the wider ZoI (3km), infrequently and in low numbers. Similarly, while Nathusius' pipistrelle was recorded throughout the bat active season, their passes accounted for less than 1% of total activity during static detector surveys across the EDF Energy estate (see **Appendix 14A8 – Bats** of this volume). Therefore, in conjunction with the absence of identified roosts and little evidence of early evening activity, it is unlikely that notable roosts (i.e. are present within the site boundary, though limited occurrence of occasional and/or transitional roosts by individuals/very small numbers cannot be ruled out. As such this impact would be of a very low magnitude.

14.13.236 The principle of avoidance of tree loss has been embedded into the proposed construction layout and areas contributing to the wider bat roost resource (including identified roosts and the surrounding trees) have been retained as far as possible. Details on the potential tree roost loss are presented within the barbastelle section above, and are not repeated here. Given the limited extent of suitable tree roost resource loss and the presence of alternative suitable roost habitat within the bat CSZ, it is considered unlikely that the establishment of the site would significantly reduce the overall tree roost resource available for these species.

14.13.237 Table 14.36 presents a high-level assessment of the number of trees with medium, high or very high roosting potential likely to be impacted by the removal of woodland areas across the site. These tree numbers are taken from surveys conducted on the site reported in **Appendix 14A8 – Bats** of this volume. It is considered that these are sufficient to assess the likely impact upon roost resources within this **ES** (Doc Ref. Book 6).

14.13.238 Of the trees to be lost, a number of trees were identified as having moderate or higher suitability for roosting bats (current surveys suggest <100).

14.13.239 Measures to ensure that no roosts are present within these features prior to felling and suitable mitigation and compensation is outlined in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.240 For each tree to be removed, there will be provision of new roosting features (bat boxes erected on retained trees). This provision is specified within the Bat Mitigation Strategy (**Appendix 14C1A** of this volume). Provision of a bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm is also proposed, as presented in the Bat Mitigation Strategy. The locations of these areas are also presented in the Bat Mitigation Strategy.

14.13.241 Given the retention of much of the wider tree resource, the likely absence of notable roosts within the site boundary, the absence of evidence indicative of roosts of either species in close proximity to the site and the scarcity of both species within Suffolk, it is considered unlikely that the proposed development would significantly reduce the overall tree roost resource available for either species.

14.13.242 Overall, the impact of roost loss on the Leisler's bat and Nathusius' pipistrelle population would have a **negligible adverse** effect, which is considered to be **not significant**.

Habitat loss – foraging

14.13.243 The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of foraging habitat (the temporary functional loss of foraging habitat (i.e. avoidance and/or displacement as a result of disturbance) is covered as a separate impact).

14.13.244 **Table 14.53** summarises the habitat types due to be lost and the proportion of the total area lost within the wider EDF Energy estate that these habitat types account for. Due to the limited presence of Leisler's bat and Nathusius' pipistrelle, it is not possible to determine areas of particular value for these species within the site. As an open-adapted species, Leisler's bat commonly forage over more open habitats, while also making use of rides, woodland edges, hedgerows and treelines as well as larger waterbodies and waterways. Nathusius' pipistrelle show a strong association with water, while also using a range of woodland habitats (Ref 14.109 - Ref 14.113). These species therefore have a low sensitivity to this impact.

Table 14.53: Habitat loss relative to Leisler's bat and Nathusius' pipistrelle

Habitat Type	Area/length to be lost	Proportion of EDF Energy estate area/length lost	Proportion of CSZ (3km radius)
Arable, improved and amenity grassland	123.3ha	33.9%	4.4%
Semi-improved grassland	36.3ha	9.7%	1.3%
Plantation woodland (inc. coniferous and mixed)	39.4ha	10.5%	1.4%
Semi-natural broadleaved woodland	7.2ha	1.9%	0.3%
Water (running)	670m	N/A	Unknown
Swamp and marsh	4.3ha	1.3%	0.2%
Hedgerows	0m	N/A	Unknown
Scrub, bracken and ruderals	1.2ha	0.3%	<0.1%

Habitat Type	Area/length to be lost	Proportion of EDF Energy estate area/length lost	Proportion of CSZ (3km radius)
Dune and shingle	1.2ha	0.3%	<0.1%
Built-up and hard standings	0ha	0.0%	0%
Total habitat areas excluding arable, improved and amenity grassland	**89.6**	**23.9%**	**3.2%**

14.13.245 As detailed for barbastelle and Natterer's bat above, arable and improved grassland habitats are considered to be sub-optimal for foraging bats; however, the remaining habitats to be lost within the site boundary are potentially suitable, to varying degrees, for foraging Leisler's bat and/or Nathusius' pipistrelle. The total habitat loss accounts for 7.6% of the 3km CSZ for Leisler's bat and Nathusius' pipistrelle (as a worst-case scenario, given the site may not be an important part of these species' CSZs). If arable, improved and amenity grassland and built-up habitats are discounted as being of lower value, the loss of the more suitable habitats (89.6ha) amounts to 23.9% of land within the EDF Energy estate and 3.2% of land within the CSZ resulting in a low magnitude of impact.

14.13.246 The establishment of the site, therefore, has the potential to reduce the overall foraging resource available, albeit to a limited extent. The impact of this habitat loss would occur over the duration of the construction period (9-12 years). Woodland loss would be permanent; however, as detailed for barbastelle, much of the landscape would be restored following construction, and habitat creation, within the 3km CSZ, would provide a resource of equivalent or greater foraging value than that provided by the majority of habitats present within the site boundary.

14.13.247 Despite the extent of habitat loss and the time period (9-12 years) over which this loss would occur, due to the apparently limited presence of these species within the site boundary, the scarcity of both species within Suffolk and the range of foraging habitats used, it is considered unlikely that the proposed development would significantly reduce the overall foraging resource available for either species.

14.13.248 The mitigation areas created at Aldhurst Farm, the marsh harrier habitat improvement area and the reptile receptor area at Sizewell Gap are located within the CZS for Natterer's bat. These areas, while not specifically designed for Natterer's bat, would provide a resource of equivalent or greater foraging value than that currently provided by the majority of habitats present within the site boundary. The locations of these areas is presented in the Bat

Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.249 Overall, the loss of foraging habitat for Leisler's bat and Nathusius' pipistrelle would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.13.250 The establishment of the proposed development would result in direct habitat loss, which could result in the isolation of areas currently used by bats. This effect would be temporary and reversible but would persist for the duration of the construction period.

14.13.251 Leisler's bat is an "open-adapted" species and as such is less reliant on linear features for commuting (Ref. 14.68). Nathusius' pipistrelle is an "edge-adapted" species capable of long migratory flights (frequently recorded crossing to the UK from mainland Europe) (Ref. 14.68), with a similar low-level reliance on linear features.

14.13.252 While both species have CSZs of 3km, maximum recorded foraging distances for both species are considerably further (10km for Leisler's bat and 6km for Nathusius' pipistrelle) (Ref. 14.68). As such, both species would be capable of regularly undertaking the more circuitous route around the site to reach unaffected parts of the landscape. However, due to the ability of these species to navigate open landscapes, the considerably more open landscape resulting from construction phase habitat loss may not act as a barrier to movement. As such, this impact would be of a very low magnitude, with Leisler's bat and Nathusius' pipistrelle having a low sensitivity. Nonetheless, the influence of disturbance impacts (including noise and lighting) as detailed below may affect the use of these areas, albeit for a small number of individuals.

14.13.253 Although the construction phase is long (9-12 years), the limited presence of these species within the site boundary and ZoI, and the limited reliance of these species on the habitats to be lost or the linear features connecting them, it is unlikely to result in the fragmentation or isolation of these populations.

14.13.254 Overall, the impact of habitat fragmentation on the Leisler's bat and Nathusius' pipistrelle populations would have a **negligible adverse** effect, which is considered to be **not significant**.

Disturbance from noise

14.13.255 This section of the ES discusses the potential impacts from noise upon Leisler's bat and Nathusius' pipistrelle bats resulting from the development, within the Construction Phase.

14.13.256 The construction of the proposed development will result in an increase in noise within the site boundary and adjacent areas. Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. The level (intensity), timing and duration of high frequency noise will be variable, depending on the nature of the construction activity. It is expected that noise levels will decrease over the course of the overall construction programme, with Phase 1 having the highest predicted noise levels.

14.13.257 There is potential for impacts on Leisler's and Nathusius' pipistrelle bats resulting from noise associated with construction due to the location of the proposed development between woodland areas used by these species, and also due to the scale and duration of the construction phase.

14.13.258 Similar to barbastelle bats, noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. Leisler's and Nathusius' pipistrelle bats could be affected in the following ways:

- disturbance to foraging bats, through a masking effect impacting the ability of bats to echolocate; and
- disturbance to commuting bats, through displacement of bats from perceived 'noisy' areas.

14.13.259 Bats' hearing is likely to be most sensitive to frequencies at and above the upper end of the human hearing range (8 kHz and above). Leisler's and Nathusius' pipistrelle bats do not employ passive listening during foraging and may therefore be less susceptible to masking effects of construction noise.

Setting Thresholds for impacts

14.13.260 This section outlines the thresholds utilised to assess likely impacts in relation to noise for these two species. Within this section the assessment is split into impacts upon bat species whilst a) Roosting and b) commuting and foraging.

14.13.261 Bats use ultrasonic frequencies to produce a range of echolocation calls, used for foraging, commuting and for social interaction. Bat typically use sound frequencies outside the human range of hearing and are most responsive to frequencies at and above 8kHz (this is towards the end of human hearing).

14.13.262 There is little evidence available, within the scientific literature, on how bats respond to high frequency noise. In particular, noise thresholds which bats can tolerate, and levels which may cause disturbance to roosts, foraging or commuting activities (as outlined above). To assess the impacts to Leisler's bat and Nathusius' pipistrelle bats, the same source data was utilised as reported in the barbastelle section of this **ES** (Doc Ref. Book 6), and is not repeated here.

Potential Roosting Disturbance

14.13.263 No roost sites have been confirmed for either species on or close to the construction site, and activity assessments showed it was unlikely that these species were present in the vicinity of the site. Therefore, impacts on roosting bats are considered unlikely.

14.13.264 However, there would be losses of tree groups or areas considered to be a 'roost resource' which are likely to support roosting bats. Measures to ensure that any new or previously unidentified roosts within this resource are identified and mitigated are proposed within this **ES** (Doc Ref. Book 6) and the associated Bat Mitigation Strategy (**Appendix 14C1A** of this volume). This includes the provision of bat roosting boxes, the number of which are to be provided will be based upon the number of potential roosting features lost due to the tree removal.

14.13.265 On the basis of the evidence outlined in full in the barbastelle section the following is inferred:

- Areas subject to noise levels at or below 40dB (at 8 kHz) are not considered to have any effect on roosting bats, 100% of roosts within the wider study area are subject to an existing background level of noise above 40dB (assessed using data in the noise chapter of this **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration.**
- Noise levels between above 60dB (at 8 kHz) may have the potential to affect roosting bats. However, the limit evidence is conflicting regarding roosting bats and noise. Several studies have shown the ability of bats to be habituated to noise within these parameters and tolerate even higher noise levels so noise levels up to and including 60dB are not considered likely to have a significant adverse impact;
- Again, the literature is limited, but noise exceeding 60dB (at 8 kHz) may delay emergence and/or cause abandonment. This level of noise will be used a threshold for potential disturbance within this assessment.

Potential Foraging/ Commuting Disturbance

14.13.266 The Leisler's bat is a high-flying species with very loud echolocation calls and is less dependent on linear vegetation for commuting than most bat species. Nathusius' pipistrelle is, like the other two UK pipistrelle species, regularly recorded commuting and foraging in areas with higher levels of human disturbance, compared to barbastelle or Natterer's bats, and so it is likely that both species relatively are less susceptible to disturbance from construction site noise.

14.13.267 The majority of noise disturbance studies on bats relate to traffic noise. Some evidence relates to echolocating bats e.g. Daubenton's bats, a similar species (i.e. both are Myotis bats), however, none specifically have been conducted in relation to Leisler's or Nathusius' pipistrelles. Based on the evidence outlined above, the following is inferred:

14.13.268 The evidence available indicates that noise levels above 65 dB (at 8 kHz) may have the potential to affect foraging and commuting Leisler's bats and Nathusius pipistrelles. In the absence of other evidence this provides a basis on which to assess the impact of high frequency noise on commuting and foraging Leisler's and Nathusius' pipistrelle, although this is likely to represent a precautionary approach given that these species do not use passive listening.

14.13.269 High frequency noise modelling for construction Phases 1 and 2 assumes a 5m noise barrier along site boundaries but no other boundary treatments such as buffer zones or soil bunds. Current proposals presented in **Chapter 11** of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, predominantly to minimise noise to marsh harriers to the north and an earth bund north of Kenton Hills. However, it should be noted that both these species may roost and forage more than 5m above ground level, and if doing so are not likely to be screened from the construction area by these boundary treatments. As for barbastelle, the modelling has used a height of 10m above ground level for the assessment.

14.13.270 No studies have specifically been conducted in relation to Leisler's bats and Nathusius' pipistrelles. However, based on the evidence outlined above, the following is inferred:

- Areas subject to noise levels at or below 50dB (at 8 kHz) are not considered likely to have any effect on foraging and/or commuting activities;
- Noise levels between 50-65dB (at 8 kHz) may have the potential to affect foraging and commuting bats. However, the literature is varied and there is evidence to suggest that bats will become habituated to noise within these parameters significant as several studies have shown the ability of bats to habituated to noise within these parameters and tolerate even higher noise levels;
  - The evidence suggested that noise exceeding 65dB (at 8 kHz) may disturb bats, result in noise avoidance and/ or reduced foraging efficiency. This level of noise will be used a threshold for potential disturbance within this assessment.

Assessment of noise levels resulting from the construction phase of the development

14.13.271 Noise modelling was used to assess the likely noise level increase at sensitive locations across the development during the peak noise periods of the works. Within this **ES** (Doc Ref. Book 6) chapter, high-frequency noise modelling is utilised to inform the impact assessment. This is detailed in full in the barbastelle section above.

14.13.272 High frequency noise modelling for construction Phases 1 and 2 assumes a 5m noise barrier along site boundaries but no other boundary treatments such as buffer zones or soil bunds are included within the modelling. Proposals presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, and an earth bund located along the north of Kenton Hills.

Roosts

14.13.273 No Leisler's or Nathusius' pipistrelle roosts have been found within the surveys. However, based on areas with a significant roost resource (i.e. trees with potential to be used as roosts, based on the trees present), modelling of high frequency noise predicts a dB level above 60 in the following locations, during Phase 1, as presented in Table 14.54 below. The locations of these areas are presented the Bat Mitigation Strategy **Appendix 14C1A** of this volume. This table subdivides the roost resource areas which are considered to be at risk of experiencing noise levels above 60dB and those which are not. These are also divided into roosts which are within and outside of draft order limits. The locations of these roosts are presented overlaid on the proposed construction works and overlaid on the noise contours calculated for the construction phase of the development as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.54: Potential Leisler's and/ or Nathusius' pipistrelle roost locations with predicted noise levels

dB at 8 kHz	Within Order Limits	Outside Order Limits
Below 60 dB	None	Kenton Hills/ Fiscal Policy complex/ Nursery Covert
		Sandypytle Plantation
Above 60 dB	Upper Abbey Farm	Ash Wood
	Kenton Hills/ Fiscal Policy/ Nursery Covert complex	Leiston Old Abbey

14.13.274 There is considerable variation between these areas in the duration of noise impacts predicted, both as individual noise events (associated with a particular construction activity) and their duration within the construction period. Several of these areas will also be at risk of fragmentation, disturbance through lighting etc. (considered elsewhere in this chapter).

14.13.275 Four potential roost areas were identified which may experience disturbance above the 60dB precautionary limit.

Commuting and foraging

14.13.276 Based on identified commuting and foraging areas for Leisler's bats and Nathusius' pipistrelles, modelling of high frequency noise predicts impacts on these species in the following locations, during Phase 1, as presented within **Table 14.55**.

Table 14.55: Leisler's / Nathusius' pipistrelle foraging/ commuting areas with predicted noise levels

dB at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 65 dB	N/A	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – remaining woodland complex approximately 50m beyond development site boundary
		The Grove – commuting route north from Goose Hill.
Above 65 dB	**Upper Abbey Bridleway and Fiscal Policy Junction** – north-south commuting route	**Leiston Old Abbey** – woodland foraging area
	Kenton Hills - (Northern boundary) east-west commuting and foraging area.	**Ash Wood** – woodland foraging area
	Black Walks – north-south commuting route between Ashwood & Minsmere	
	Stonewall Belt – north-south commuting route between Ashwood & Hilltop Covert	
	SSSI crossing – north-south commuting route & foraging area	

14.13.277 In summary, seven key Leisler's bat / Nathusius' pipistrelle foraging and commuting areas were identified that were considered to have the potential to experience noise above 65dB. The sections below describes key impacts to these areas and the disturbance these areas are likely to receive.

14.13.278 A number of areas will receive impacts from the construction and operation of the Green Rail Route. The impacts from the Green Rail Route are discussed in **Volume 9 Chapter 7** of the **ES** (Doc Ref. Book 6).

14.13.279 Most of Upper Abbey bridleway will be subject to noise levels above 65 dB (at 8kHz and above) during Phases 1 and 2 of construction (years 1 – 4, therefore four active seasons for bats).

14.13.280 With regards to Kenton Hills, noise levels will drop fairly rapidly with distance from the construction site, much of Kenton Hills will remain undisturbed. Black Walks adjoins a borrow pit area and will therefore only be affected during Phases 1 and 2 of construction.

14.13.281 Of the potential alternative commuting routes, The SSSI crossing will be subject to high levels of construction noise during Phase 1 (above 65 dB at 8 kHz and above), however, this is likely to reduce to noise levels below the identified threshold, but below the identified threshold level (at up to 50 dB at 8 kHz and above) for the remainder of the construction period. Similarly, the eastern edge of Goose Hill will be subject to high levels of noise (above 65 dB at 8 kHz and above) during construction of the Water Management Zone in this area during Phase 1, but will however, noise levels will reduce to receive less than 30 dB (at 8 kHz and above) or less during the remaining phases. construction noise thereafter. The northern, western and southern edges of Ash Wood would be subject to construction noise above 65 dB (at 8 kHz and above) in Phases 1 and will likely reduce to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

14.13.282 The foraging habitat around Leiston Old Abbey would be subject to continuing construction noise beyond Phases 1 and 2, due to construction and operation of the Green Rail Route and main vehicular access to the site, however, this is likely to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

Assessment

14.13.283 Without mitigation, construction site noise has the potential to affect Leisler's bat and Nathusius' pipistrelle commuting routes and foraging areas. The extent to which this will occur depends on the time of year, the intensity of the noise, its duration and location. Leisler's bat and Nathusius' pipistrelles are only likely to be affected during the active season, and if noise exceeds the 65dB threshold for foraging/commuting. The duration of construction noise, both in terms of individual noise events and the proportion of the construction period during which noise will be produced in areas close to those used by bats is also variable.

14.13.284 Bats' commuting and foraging along Black Walks, the northern edge of Kenton Hills and Ash Wood may be affected by construction noise, but the likely effect of this would be to displace bats further into (or, for Leisler's, above) these woodland areas, rather than to cause fragmentation. Potential alternative commuting routes via the SSSI crossing and eastern edge of Goose Hill would be affected during Phase 1.

14.13.285 Overall, high levels of construction noise is predicted to be restricted to Phases 1 and 2; during these phases these noise levels have the potential to temporarily displace bats from commuting routes and foraging areas at times when high levels of noise are produced. It is not considered likely that fragmentation of habitat would occur even during Phase 1 when construction works, with high noise levels (above 65 dB) will take place close to Upper Abbey Bridleway and at the SSSI crossing.

14.13.286 As detailed under primary mitigation (**section 4.12** of this chapter), alternative roosts and foraging areas to mitigate potential effects of significant construction noise on roosting and foraging bats are proposed, these are located in undisturbed locations.

14.13.287 New roosts have and would be erected across the site. These include a new structure (either bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm) in a location which would remain relatively quiet during construction and bat boxes, the number of which will be calculated to be adequate for the foreseen tree loss as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. These new roosts would provide an abundance of new roost provision. Bats are known to frequently change roosts as a component of natural behaviour (Ref 14.38 and Ref 14.109), and it is considered that the provision of these roosts provides adequate alternative roosting provision should roosts be impacted by adverse noise levels.

14.13.288 Alternative foraging and commuting areas are also being provided. The marsh harrier mitigation area as well as the multiple reptile receptor sites will provide extensive new areas of foraging habitat, these are shown in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. Furthermore, detailed monitoring of known roost locations and key foraging/commuting routes during Phase 1 and 2 would be essential to establish disturbance and potentially negative impacts e.g. roost abandonment. A description of the monitoring proposed and the potential further mitigation required is presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

14.13.289 In line with the mitigation hierarchy, all appropriate measures have been employed to avoid impacts and safeguard roosting, commuting and foraging Leisler's bats and Nathusius' pipistrelles. Within the development, a suite of noise mitigation measures are proposed, the benefits of some of which (the earth bunds etc.) were not possible to incorporate within the impact assessment. The noise levels which exceed the calculated thresholds are likely to do so irregularly, and very rarely at night, and it is not possible to estimate with absolute certainty whether construction noise would (or would not) trigger an offence under the relevant wildlife legislation.

14.13.290 Natural England guidance states that, an EPS derogation licence should only be obtained as a 'last resort' where all other alternative ways of avoiding impacts on the species have been discounted" (Ref 14.124). Multiple approaches to reduce impacts from noise have been incorporated, as outlined above and in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. In addition, Natural England does not generally grant 'precautionary licences' (i.e. as insurance against potential impacts). As no direct impacts to know roosts are currently foreseen with the information currently known, it is not appropriate to commit to the requirement of an EPS licence. An approach is proposed that will mean that a licence will not initially be required to facilitate the works (although this would be reviewed throughout the process). An appropriate approach to safeguarding bats and ensuring legal compliance is proposed within the Bat Mitigation Strategy **Appendix 14C1A** of this volume and Bat Method Statement **Appendix 14C1B** of this volume.

14.13.291 This approach is based upon the mitigation measures outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, combined with following a non-licenced method statement, which endeavours to reduce any impacts as far as is practicable. This method statement is presented in **Appendix 14C1B** of this volume**.** It should be noted however that as further information is obtained (for example through further tree assessments), the assessment of impacts to roosts may need to be updated. This may trigger the need for an EPS licence.

14.13.292 In addition, there will be monitoring of the actual noise impacts to key areas of the site for bats throughout the construction phase to determine if disturbance levels are actually likely to exceed the threshold for which a licence would be required. This would be achieved through monitoring throughout the construction process of key roosting areas and commuting and foraging areas. This will allow the potential impacts to Leisler's bats and Nathusius' pipistrelles to be monitored and preventative measures taken if requires. The monitoring will assess two key indicators:

- The noise levels actually produced by the works (monitoring as outlined in **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration**);
- The bats usage of roosts and foraging and commuting areas, as compared to the base line surveys (as reported in **ES** (Doc Ref. Book 6) **Appendix 14A8** of this volume).

14.13.293 If noise levels are deemed to be at a level that an offence is considered more likely than unlikely, or observed impacts to bats indicate an impact to roosting, two approaches can be employed to safeguard bats:

14.13.294 If noise levels are deemed to be at a level that an offence is considered likely, or observed impacts to bats indicate an impact to roosting, further mitigation would be focussed on the bat population, which could include further roost provision. If necessary, this is a juncture at which a EPS derogation licence may be triggered.

14.13.295 Overall, once the embedded mitigation and construction monitoring and mitigation approach outlined above is implemented, alongside the associated enhancements outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, the impact of construction noise on the Leisler's bats and Nathusius' pipistrelle populations is assessed to have a **minor adverse** effect which is considered to be **not significant**.

Disturbance from lighting

14.13.296 As detailed under barbastelle, construction lighting would increase light levels and could cause light intrusion into adjacent habitats. While Leisler's bat and Nathusius' pipistrelle show similar preferences for unlit roosting locations, they are not light-adverse in relation to foraging behaviour, with Leisler's bat observed foraging under white streetlights. In line with this, Leisler's bat have been recorded with a median emergence time of 18 minutes after sunset (Ref 14.81) while Nathusius' pipistrelle is also a typically early emerging species.

14.13.297 It is not possible to accurately predict the impact from lighting once the mitigation measures proposed (as outlined in The Bat Mitigation Strategy **Appendix 14C1A** of this volume) are applied. A suite of monitoring measures is proposed throughout the construction phase as outlined in the Bat Non-licenced Method Statement (**Appendix 14C1B** of this volume).

Roosts

14.13.298 As detailed above, these species have not been recorded roosting within the site boundary, with no evidence suggesting the presence of a notable roost in close proximity to the site. While both species are primarily tree-roosting, and suitable trees within the site boundary may be impacted by lighting, the limited occurrence of both species in Suffolk (Ref. 14.1) mean that increased lighting levels associated with the proposed development are unlikely to impact the overall roost resource available to these species.

Foraging

14.13.299 Both species are present within the site boundary to only a limited degree. In addition, although Nathusius' pipistrelle feeds largely on aquatic insects, neither are specialist feeders and, while invertebrate groups such as moths that may be more significantly impacted by increased lighting levels are taken, a range of other prey species are also targeted. This generalist feeding strategy, in combination with the ability to opportunistically use lit areas for foraging, means the ability of both species to forage within the site and ZoI is unlikely to be impacted by increased lighting levels.

Commuting

14.13.300 The flight strategies used by both species indicate a limited reliance on linear features and an ability to cross large, open areas. In combination with an opportunistic or at-worst neutral relation with lit areas during commuting (Ref 14.104), it is considered unlikely that the ability of these species to move within the site and the ZoI would be impacted by increased lighting levels.

Assessment

14.13.301 Details of the primary mitigation (**section 14.4** of this chapter) include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).

14.13.302 This impact would be of a very low magnitude with Leisler's bat and Nathusius' pipistrelle having very low sensitivity to the impact.

14.13.303 Overall, the impact of lighting on the Leisler's bat and Nathusius' pipistrelle would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Noctule and serotine

14.13.304 Noctule and serotine have been grouped due to their shared adaptation for foraging in open space and shared CSZ and ZoI of 4km.

14.13.305 During construction, the main impact pathways experienced by noctule and serotine would be associated with:

- habitat loss;
- habitat fragmentation (including connectivity); and
- disturbance from lighting and noise.

14.13.306 The characterisation of the above impacts is described in detail below.

Habitat loss – roosts

14.13.307 No roosts identified to date will be directly lost to the development. The establishment of the site would result in direct habitat loss, which would result in the direct loss of potential roosts (the temporary functional loss of roosts (i.e. abandonment as a result of disturbance) is covered as a separate impact.

14.13.308 Not all trees to be removed have been fully surveyed for roosting potential. Therefore, the trees and tree groups to be removed are treated as a 'roost resource', considering that bats usage of trees can be transient and varies throughout the year.

14.13.309 This impact assessment is based on impacts on the overall roost resource, not on confirmed occupation of individual trees, in accordance with relevant guidance (Ref 14.38), which states *"from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence*."

14.13.310 Noctule are a primarily tree roosting species with woodpecker holes strongly favoured although bat boxes are also used. Hibernation preferences are less clear, but it is considered that trees would be used. Serotine maternity roosts are almost exclusively located within buildings, often located in close proximity to areas of woodland, water, pasture and/or improved grassland, although solitary individuals may use trees or bat boxes. As with noctule, there is limited understanding of hibernation roosts, but it is considered likely they would remain in buildings, although they have occasionally been found hibernating underground (Ref 14.38 and Ref 14.109).

14.13.311 No evidence of serotine roosts has been identified within the site boundary. No buildings or associated roost features would be directly lost due to site clearance and therefore serotine is not considered further in this assessment of the impacts of roost loss.

14.13.312 **Table 14.35** details the type and extent of woodland loss that would occur during the establishment of the site. No identified noctule roosts are located within areas of woodland to be lost. Of the trees to be lost, a relatively small number of trees have been identified as having moderate or higher suitability for roosting bats. Some of these trees are likely to be suitable for roosting noctule. The impact of this habitat loss would occur over the duration of the construction period (9-12 years). The loss of these elements of the tree woodland resource would effectively be permanent. Roost loss is therefore of a medium magnitude of impact

14.13.313 Survey results indicate that noctule are unlikely to be roosting within the site in large numbers, or breeding within the site. Significant numbers of hibernating individuals are also thought to be unlikely (though they may hibernate in small groups) (Ref. 14.1). As with other tree-roosting bats, regular roost switching has also been observed. These species therefore have a low sensitivity to this impact.

14.13.314 The principal of avoidance of tree loss has been embedded into the proposed construction layout and areas contributing to the wider noctule bat roost resource (i.e. identified roosts and surrounding trees) have been retained where possible. However, a small proportion of trees identified as suitable for supporting roosting bats within the EDF Energy estate, which may be suitable for noctule, would be lost.

14.13.315 **Table 14.36** presents a high-level assessment of the number of trees with medium, high or very high roosting potential likely to be impacted by the removal of woodland areas across the site. These tree numbers are taken from surveys conducted on the site reported in **Appendix 14A8 – Bats** of this volume. It is considered that these are sufficient to assess the likely impact upon roost resources within this ES (Doc Ref. Book 6).

14.13.316 Of the trees to be lost, a number of trees were identified as having moderate or higher suitability for roosting bats (current surveys suggest <100).

14.13.317 Measures to ensure that no roosts are present within these features prior to felling and suitable mitigation and compensation is outlined in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.318 For each tree to be removed, there will be provision of new roosting features (bat boxes erected on retained trees). This provision is specified within the Bat Mitigation Strategy (**Appendix 14C1A** of this volume). Provision of a bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm is also proposed, as presented in the Bat Mitigation Strategy. The locations of these areas are also presented in the Bat Mitigation Strategy.

14.13.319 Given the absence of confirmed noctule roost loss, the relatively small proportion of trees to be lost that have the potential to support roosting bats and the presence of alterative suitable roost habitat within the ZoI, it is considered unlikely that establishment of the site would significantly reduce the overall tree roost resource available for noctule.

14.13.320 Overall, the impact of roost loss on the noctule and serotine populations would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat loss – foraging

14.13.321 The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of foraging habitat (the temporary functional loss of foraging habitat (i.e. avoidance and/or displacement as a result of disturbance) is covered as a separate impact).

14.13.322 **Table 14.56** summarises the habitat types to be lost and the proportion of the total area lost within the wider EDF Energy estate that these habitat types account for. These areas differ in their value to noctule and serotine bat, which can use a wide range of habitats. Both species are 'open-adapted', regularly foraging in open areas. Noctule also regularly use woodland habitats, with a preference for broadleaved woodland and pasture shown. Serotine are often associated with pasture and parkland. These species therefore have a low sensitivity to this impact (Ref 14.38 and Ref 14.109).

Table 14.56: Habitat loss for noctule and serotine

Habitat Type	Area/length to be lost	Proportion of total EDF Energy estate area/length lost	Proportion of CSZ (4km radius)
Arable, improved and amenity grassland	123.3ha	33.9%	2.5%
Semi-improved grassland	36.3ha	9.7%	0.7%
Plantation woodland (inc. coniferous and mixed)	39.4ha	10.5%	0.8%
Semi-natural broadleaved woodland	7.2ha	1.9%	0.1%
Water (running)	670m	N/A	Unknown
Swamp and marsh	4.3ha	1.3%	0.1%
Hedgerows	0m	N/A	Unknown
Scrub, bracken and ruderals	1.2ha	0.3%	<0.1%
Dune and shingle	1.2ha	0.3%	<0.1%
Built-up and hard standings	0ha	0.0%	<0.1%
Total habitat areas excluding arable, improved and amenity grassland	**89.6**	**23.9%**	**1.8%**

14.13.323 Despite the greater ability of both noctule and serotine to forage in open areas, arable, improved and amenity grasslands and built-up areas are still considered to be of sub-optimal value for foraging due to limited prey availability; however, much of the remaining habitat to be lost is potentially suitable, to varying degrees. The total habitat loss within the site boundary accounts for 4.2% of the CSZ for these species. If arable, improved and amenity grasslands and built-up habitats are discounted, as being of lower value, the loss of the more valuable habitats (89.6ha) amounts of 23.9% of land within the EDF Energy estate boundary and 1.8% of land within the CSZ resulting in a low magnitude of impact.

14.13.324 The establishment of the site therefore has the potential to reduce the overall foraging resource available for noctule and serotine. The impact of this habitat loss would occur over the duration of the construction period (9-12 years).

14.13.325 While the loss of woodland would be permanent, post-construction, with the exception of the main platform footprint, the access road and the SSSI crossing that links them, much of the landscape would be restored to reflect historical use, resulting in an open acid grassland landscape with small woodland blocks linked by strengthened hedge lines and new areas of scrub and woodland planting. These habitats are located within the CSZ for these species. Furthermore, habitat creation within the mitigation areas at Aldhurst Farm, the marsh harrier habitat improvement area and the reptile receptor areas at Sizewell Gap would provide additional foraging areas within the CSZ. Habitat creation and restoration would provide a resource of equivalent or greater foraging value than that currently provided by the majority of habitats present within the site boundary.

14.13.326 As the habitats which would be lost consist largely of sub-optimal (arable) foraging habitat, the evidence that noctule and serotine would use a wide range of habitats, the presence of suitable alternate foraging habitat within the ZoI and the ongoing establishment of habitat areas as advanced mitigation, indicates that the loss is unlikely to significantly reduce the overall foraging resource available for either species.

14.13.327 Overall, the impact of foraging habitat loss on the noctule and serotine bat populations would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.13.328 The establishment of the proposed development would result in direct habitat loss, which could result in the isolation of areas currently used by bats. This effect would be temporary and reversible but would persist for the duration of the construction period.

14.13.329 Both species are “open-adapted”, thereby having a reduced sensitivity to gaps within the landscape and less reliance on linear features (Ref 14.38 and Ref 14.109). Both species have been shown to use a wide range of habitats within the site.

14.13.330 While both species have CSZs of 4km, maximum recorded foraging distances for both species are considerably further (over 10km recorded (Ref. 14.70). As such, both species would be capable of regularly undertaking the more circuitous route around the site to reach unaffected parts of the landscape. However, due to the ability of these species to navigate open landscape, the considerably more open landscape resulting from construction phase habitat loss may not act as a barrier to movement. As such, this impact would be of very low magnitude, with noctule and serotine having a very low sensitivity. Nonetheless, the influence of disturbance impacts (including noise and lighting) as detailed below may affect the use of these areas, albeit for a small number of individuals.

14.13.331 To mitigate the impacts of severance, the SSSI crossing, linking Goose Hill to the main platform, would be designed to promote connectivity between habitats to the north and south of the construction footprint. The crossing has been designed to include a culvert of suitable dimensions for use by bats to enable east-west movement whilst scrub planting along the embankment margins would help to facilitate north-south movements. Further details are provided in the Bat Mitigation Strategy **Appendix 14C1A** of this volume**.**

14.13.332 It is therefore considered unlikely that significant fragmentation of these populations would occur. Overall, the impact of habitat fragmentation on the noctule and serotine populations would have a **negligible adverse** effect, which is considered to be **not significant**.

Disturbance from noise

14.13.333 This section of the **ES** (Doc Ref. Book 6) discusses the potential impacts from noise upon noctule and serotine bats resulting from the development, within the Construction Phase.

14.13.334 It is assessed that the impact from the operation of the site will be negligible, with the only likely change in noise impacts upon bats being from the Green Rail Route and main vehicular access to the site. Impacts form the Green Rail Route to the west of the site boundary are discussed in **Volume 9 Chapter 7** of the **ES** (Doc Ref. Book 6).

14.13.335 The construction of the proposed development will result in an increase in noise within the site boundary and adjacent areas. Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. The level (intensity), timing and duration of high frequency noise will be variable, depending on the nature of the construction activity. It is expected that noise levels will decrease over the course of the overall construction programme, with Phase 1 having the highest predicted noise levels.

14.13.336 There is potential for impacts on Noctule and serotine bats resulting from noise associated with construction due to the location of the proposed development between woodland areas which are of importance to this species, and also due to the scale and duration of the construction phase.

14.13.337 Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence on site during construction. Noctule and serotine bats could be affected in the following ways:

- disturbance to roosting noctule bats in adjacent areas of woodland causing delayed emergence, increased activity within the roost or, at higher intensity, roost abandonment;
- disturbance to foraging bats, through a masking effect impacting the ability of bats to echolocate; and
- disturbance to commuting bats, through displacement of bats from perceived 'noisy' areas.

Similar to barbastelle, noctule and serotine bats' hearing is most sensitive to frequencies at and above the upper end of the human hearing range (8 kHz and above). These species do not employ passive listening during foraging, have loud calls and noctules are less dependent on linear feature for use as commuting routes than other UK bat species, so are likely to be less susceptible to masking effects or fragmentation from construction noise.

14.13.338 Noctule bat is a high-flying species with very loud echolocation calls, and is less dependent on linear vegetation for commuting than other UK bat species. Serotine bat is, like the UK pipistrelle species, regularly recorded commuting and foraging in areas with higher levels of human disturbance, compared to barbastelle or Natterer's bats, and so it is likely that both species relatively are less susceptible to disturbance from construction site noise.

14.13.339 The evidence available indicates that roosting noctule and serotine bats could reasonably be expected to tolerate noise levels of 60 dB (at 8 Khz and above) without showing evidence of disturbance, and this therefore represents a precautionary threshold for assessment of noise impacts on roosting bats. It is assumed that hibernating bats will not be disturbed by high frequency noise.

Setting Thresholds for impacts

14.13.340 This section of the **ES** (Doc Ref. Book 6) outlines the thresholds utilised to assess likely impacts in relation to noise. Within this section the assessment is split into impacts upon bat species whilst a) roosting and b) commuting and foraging. The source data used for this assessment is that used for barbastelle and so is not repeated here.

Potential Roosting Disturbance

14.13.341 No roost sites have been confirmed for either species on or close to the construction site, and activity assessments showed it was unlikely that these species were present in the vicinity of the site. Therefore, impacts on roosting bats are considered unlikely.

14.13.342 However, there would be losses of tree groups or areas considered to be a 'roost resource' which are likely to support roosting bats. Measures to ensure that any new or previously unidentified roosts within this resource are identified and mitigated are proposed within this **ES** (Doc Ref. Book 6) and the associated Bat Mitigation Strategy (**Appendix 14C1A** of this volume). This includes the provision of bat roosting boxes, the number of which are to be provided will be based upon the number of potential roosting features lost due to the tree removal.

14.13.343 On the basis of the evidence outlined within the barbastelle assessment above, the following is inferred:

- Areas subject to noise levels at or below 40dB (at 8 kHz) are not considered likely to have any effect on roosting bats, and in fact 100% of roosts within the wider study area are subject to an existing background level of noise above 40dB (assessed using data in the noise chapter of this **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration.**
- Noise levels between 40-60dB (at 8 kHz) may have the potential to affect roosting bats. However, the limit evidence is conflicting regarding roosting bats and noise. Several studies have shown the ability of bats to be habituated to noise within these parameters and tolerate even higher noise levels so noise levels up to and including 60dB are not considered likely to have a significant adverse impact;
- Again, the literature is limited, but noise exceeding 60dB (at 8 kHz) may delay emergence and/or cause abandonment. This level of noise will be used a threshold for potential disturbance within this assessment.

14.13.344 The evidence available indicates that roosting bats could reasonably be expected to tolerate noise levels above 60 dB (at 8 Khz and above) without showing evidence of disturbance, and this therefore represents a very precautionary threshold for assessment of potential noise impacts on roosting bats. It is assumed that hibernating bats will not be disturbed by high frequency noise.

Potential Foraging/ Commuting Disturbance

14.13.345 The evidence available indicates that noise levels above 65 dB (at 8 kHz) may have the potential to affect foraging and commuting bats. In the absence of other evidence this provides a basis on which to assess the impact of high frequency noise on commuting and foraging noctule and serotine, although this is likely to represent a precautionary approach given that these species do not use passive listening. The majority of noise disturbance studies on bats relate to traffic noise. Some evidence relates to echolocating bats e.g. the Brazilian free-tailed bat, a species which also uses low frequency echolocation calls like noctule and serotine. However, none specifically have been conducted in relation to these species.

14.13.346 High frequency noise modelling for construction Phases 1 and 2 assumes a 5m noise barrier along site boundaries but no other boundary treatments such as buffer zones or soil bunds. Current proposals presented in **Chapter 11** of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, predominantly to minimise noise to marsh harriers to the north and an earth bund along the north of Kenton Hills. However, it should be noted that both these bat species may roost and forage more than 5m above ground level, and if doing so are not likely to be screened from the construction area by these boundary treatments. As for barbastelle, the modelling has used a height of 10m above ground level for the assessment.

14.13.347 Based on the evidence outlined in the barbastelle section above, the following is inferred:

- Areas subject to noise levels at or below 50dB (at 8 kHz) are not considered likely to have any effect on foraging and/or commuting activities;
- Noise levels between 50-65dB (at 8 kHz) may have the potential to affect foraging and commuting bats. However, the literature is varied and there is evidence to suggest that bats will become habituated to noise within these parameters significant as several studies have shown the ability of bats to habituated to noise within these parameters and tolerate even higher noise levels;
- The evidence suggested that noise exceeding 65dB (at 8 kHz) may disturb bats, result in noise avoidance and/ or reduced foraging efficiency. This level of noise will be used a threshold for potential disturbance within this assessment.

Assessment of noise levels resulting from the construction phase of the development

14.13.348 Noise modelling was used to assess the likely noise level increase at sensitive locations across the development during the peak noise periods of the works. Within this **ES** (Doc Ref. Book 6) chapter, high-frequency noise modelling is utilised to inform the impact assessment. This is detailed in full in the barbastelle section above.

Roosts

14.13.349 Based on locations of areas with a significant roost resource (i.e. trees with potential to be used as roosts), modelling of high frequency noise (above 60 dB) predicts potential impacts on noctule bats in the following locations presented in **Table 14.57**. It is considered unlikely that roosting serotine bats would be affected, as surveys did not identify any roosts adjacent to or within the construction area. The locations of these areas are presented on with the roosts overlaid on the noise contour plans in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.57: Noctule roost / potential roost locations with predicted noise levels

dB at 8 kHz	Within Order Limits	Outside Order Limits
Below 60 dB	None	**Kenton Hills/ Fiscal Policy complex/ Nursery Covert** – woodland resource 50m beyond site boundary
		Theberton House – unidentified building with confirmed serotine roost
		The Grove – woodland resource
Above 60 dB	**Kenton Hills/ Fiscal Policy/ Nursery Covert** - (northern boundary) woodland resource & confirmed noctule roost in bat box	**Ash Wood** – (southern, western & northern boundaries) woodland resource
	Grimseys – (southern end) woodland resource	
	Goose Hill – woodland resource	

14.13.350 There is considerable variation between these areas in the duration of noise impacts predicted, both as individual noise events (associated with a particular construction activity) and their duration within the construction period.

14.13.351 In summary, four Noctule roost areas were identified which may experience disturbance above the 60dB precautionary limit.

Commuting and foraging

14.13.352 Based on identified commuting and foraging areas for noctule and serotine bats, modelling of high frequency noise (above 65 dB) predicts impacts on these species in the following locations, during Phase 1, as presented in **Table 14.58**. The locations referred to in this section are presented on the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.58 Noctule and serotine foraging/ commuting areas with predicted noise levels

d) at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 65 dB	N/A	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – remaining woodland complex

d) at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
		approximately 50m beyond development site boundary
		The Grove – commuting route north from Goose Hill.
Above 65 dB	**Upper Abbey Bridleway and Fiscal Policy Junction** – north-south commuting route	**Leiston Old Abbey** – woodland foraging area
	Black Walks – north-south commuting route between Ashwood & Minsmere	**Ash Wood** – woodland foraging area
	Goose Hill – (eastern boundary) east-west commuting and foraging	
	Kenton Hills (Northern boundary) – east-west commuting and foraging area.	
	Stonewall Belt – north-south commuting route between Ashwood & Hilltop Covert	
	SSSI crossing – north-south commuting route & foraging area	

14.13.353 In summary, seven key foraging and commuting areas were identified that were considered to have the potential to experience noise above 65dB. The sections below describes key impacts to these areas and the disturbance these areas are likely to receive.

14.13.354 A number of areas will receive impacts from the construction and operation of the rail extension route. The impacts from the Green Rail Route, west of the main development site boundary, are discussed in the **Volume 9 Chapter 7** of the **ES** (Doc Ref. Book 6).

14.13.355 Most of Upper Abbey bridleway would be subject to noise levels above 65 dB (at 8kHz and above) during Phases 1 and 2 of construction (years 1 – 4, therefore four active seasons for bats).

14.13.356 With regards to Kenton Hills, noise levels will drop fairly rapidly with distance from the construction site, much of Kenton Hills will remain undisturbed. Black Walks adjoins a borrow pit area and will therefore only be affected during Phases 1 and 2 of construction.

14.13.357 Of the potential alternative commuting routes, The SSSI crossing will be subject to high levels of construction noise during Phase 1 (above 65 dB at 8 kHz and above), however, this is likely to reduce to noise levels below the identified threshold (at up to 50 dB at 8 kHz and above) for the remainder of the construction period. Similarly, the eastern edge of Goose Hill will be subject to high levels of noise (above 65 dB at 8 kHz and above) during construction of the Water Management Zone in this area during Phase 1, however, noise levels will reduce to 30 dB (at 8 kHz and above) or less during the remaining phases. Ash Wood would be subject to high levels of construction noise in Phases 1 and 2 and will likely reduce to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

14.13.358 The foraging habitat around Leiston Old Abbey would be subject to continuing construction noise beyond Phases 1 and 2, due to construction and operation of the rail route extension and main vehicular access to the site, however, this is likely to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

Assessment

14.13.359 A precautionary assessment is made that without mitigation, construction site noise at 60 dB has the potential to impact roosts and at 65 dB or above (at 8 kHz and above) has the potential to affect commuting routes and foraging areas. The extent to which this will occur depends on the time of year, the intensity of the noise, its duration and location. Noctules and serotines are only likely to be affected during the active season, and if noise exceeds the respective thresholds for roosting and foraging/commuting. The duration of construction noise, both in terms of individual noise events and the proportion of the construction period during which noise will be produced in areas close to those used by bats is also variable.

14.13.360 Given the complexity of these interactions, it is assumed on a precautionary basis that roosting noctule could be disturbed in roosts on the northern edge of Kenton Hills/Fiscal Policy/Nursery Covert during the construction. It is considered unlikely that commuting and foraging noctule and serotine bats would be excluded from Upper Abbey bridleway even during any night works producing substantial noise impacts were underway in Phases 1 and 2 of construction. Bats' commuting and foraging along Black Walks, the northern edge of Kenton Hills and in Ash Wood may be affected by construction noise at 65 dB or higher, but the likely effect of this would be to displace bats further into (or, for noctule, above) these woodland areas, rather than to cause fragmentation. Potential alternative commuting routes via the SSSI crossing and eastern edge of Goose Hill would be affected during Phase 1.

14.13.361 Overall, high levels of construction noise is predicted to be restricted to Phases 1 and 2; during these phases these noise levels have the potential to temporarily displace disturb bats in roosts, commuting routes and foraging areas, potentially displacing bats, at times when high levels of noise are produced. It is not considered likely that fragmentation of habitat would occur even during Phase 1 when construction works will take place close to Upper Abbey Bridleway and at the SSSI crossing.

14.13.362 As detailed under primary mitigation (**section 4.4** of this chapter), alternative roosts and foraging areas to mitigate effects of significant construction noise on roosting and foraging bats are proposed, these are located in undisturbed locations.

14.13.363 New roosts have and will be erected across the site. These include a new structure (either bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm) in a location which would remain relatively quiet during construction and bat boxes, the number of which will be calculated to be adequate for the foreseen tree loss as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. These new roosts would provide an abundance of new roost provision. Bats are known to frequently change roosts as a component of natural behaviour (Ref 14.38 and Ref 14.109), and it is considered that the provision of these roosts provides adequate alternative roosting provision should roosts be impacted by adverse noise levels.

14.13.364 Alternative foraging and commuting areas are also being provided. The marsh harrier mitigation area as well as the multiple reptile receptor sites will provide extensive new areas of foraging habitat, these are shown in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. Furthermore, detailed monitoring of known roost locations and key foraging/commuting routes during Phase 1 and 2 would be essential to establish disturbance and potentially negative impacts e.g. roost abandonment. A description of the monitoring proposed and the potential further mitigation required is presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

14.13.365 In line with the mitigation hierarchy, all appropriate measures have been employed to avoid impacts and safeguard roosting, commuting and foraging Noctule and Serotine bats. Within the development, a suite of noise mitigation measures are proposed, the benefits of some of which (the earth bunds etc.) were not possible to incorporate within the impact assessment. The noise levels which exceed the calculated thresholds are likely to do so irregularly, and very rarely at night, and it is not possible to estimate with absolute certainty whether construction noise would (or would not) trigger an offence under the relevant wildlife legislation.

14.13.366 Natural England guidance states that, an EPS derogation licence should only be obtained as a ‘last resort’ where all other alternative ways of avoiding impacts on the species have been discounted (Ref 14.124). Multiple approaches to reduce impacts from noise have been incorporated, as outlined above and in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. In addition, Natural England does not generally grant ‘precautionary licences’ (i.e. as insurance against potential impacts). As no direct impacts to know roosts are currently foreseen with the information currently known, it is not appropriate to commit to the requirement of an EPS licence. An approach is proposed that will mean that a licence will not initially be required to facilitate the works (although this would be reviewed throughout the process). An appropriate approach to safeguarding bats and ensuring legal compliance is proposed within the Bat Mitigation Strategy **Appendix 14C1A** of this volume and Bat Method Statement **Appendix 14C1B** of this volume.

14.13.367 This approach is based upon the mitigation measures outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, combined with following a non-licenced method statement, which endeavours to reduce any impacts as far as is practicable. This method statement is presented in **Appendix 14C1B** of this volume. It should be noted however that as further information is obtained (for example through further tree assessments), the assessment of impacts to roosts may need to be updated. This may trigger the need for an EPS licence.

14.13.368 In addition, there will be monitoring of the actual noise impacts to key areas of the site for bats throughout the construction phase to determine if disturbance levels are actually likely to exceed the threshold for which a licence would be required. This would be achieved through monitoring throughout the construction process of key roosting areas and commuting and foraging areas. This will allow the potential impacts to Noctule and Serotine to be monitored and preventative measures taken if required. The monitoring will assess two key indicators:

- The noise levels actually produced by the works (monitoring as outlined in **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration**);
- The bats usage of roosts and foraging and commuting areas, as compared to the base line surveys (as reported in **ES** (Doc Ref. Book 6) **Appendix 14A8** of this volume).

14.13.369 If noise levels are deemed to be at a level that an offence is considered more likely than unlikely, or observed impacts to bats indicate an impact to roosting, two approaches can be employed to safeguard bats:

14.13.370 If noise levels are deemed to be at a level that an offence is considered likely, or observed impacts to bats indicate an impact to roosting, further mitigation would be focussed on the bat population, which could include further roost provision. If necessary, this is a juncture at which a EPS derogation licence may be triggered.

14.13.371 Overall, once the embedded mitigation and construction monitoring and mitigation approach outlined above is implemented, alongside the associated enhancements outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, the impact of construction noise on the noctule and serotine population is assessed to have a **minor adverse** effect which is considered to be **not significant**.

Disturbance from lighting

14.13.372 As detailed under barbastelle, construction lighting would increase light levels and could cause light intrusion into adjacent areas.

14.13.373 While noctule and serotine show preferences for unlit roosting locations, they are not considered to be light-adverse species in relation to foraging behaviour. Noctule would occasionally emerge before sunset although are typically recorded with a median emergence time of five minutes after sunset and have been recorded foraging around streetlighting. Serotine show similar early emerging characteristics with a medium emergence time of 20 minutes after sunset and can often be seen foraging around streetlighting (Ref 14.109 - Ref 14.113).

Roosts

14.13.374 **Table 14.59** summarises the identified and potential roost locations for noctule within and in close proximity to the site boundary, and the anticipated surrounding light conditions.

Table 14.59: Retained confirmed and potential noctule roost locations and associated construction lighting levels

Roost Area (roost type)	Nature of Works and Anticipated Lighting Levels
Kenton Hills (confirmed).	Outside the site boundary but adjacent to temporary construction area. An area of no fixed lighting approximately 30m wide containing a five-metre bund would provide some screening from lighting, with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
North of Nursery Covert (potential).	Outside the site boundary but adjacent to temporary construction area. An area of no fixed lighting approximately 30m wide containing a five-metre bund would provide some screening from lighting, with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
Near Ash Wood (potential).	Outside the site boundary but immediately adjacent to stock-piling areas to the north, west and south-west, lit up to 50 lux during active working, but without ambient lighting. To the south the temporary construction area would have lighting up to 200 lux.
The Grove (potential).	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Eastern Goose Hill (potential).	Within the site boundary within the temporary construction area. Habitat in this location would largely be lost during the establishment of the proposed development. Lighting levels would range from 5-200 lux.

Roost Area (roost type)	Nature of Works and Anticipated Lighting Levels
Leiston Old Abbey woodland (potential).	Outside the site boundary but adjacent to the proposed site entrance which would be lit to a maximum of 100 lux, although an area of no fixed lighting is located between the two areas.
Grimseys (potential).	Outside the site boundary but adjacent to the site at the south-eastern extent. This area would have ambient lighting to 20 lux and task specific lighting to 200 lux.

14.13.375 As detailed under barbastelle, construction lighting has the potential to reduce the overall roost resource available to noctule. The impact of this lighting disturbance would occur over the duration of the construction period (9-12 years).

Foraging

14.13.376 **Table 14.60** summarises the key noctule and serotine foraging areas that would be retained, but that may experience lighting disturbance from the proposed development, along with details of the likely surrounding construction phase lighting levels.

Table 14.60: Retained noctule and serotine foraging areas and associated construction lighting levels

Foraging area	Nature of Works and Anticipated Lighting Levels
Black Walks.	Outside of the site boundary but to the west adjacent to the proposed stock piling area anticipated to have no ambient lighting but task specific lighting levels of 5-50 lux.
The Grove.	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Goose Hill – Eastern edge.	Within the site boundary within the temporary construction area. Habitat in this location suitable for barbastelle would largely be during establishment of the proposed development. Ambient lighting levels would range from 5-20 lux with task-specific lighting up to 200 lux.
Goose Hill – wet grassland to east.	Outside the site boundary but adjacent to the temporary construction area, which would be lit to a maximum of 200 lux.
Leiston Old Abbey woodland.	Outside the site boundary but adjacent to the proposed site entrance which would be lit to a maximum of 100 lux, although an area of no fixed lighting is located between the two areas.
Reckham Pits Wood.	Outside the site boundary and not adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.

14.13.377 As opportunistic users of lit foraging areas, the impacts of increased lighting on noctule and serotine would be limited and such areas would not be entirely lost to them. In addition, as species that take a wide range of prey items they are also better able to adapt to changes in prey distribution by making use of other prey species available as well as using the lit areas that insect prey may be drawn to.

Commuting

14.13.378 The flight strategies used by noctule and serotine indicate a limited reliance on linear features and a willingness to cross open areas and, in line with this, no specific commuting routes were identified within the site.

14.13.379 However, while both species would opportunistically use lit foraging areas, serotine demonstrate light-adverse behaviour when commuting (Ref 14.38 and Ref 14.109). When commuting, the light adverse behaviour demonstrated by serotine, and the potential for similar behaviour in noctule, indicate that lighting disturbance could result in a habitat fragmentation effect. The impact of lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase.

Assessment

14.13.380 Details of the primary mitigation (**section 14.4** of this chapter) include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).

14.13.381 Given the duration of the construction phase and the sensitivity of noctule and/or serotine to lighting in relation to roosts and commuting, there is the potential for increased lighting to reduce the ability of both species to use the roost resource within the site and result in a habitat fragmentation effect. The ability of both species to use lit areas when foraging means it is considered that increased lighting would not significantly impact their ability to forage within the site. Therefore, this impact would be of a low magnitude with noctule and serotine having a medium sensitivity to this impact.

14.13.382 Overall, the impact of lighting on the noctule and serotine populations would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle

14.13.383 Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle are grouped together as an IEF due to their shared commonality and contribution to the overall bat assemblage within the ZoI.

14.13.384 During construction, the main impact pathways experienced by this IEF would be associated with:

- habitat loss;

- habitat fragmentation (including connectivity); and
- disturbance from lighting and noise.

14.13.385 The characterisation of the above impacts is described in detail below.

Habitat loss – roosts

14.13.386 No roosts identified to date will be directly lost as a result of the development. The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of confirmed and potential roosts (the temporary functional loss of roosts (i.e. abandonment as a result of disturbance) is covered as a separate impact).

14.13.387 However, there would be losses of tree groups or areas considered to be a 'roost resource' which are likely to support roosting bats. Measures to ensure that any new or previously unidentified roosts within this resource are identified and mitigated are proposed within this **ES** (Doc Ref. Book 6) and the associated Bat Mitigation Strategy (**Appendix 14C1A** of this volume). This includes the provision of bat roosting boxes, the number of which are to be provided will be based upon the number of potential roosting features lost due to the tree removal.

14.13.388 This impact assessment is based on impacts on the overall roost resource, not on confirmed occupation of individual trees, in accordance with relevant guidance (Ref 14.38), which states *"from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence*."

14.13.389 Daubenton's bat maternity roosts primarily occur in trees with a preference for features such as rot holes, woodpecker holes and narrow cracks within broadleaved and riparian woodland. A preference for trees on woodland edges or close to glades or trails has been noted, with regular roost switching occurring. Bat boxes and more rarely buildings would also be used. Hibernation primarily occurs underground although trees may occasionally be used (Ref 14.38 and Ref 14.109). There is no evidence for the presence of significant numbers of Daubenton's bat roosting within the site boundary although small numbers cannot be ruled out. A single Daubenton's bat was recorded hibernating within Upper Abbey Farm.

14.13.390 Brown long-eared bat use trees, buildings and bat boxes during Summer months, often within or in close proximity to broadleaved woodland. As with other tree-roosting species, regular roost switching occurs. Hibernation occurs underground (Ref 14.38 and Ref 14.109). Brown long-eared bat maternity roosts have been identified within Ash Wood Cottages and Upper Abbey Farm buildings, with hibernating individuals recorded within a bunker and a probable brown long-eared bat within Upper Abbey Farm as well as occasional roosts in outbuildings associated with Upper Abbey Farm. There is considered to be the potential for additional roosts within woodland at The Grove.

14.13.391 Common pipistrelle and soprano pipistrelle Summer roosts occur primarily within buildings although occasional use of bat boxes, and more rarely trees is known . The location of most hibernation roosts is unclear but common pipistrelle have occasionally been found in buildings or underground, while soprano pipistrelle have been recorded using buildings, trees and bat boxes (Ref 14.38 and Ref 14.109). Early evening capture of pregnant soprano pipistrelle suggests the presence of a maternity roost within or in close proximity to the site boundary, as well as a confirmed maternity colony of 70 soprano pipistrelle that was identified within a bat box in Kenton Hills. Occasional use of outbuildings at Upper Abbey Farm has been recorded for both common and soprano pipistrelle with Plantation Cottage and the surrounding habitat also considered to have the potential to support a roost.

14.13.392 No buildings would be lost to the proposed development. This section therefore focusses on tree loss. It is considered to be likely that roosts of Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle within trees will be lost to the development.

14.13.393 **Table 14.36** above presents a high-level assessment of the number of trees with medium, high or very high roosting potential likely to be impacted by the removal of woodland areas across the site. These tree numbers are taken from surveys conducted on the site reported in **Appendix 14A8 – Bats** of this volume. It is considered that these are sufficient to assess the likely impact upon roost resources within this **ES** (Doc Ref. Book 6).

14.13.394 Of the trees to be lost, a number of trees were identified as having moderate or higher suitability for roosting bats (current surveys suggest <100).

14.13.395 Measures to ensure that no roosts are present within these features prior to felling and suitable mitigation and compensation is outlined in the Bat Mitigation strategy of this **ES** (Doc Ref. Book 6) (**Appendix 14C1A** of this volume).

14.13.396 For each tree to be removed, there will be provision of new roosting features (bat boxes erected on retained trees). This provision is specified within the Bat Mitigation Strategy (**Appendix 14C1A** of this volume). Provision of a bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm is also proposed, as presented in the Bat Mitigation Strategy. The locations of these areas are also presented in the Bat Mitigation Strategy.

14.13.397 **Table 14.35** details the type and extent of woodland loss that would occur during the establishment of the proposed development. No confirmed tree roosts would be lost. However, of the trees to be lost, a relatively small number of trees have been identified as having moderate or higher suitability for roosting bats. Some of these trees are likely to be suitable for roosting Daubenton's bat, brown long-eared bat, and common or soprano pipistrelle resulting in a low magnitude of impact. The impact of this habitat loss would occur over the duration of the construction period (9-12 years). The loss of these elements of the tree woodland resource would effectively be permanent.

14.13.398 As with other primarily tree-roosting species, Daubenton's bat and brown long-eared bat display regular roost-switching behaviour, and as such the impacts would be similar to those described above for other tree roosting species (i.e. barbastelle and Natterer's bat). Given the roost preferences detailed above common and soprano pipistrelle are likely to experience a more limited impact from the loss of a proportion of the woodland roost resource. As such these species would have a low sensitivity to this impact.

14.13.399 The principal of avoidance of building demolition and tree loss has been embedded into the proposed construction layout and areas contributing to the wider roost resource have been retained as far as possible. However, a proportion of trees identified as suitable for supporting roosting bats within the EDF Energy estate (some but not all of which would be suitable for a range of roost types of these species) would be lost.

14.13.400 Given the absence of confirmed tree roosts for these species within the areas to be lost, the limited extent of optimal tree roost resource loss and the presence of alternative suitable roost habitat within the CSZs[25],combined with the proposed bat box provision, it is considered unlikely that the establishment of the site would significantly reduce the overall tree roost resource available.

14.13.401 Overall, the impact of roost loss on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle populations would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat loss – foraging

14.13.402 The establishment of the site would result in direct habitat loss, which is likely to result in the direct loss of foraging habitat (the temporary functional loss of foraging habitat (i.e. avoidance and/or displacement as a result of disturbance) is covered as a separate impact).

[25] 3km brown long-eared bat and soprano pipistrelle and 2km for Daubenton's bat and common pipistrelle.

14.13.403 **Table 14.61** summarises the habitat types due to be lost and the proportion of the total area lost within the wider EDF Energy estate boundary that these habitat types account for. These areas differ in their value to the species covered in this IEF. Common pipistrelle, soprano pipistrelle and Daubenton's bat all show flexible foraging habitat requirements . Common pipistrelle occur in most habitats, though would avoid more open areas and show a preference for woodland and water when available. Soprano pipistrelle, while also found in most habitats, show a strong associations with riparian habitats. More limited use is made of areas of farmland, including improved grassland and arable. Similarly most Daubenton's bat foraging occurs over water, with riparian treelines and woodland paths also occasionally used. Brown long-eared bat use a range of woodland habitats, with more open areas, including around large trees and hedgerows are also used (Ref 14.38 and Ref 14.109).

Table 14.61: Habitat loss for Daubenton's bat, brown long-eared bat, common and soprano pipistrelle

Habitat Type	Area/length to be lost	Proportion of total EDF Energy estate area/length lost	Proportion of CSZ (3km radius/2km radius)
Arable, improved and amenity grassland	123.3ha	33.9%	4.4%/9.8%
Semi-improved grassland	36.3ha	9.7%	1.3%/2.9%
Plantation woodland (inc. coniferous and mixed)	39.4ha	10.5%	1.4%/3.1%
Semi-natural broadleaved woodland	7.2ha	1.9%	0.3%/0.6%
Water (running)	670m	N/A	Unknown
Swamp and marsh	4.3ha	1.3%	0.2%/0.3%
Hedgerows	0m	N/A	Unknown
Scrub, bracken and ruderals	1.2ha	0.3%	<0.1%/0.1%
Dune and shingle	1.2ha	0.3%	<0.1%/0.1%
Built-up and hard standings	0ha	0.0%	0%/0%
Total habitat areas excluding arable, improved and amenity grassland	**89.6ha**	**23.9%**	**3.2%/7.1%**

14.13.404 As noted for the bat species above, both arable and built-up land are considered to be of sub-optimal value for these species due to the limited prey these habits typically provide, though improved and amenity grasslands may provide foraging opportunities for common and soprano pipistrelles.

Activity from these species was recorded throughout the site; in particular, for common pipistrelle, soprano pipistrelle and brown long-eared bat. Most areas surveyed by static detectors met the criteria for a "bat hotspot"[26] on at least one occasion, often largely on the basis of the amount of common pipistrelle and soprano pipistrelle activity. These species therefore have a low sensitivity to this impact.

14.13.405 The total habitat loss within the site boundary accounts for 7.6% of the 3km CSZ for brown long-eared bat and soprano pipistrelle and 16.9% of the 2km CSZ for Daubenton's bat and common pipistrelle. If arable and built-up habitats are discounted as being of lower value, the loss of the more valuable habitats (89.6ha) amounts to 23.9% of land within the EDF Energy estate boundary and 3.2% (3km CSZ) and 7.9% (2km CSZ) of land within the CSZ.

14.13.406 The establishment of the site therefore has the potential to reduce the overall foraging resource available for these species. The impact of this habitat loss would occur over the duration of the construction period (9-12 years). While the loss of woodland would be permanent, post-construction, much of the landscape would be restored to and landscape of acid grassland with additional areas of trees and scrub, as detailed in barbastelle. Furthermore, additional habitat creation, as detailed under barbastelle, outside the site boundary, would provide a resource of equivalent or greater foraging value than that currently provided by the majority of habitats present within the site boundary.

14.13.407 Due to the habitats being lost consisting largely of sub-optimal (arable) foraging habitat, the flexible foraging habits of these species and the presence of suitable alternate foraging habitat within the respective CSZs and the ongoing establishment of habitat areas as advanced mitigation, this loss is considered unlikely to significantly reduce the overall foraging resource available for these species.

14.13.408 Overall, the impact of foraging habitat loss on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.13.409 The establishment of the proposed development would result in direct habitat loss, which could result in the isolation of areas currently used by bats. This effect would be temporary and reversible but would persist for the duration of the construction period.

[26] A bat hotspot is defined as a location where the overall bat activity (i.e. mean passes per night for a single recording season from all species combined) exceeded 300.

14.13.410 All four species demonstrate a reliance on linear features when commuting, with large, open spaces, such as grassland and farmland, typically continuing limited linear features, often avoided (Ref 14.38 and Ref 14.109). No evidence of Daubenton's bat commuting routes was identified; however, it is likely that insufficient numbers are roosting in close enough proximity for such routes to be notable. Brown long-eared bat is considered likely to use Stonewall Belts to commute south from a known roost in Ash Wood Cottages and are likely to use Ash Wood to commute to habitats north of this roost. Commuting is considered to account for a proportion of the common and soprano pipistrelle activity recorded along the Upper Abbey Bridleway and the track at the northern edge of Kenton Hills. The Upper Abbey Bridleway, Kenton Hills track and Ash Wood would be retained, although may be subject to disturbance impacts as detailed below. Stonewall Belts would be lost.

14.13.411 The loss of Stonewall Belts would limit the ability of brown long-eared bat to access habitats to the south of Ash Wood Cottages. Continued movement to habitats in the south would require a more circuitous route either via the Upper Abbey Bridleway (which would require crossing an area of open arable land), or east along the edge of the site to the SSSI crossing at the south-eastern corner of Goose Hill. More broadly, the habitat loss during construction would result in a considerably more open landscape than is currently present with flight-lines between the north and south being disrupted. These species have been recorded using habitats to both the north and south of the site. Given the limited use of open spaces by these species and their reliance on linear features for commuting the open landscape through the centre of the EDF Energy estate is likely to act as a long-term limitation to movement resulting in a medium magnitude of impact.

14.13.412 Given the comparatively small CSZs for these species, it is unlikely that notable numbers of individuals of these species would regularly undertake these more circuitous routes, and therefore colonies may be displaced to one side of the site, limiting access to a proportion of their retained habitat and areas of habitat enhancement (or divided into sub-groups). In the short term, increased competition may be experienced between individuals, which may result in increased energy expenditure and a subsequent reduction in productivity. However, although movement through the site is likely to be restricted by the proposed works, particularly the presence of the temporary construction area, it is considered unlikely that fragmented populations would experience genetic isolation as the majority of Daubenton's bat and brown long-eared bat are likely to visit swarming sites outside the site, while significant isolation of these common and soprano pipistrelle is considered unlikely due to the widespread distribution of these species across the UK and Suffolk. These species are therefore considered to have medium sensitivity to this impact.

14.13.413 To mitigate the impacts of severance, the SSSI crossing, linking Goose Hill to the main platform, would be designed to promote connectivity between habitats to the north and south of the construction footprint. The crossing has been designed to include a culvert of suitable dimensions for use by bats to enable east-west movement whilst planting along the embankment margins would help to facilitate north-south movements. Details of this structure are presented in the Bat Mitigation Strategy.

14.13.414 Although the construction phase would last 9-12 years, and these species show a reliance on linear features for commuting, they also show flexibility in habitat use and are widely distributed.

14.13.415 Overall, the impact of habitat fragmentation on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle would have a **minor adverse** effect, which is considered to be **not significant**.

Disturbance from noise

14.13.416 This section of the **ES** (Doc Ref. Book 6) discusses the potential impacts from noise upon Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats resulting from the development, within the Construction Phase.

14.13.417 It is assessed that the impact from the operation of the site will be negligible, with the only likely change in noise impacts upon bats being from the rail route extension and main vehicular access to the site. Impacts form the Green Rail Route, west of the site boundary are discussed in Volume 9 Chapter 7.

14.13.418 The construction of the proposed development will result in an increase in noise within the site boundary and adjacent areas. Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. The level (intensity), timing and duration of high frequency noise will be variable, depending on the nature of the construction activity. It is expected that noise levels will decrease over the course of the overall construction programme, with Phase 1 having the highest predicted noise levels.

14.13.419 There is potential for impacts on Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle resulting from noise associated with construction due to the location of the proposed development between woodland areas which are of importance to this species, and also due to the scale and duration of the construction phase.

14.13.420 Noise disturbance may arise through construction activities (such as noise from machinery), increased vehicle movements and increased human presence of site during construction. These species could be affected in the following ways:

- disturbance to roosting bats in adjacent areas of woodland or buildings causing delayed emergence, increased activity within the roost or, at higher intensity, roost abandonment;
- disturbance to foraging bats, through a masking effect impacting the ability of bats to echolocate; and
- disturbance to commuting bats, through displacement of bats from perceived 'noisy' areas.

14.13.421 Similar to barbastelle, Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats hearing is likely to be most sensitive to frequencies at and above the upper end of the human hearing range (8 kHz and above). Of these, brown long-eared bats employ passive listening during foraging and may therefore be more susceptible to masking effects of construction noise than the other three species.

14.13.422 The evidence available indicates that roosting Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats could reasonably be expected to tolerate noise levels up to 60 dB (at 8 kHz) without showing evidence of disturbance, and this therefore represents a precautionary threshold for assessment of noise impacts on roosting bats. It is assumed that hibernating bats will not be disturbed by high frequency noise.

Setting Thresholds for impacts

14.13.423 This section of the **ES** (Doc Ref. Book 6) outlines the thresholds utilised to assess likely impacts in relation to noise. Within this section the assessment is split into impacts upon bat species whilst a) roosting and b) commuting and foraging. The source data used for this assessment is that used for barbastelle bat, and it is as such not repeated here.

14.13.424 **Potential Roosting Disturbance** On the basis of the evidence outlined in full within the barbastelle section the following is inferred:

- Areas subject to noise levels at or below 40dB (at 8 kHz) are not considered likely to have any effect on roosting bats, and in fact 100% of roosts within the wider study area are subject to an existing background level of noise above 40dB (assessed using data in the noise chapter of this **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration.**
- Noise levels between 40-60dB (at 8 kHz) may have the potential to affect roosting bats. However, the limit evidence is conflicting regarding roosting bats and noise. Several studies have shown the ability of bats to be habituated to noise within these parameters and tolerate even higher noise levels so noise levels up to and including 60dB are not considered likely to have a significant adverse impact;

- Again, the literature is limited, but noise exceeding 60dB (at 8 kHz) may delay emergence and/or cause abandonment. This level of noise is used a threshold for potential disturbance within this assessment.

Potential Foraging/ Commuting Disturbance

14.13.425 The evidence available indicates that noise levels above 65 dB (at 8 kHz) may have the potential to affect foraging and commuting bats. In the absence of other evidence this provides a basis on which to assess the impact of high frequency noise on commuting and foraging.

14.13.426 High frequency noise modelling for construction Phases 1 and 2 assumes a 5m noise barrier along site boundaries but no other boundary treatments such as buffer zones or soil bunds. Current proposals presented in Chapter 11 of this volume include a 5m acoustic fence around the edge of Ash Wood and along the northern edge of the construction area to the SSSI crossing, predominantly to minimise noise to marsh harriers to the north and a and an earth bund along the north of Kenton Hills.

14.13.427 The majority of noise disturbance studies on bats relate to traffic noise. Some evidence relates to Daubenton's bats, soprano pipistrelle and brown and the greater mouse-eared bat, a species which uses a similar foraging strategy to brown long-eared bats. Based on the evidence outlined above, the following is inferred:

- Areas subject to noise levels at or below 50dB (at 8 kHz) are not considered likely to have any effect on foraging and/or commuting activities;

- Noise levels between 50-65dB (at 8 kHz) may have the potential to affect foraging and commuting bats. However, the literature is varied and there is evidence to suggest that bats will become habituated to noise within these parameters significant as several studies have shown the ability of bats to habituated to noise within these parameters and tolerate even higher noise levels;

- The evidence suggested that noise exceeding 65dB (at 8 kHz) may disturb bats, result in noise avoidance and/ or reduced foraging efficiency. This level of noise will be used a threshold for potential disturbance within this assessment.

Assessment of noise levels resulting from the construction phase of the development

14.13.428 Noise modelling was used to assess the likely noise level increase at sensitive locations across the development during the peak noise periods of the works. Within this **ES** (Doc Ref. Book 6) chapter, high-frequency noise modelling is utilised to inform the impact assessment. This is detailed in full in the barbastelle section above.

Roosts

14.13.429 Based on locations of identified Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bat roosts and areas with a significant roost resource (i.e. trees with potential to be used as roosts), modelling of high frequency noise predicts a dB level above 60 in the following locations, during Phase 1, as presented within **Table 14.62**. The locations of these roosts are presented with the roosts overlaid on the noise contour plans the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.62: Potential & confirmed Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle roost locations with predicted noise level

dB at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 60 dB	None	**Kenton Hills/ Fiscal Policy complex/ Nursery Covert** – woodland resource 50m beyond site boundary & confirmed common & soprano pipistrelle roosts
		Lower Abbey Farm – Buildings 1, 2, 6, 8 & 11 – confirmed common pipistrelle and brown long-eared day roosts.
		St. Peter's Church, Theberton – confirmed Pipistrellus sp. & brown long-eared day roosts.
Above 60 dB	**Upper Abbey Farm** – Building 1, 5, 9 10 & 11 confirmed common & soprano pipistrelle and brown long-eared day roosts; brown long-eared maternity roost; Daubenton's bat, brown long-eared hibernation roosts	**Ash Wood Cottages –** confirmed brown long-eared maternity roost
	Kenton Hills/ Fiscal Policy/ Nursery Covert complex – (northern boundary) woodland resource	**Leiston Old Abbey** – confirmed *pipistrellus* sp. roost

14.13.430 There is considerable variation between these areas in the duration of noise impacts predicted, both as individual noise events (associated with a particular construction activity) and their duration within the construction period. Several of these areas will also be at risk of fragmentation, disturbance through lighting etc. (considered elsewhere in this chapter).

14.13.431 In summary, four potential & confirmed Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle areas were identified which may experience disturbance above the 60dB precautionary limit.

Commuting and foraging

14.13.432 Based on identified commuting and foraging areas for Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bat, modelling of high frequency noise (above 65 dB) predicts impacts on these species in the following locations, during Phase 1, as presented within **Table 14.63** below. The locations referred to in this section are presented the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

Table 14.63 Daubenton's bat, brown long-eared, common and soprano pipistrelle foraging/ commuting areas with predicted noise levels

dB at 8 kHz	Within Red Line Boundary	Outside Red Line Boundary
Below 65 dB	None	**Kenton Hills/ Fiscal Policy/ Nursery Covert complex** – remaining woodland complex approximately 50m beyond development site boundary
		The Grove – commuting route north from Goose Hill.
Above 65 dB	**Upper Abbey Bridleway and Fiscal Policy Junction** – north-south commuting route	**Leiston Old Abbey** – woodland foraging area
	Black Walks – north-south commuting route between Ashwood & Minsmere	**Ash Wood** – woodland foraging area
	Kenton Hills - (Northern boundary) east-west commuting and foraging area.	
	Goose Hill – (eastern boundary) used as commuting and foraging area.	
	Stonewall Belt – north-south commuting route between Ashwood & Hilltop Covert	
	SSSI crossing – north-south commuting route & foraging area	

14.13.433 In summary, eight key Daubenton's bat, brown long-eared, common and soprano pipistrelle foraging and commuting areas were identified that were considered to have the potential to experience noise above 65dB. The sections below describes key impacts to these areas and the disturbance these areas are likely to receive.

14.13.434 A number of areas will receive impacts from the construction and operation of the Green Rail Route to the west of the site boundary. The impacts from this are discussed in the appropriate chapter of the **ES** (Doc Ref. Book 6).

14.13.435 Most of Upper Abbey bridleway will be subject to noise levels above 65 dB (at 8kHz and above) during Phases 1 and 2 of construction (years 1 – 4, therefore four active seasons for bats).

14.13.436 With regards to Kenton Hills, noise levels will drop fairly rapidly with distance from the construction site, much of Kenton Hills will remain undisturbed. Black Walks adjoins a borrow pit area and will therefore only be affected during Phases 1 and 2 of construction.

14.13.437 Of the potential alternative commuting routes, The SSSI crossing will be subject to high levels of construction noise during Phase 1 (above 65 dB at 8 kHz and above), however, this is likely to reduce to noise levels below the identified threshold (at up to 50 dB at 8 kHz and above) for the remainder of the construction period. Similarly, the eastern edge of Goose Hill will be subject to high levels of noise (above 65 dB at 8 kHz and above) during construction of the Water Management Zone in this area during Phase 1, however, noise levels will reduce to 30 dB (at 8 kHz and above) or less during the remaining phases. The northern, western and southern edges of Ash Wood would be subject to construction noise above 65 dB at 8 kHz and above in Phases 1 and will likely reduce to reduce to 50 dB at 8 kHz and above) for the remainder of the construction period.

14.13.438 The foraging habitat around Leiston Old Abbey would be subject to continuing construction noise beyond Phases 1 and 2, due to construction and operation of the rail route extension and the main vehicular access to the site, however, this is likely to reduce to 50 dB (at 8 kHz and above) for the remainder of the construction period.

Assessment

14.13.439 A precautionary assessment is made that without mitigation, construction site noise at 60 dB has the potential to impact roosts and at 65 dB or above (at 8 kHz and above) has the potential to affect commuting routes and foraging areas. The extent to which this will occur depends on the time of year, the intensity of the noise, its duration and location. Natterer's bats are only likely to be affected during the active season, and if noise exceeds the respective thresholds for roosting and foraging/commuting. The duration of construction noise, both in terms of individual noise events and the proportion of the construction period during which noise will be produced in areas close to those used by bats is also variable.

14.13.440 Given the complexity of these interactions, it is assumed on a precautionary basis that roosting Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats may be disturbed in roosts on the northern edge of Kenton Hills/Fiscal Policy/Nursery Covert during the construction and operation of the rail route extension and its terminal, and from in Upper Abbey Farm and Ash Wood Cottages during Phases 1 and 2 of construction. It is assumed on a precautionary basis that commuting and foraging Daubenton's bat and brown long-eared bat would avoid Upper Abbey bridleway when night works producing significant noise were underway in Phases 1 and 2 of construction, but this is considered unlikely for common and soprano pipistrelle bats. Bats' commuting and foraging along Black Walks, the northern edge of Kenton Hills and Ash Wood may be affected by construction noise at 65 dB or higher, but the likely effect of this would be to displace bats further into these woodland areas, rather than to cause fragmentation. Potential alternative commuting routes via the SSSI crossing and eastern edge of Goose Hill would be affected during Phase 1.

14.13.441 Overall, high levels of construction noise is predicted to be restricted to Phases 1 and 2; during these phases these noise levels have the potential to temporarily disturb bats in roosts, commuting routes and foraging areas, potentially displacing bats. Overall, the proposed development therefore has the potential to temporarily displace bats from roosts, commuting routes and foraging areas at times when high levels of noise are produced, but for most of these areas except Kenton Hills/Fiscal Policy/Nursery Covert construction noise will be restricted to Phases 1 and 2 of construction. There is also potential for habitat fragmentation to occur, due to noise disturbance, particularly during Phase 1 when construction works will take place close to Upper Abbey Bridleway and at the SSSI crossing, but fragmentation is unlikely to occur as a result of noise in later phases of construction.

14.13.442 As detailed under primary mitigation (**section 4.12** of this chapter), alternative roosts and foraging areas to mitigate effects of significant construction noise on roosting and foraging bats are proposed, these are located in undisturbed locations.

14.13.443 New roosts have and will be erected across the site. These include a new structure (either bat house or equivalent mitigation within an existing structure, likely to be at Lower Abbey Farm) in a location which would remain relatively quiet during construction and bat boxes, the number of which will be calculated to be adequate for the foreseen tree loss as presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. These new roosts would provide an abundance of new roost provision. Bats are known to frequently change roosts as a component of natural behaviour (Ref 14.38 and Ref 14.109), and it is considered that the provision of these roosts provides adequate alternative roosting provision should roosts be impacted by adverse noise levels.

14.13.444 Alternative foraging and commuting areas are also being provided. The marsh harrier mitigation area as well as the multiple reptile receptor sites will provide extensive new areas of foraging habitat and these are shown in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. Furthermore, detailed monitoring of known roost locations and key foraging/commuting routes during Phase 1 and 2 would be essential to establish disturbance and potentially negative impacts e.g. roost abandonment. A description of the monitoring proposed and the potential further mitigation required is presented in the Bat Mitigation Strategy **Appendix 14C1A** of this volume.

14.13.445 In line with the mitigation hierarchy, all appropriate measures have been employed to avoid impacts and safeguard roosting, commuting and foraging Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle. Within the development, a suite of noise mitigation measures are proposed, the benefits of some of which (the earth bunds etc.) were not possible to incorporate within the impact assessment. The noise levels which exceed the calculated thresholds are likely to do so irregularly, and very rarely at night, and it is not possible to estimate with absolute certainty whether construction noise would (or would not) trigger an offence under the relevant wildlife legislation.

14.13.446 Natural England guidance states that, an EPS derogation licence should only be obtained as a 'last resort' where all other alternative ways of avoiding impacts on the species have been discounted" (Ref 14.124). Multiple approaches to reduce impacts from noise have been incorporated, as outlined above and in the Bat Mitigation Strategy **Appendix 14C1A** of this volume. In addition, Natural England does not generally grant 'precautionary licences' (i.e. as insurance against potential impacts). As no direct impacts to know roosts are currently foreseen with the information currently known, it is not appropriate to commit to the requirement of an EPS licence. An approach is proposed that will mean that a licence will not initially be required to facilitate the works (although this would be reviewed throughout the process). An appropriate approach to safeguarding bats and ensuring legal compliance is proposed within the Bat Mitigation Strategy **Appendix 14C1A** of this volume and Bat Method Statement **Appendix 14C1B** of this volume.

14.13.447 This approach is based upon the mitigation measures outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, combined with following a non-licenced method statement, which endeavours to reduce any impacts as far as is practicable. This method statement is presented in **Appendix 14C1B** of this volume. It should be noted however that as further information is obtained (for example through further tree assessments), the assessment of impacts to roosts may need to be updated. This may trigger the need for an EPS licence.

14.13.448 In addition, there will be monitoring of the actual noise impacts to key areas of the site for bats throughout the construction phase to determine if disturbance levels are actually likely to exceed the threshold for which a licence would be required. This would be achieved through monitoring throughout the construction process of key roosting areas and commuting and foraging areas. This will allow the potential impacts to Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle to be monitored and preventative measures taken if requires. The monitoring will assess two key indicators:

- The noise levels actually produced by the works (monitoring as outlined in **ES** (Doc Ref. Book 6) **Chapter 11: Noise and Vibration**);
- The bats usage of roosts and foraging and commuting areas, as compared to the base line surveys (as reported in **ES** (Doc Ref. Book 6) **Appendix 14A8** of this volume).

14.13.449 If noise levels are deemed to be at a level that an offence is considered more likely than unlikely, or observed impacts to bats indicate an impact to roosting, two approaches can be employed to safeguard bats:

14.13.450 If noise levels are deemed to be at a level that an offence is considered likely, or observed impacts to bats indicate an impact to roosting, further mitigation would be focussed on the bat population, which could include further roost provision. If necessary, this is a juncture at which an EPS derogation licence may be triggered.

14.13.451 Overall, once the embedded mitigation and construction monitoring and mitigation approach outlined above is implemented, alongside the associated enhancements outlined in the Bat Mitigation Strategy **Appendix 14C1A** of this volume, the impact of construction noise on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle population is assessed to have a **minor adverse** effect which is considered to be **not significant**.

Disturbance from lighting

14.13.452 As detailed under barbastelle, construction lighting would increase light levels and could cause light intrusion into adjacent habitats. Both Daubenton's bat and brown long-eared bat are light-adverse species, as evidenced by their late roost emergence behaviour with median emergence times of 84 minutes for Daubenton's bat and 54 minutes for brown long-eared bat. These species therefore have a medium sensitivity to this impact. Common pipistrelle and soprano pipistrelle are not light-adverse when foraging or commuting, making opportunistic use of lit areas. Both common pipistrelle and soprano pipistrelle have a median emergence time of 20 minutes after sunset but may emerge during daylight (Ref 14.38 and Ref 14.109). These species therefore have a low sensitivity to this impact.

Roosts

14.13.453 **Table 14.64** summarises known and potential roosting locations by these species and the anticipated surrounding light conditions.

Table 14.64: Retained confirmed and potential roost areas and associated construction lighting levels

Roost Area (roost type)	Nature of Works and Anticipated Lighting Levels
Upper Abbey Farm; (Daubenton's – hibernation brown long-eared bat – maternity and probable hibernation common pipistrelle – occasional soprano pipistrelle – occasional).	Located within the site boundary as part of the site entrance complex. This area would have ambient lighting levels of 10-50 lux, with task specific lighting up to 100 lux. To the north and west the temporary accommodation campus would be lit up to 75 lux. An area without fixed lighting would be present immediately to the east along the Upper Abbey Bridleway separating the buildings from the stock-piling area that would be lit up to 50 lux during active working, but would not have any ambient lighting.
Ash Wood Cottage; (brown long-eared bat – maternity common pipistrelle – occasional soprano pipistrelle – occasional).	Outside the site boundary but adjacent to the temporary construction area to the south and west. This area would have ambient lighting up to 20 lux and task specific lighting up to 200 lux.
The Grove (brown long-eared bat – potential).	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Kenton Hills (soprano pipistrelle – maternity).	Outside the site boundary but adjacent to temporary construction area and railway areas. An area of no fixed lighting approximately 30m wide containing a five-metre bund would provide some screening from lighting, with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux.
Plantation Cottages (common and/or soprano pipistrelle – potential).	Outside the site boundary and at a distance from the proposed development. Unlikely to result in substantive increases in lighting levels.

14.13.454 As detailed under barbastelle, construction lighting has the potential to reduce the overall roost resource available to these species. The impact of this lighting disturbance would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase.

Foraging

14.13.455 As detailed above, these species have broad associations with particular habitats, though these are not so specific as to be restrictive. While Daubenton's bat and soprano pipistrelle diets are dominated by aquatic species, in general, all four species have relatively diverse diets.

14.13.456 **Table 14.65** summarises the key bat foraging areas identified for these species which would be retained but that may experience lighting disturbance from the proposed development, along with details of the likely surrounding construction phase lighting levels.

Table 14.65: Retained foraging areas for Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle and associated construction lighting levels

Foraging area	Nature of Works and Anticipated Lighting Levels
Sizewell Marshes SSSI (Daubenton's bat).	Outside of the site boundary. Kenton Hills would act as a barrier to the majority of light associated with the temporary construction area to the north. At the eastern extent Sizewell Marshes SSSI would be adjacent to an area that would be lit up with ambient lighting of 5-20 lux and task-specific lighting up to 200 lux.
Ash Wood (brown long-eared bat).	Outside the site boundary but immediately adjacent to stock-piling areas to the north, west and south-west, lit up to 50 lux during active working, but without ambient lighting. To the south the temporary construction area would have lighting up to 200 lux.
The Grove (brown long-eared bat)	Outside of the site boundary and not immediately adjacent to lit areas. Unlikely to experience a substantive change in lighting levels.
Walk Barn (brown long-eared bat).	Outside the site boundary but in close proximity to the temporary construction area which would be lit up to 200 lux.
Fiscal Policy and northern track in Kenton Hills (common pipistrelle and soprano pipistrelle).	Outside the site boundary but adjacent to temporary construction area and railway areas. An area of no fixed lighting approximately 30m wide containing a five-metre bund would provide some screening from lighting, with adjacent railway line lit up to 20 lux and temporary construction area lit with ambient light of 5-20 lux and task-specific lighting of up to 200 lux. A dark buffer zone up to 30m wide between indicative footprints of light sources on either side is proposed at the location where the bridleway is crossed by haul roads at the western end of this area.
Leiston Old Abbey woodland (brown long-eared bat).	Located adjacent to the proposed site entrance which would be lit to a maximum of 100 lux. An area of no fixed lighting is located between the site entrance and woodland.
Upper Abbey Bridleway (common pipistrelle, Daubenton's bat and soprano pipistrelle).	Within the site boundary in an area of no fixed lighting. Runs between stock piling areas (no ambient lighting, task-specific lighting of 5-50 lux), temporary construction areas (ambient lighting of 5-20 lux, task-specific lighting up to 200 lux),

Foraging area	Nature of Works and Anticipated Lighting Levels
	temporary accommodation campus (5-75 lux) and site entrance (ambient lighting of 5-50 lux, task-specific of up to 100 lux) resulting in variable lighting levels ranging from no change to 200 lux. Dark buffer zones up to 30m wide between indicative footprints of light sources on either side are proposed at the locations where the bridleway is crossed by haul roads.
Goose Hill (woodland rides at south-eastern edge) (common pipistrelle and soprano pipistrelle).	Within the temporary construction area. Habitat in this location would largely be lost during the establishment of the proposed development. Lighting levels would range from 5-200 lux.

14.13.457 Daubenton's bat and brown long-eared bat demonstrate light-adverse foraging behaviour and therefore, as detailed under barbastelle, increased lighting associated with the proposed development is likely to restrict the ability of these species to forage within the site. In addition, increased lighting may have indirect impacts by altering the distribution of insect prey. While the Daubenton's bat diet focusses on aquatic invertebrates, both species show a degree of flexibility and therefore may be better able to take advantage of the range of prey species remaining in unlit areas. Common pipistrelle and soprano pipistrelle demonstrate opportunistic use of lit areas for foraging and therefore, as detailed above for noctule and serotine, increased lighting associated with the proposed development is likely to have a more limited impact on the ability of these species to forage within the site. Furthermore, while soprano pipistrelle's have a preference for aquatic invertebrate prey, both species would take a diverse range of prey species and therefore may be better able to take advantage of available prey options within foraging areas.

14.13.458 The impacts of lighting disturbance on foraging would occur over the duration of the construction period (9-12 years). This impact would be temporary and reversible following completion of the construction phase.

Commuting

14.13.459 As detailed above, no evidence of Daubenton's bat commuting routes was identified. Brown long-eared bat have been recorded using Stonewall Belts and are considered likely to use Ash Wood to travel further north from the roost in Ash Wood Cottages. Stonewall Belts would be lost due to establishment of the site (temporary construction area). Ash Wood would be retained but would be bordered on the north, west and south-west sides by stock-piling areas. 7

14.13.460 Common and soprano pipistrelle, while making use of linear features for commuting, also opportunistically use lit areas, thus, although areas such as the Upper Abbey Bridleway and the track along the northern edge of Kenton

Hills may be subject to light spill from surrounding areas, this may not result in significant disturbance to common and soprano pipistrelle commuting behaviour.

14.13.461 The **Lighting Management Plan** (**Volume 2, Appendix 2B**) includes modelling of the impact of lighting at key commuting and foraging areas for bats. This shows that at three key locations for foraging and commuting bats (along the bridleway by Upper Abbey Farm, along the northern edge of Kenton Hills and at the proposed SSSI Crossing, the light levels can be controlled to below 1lux. This is evidenced in **Table 14.36** which shows the predicted light levels at these locations.

14.13.462 The impacts of construction lighting would therefore exacerbate the impacts of habitat fragmentation for brown long-eared bat, while the impacts on Daubenton's bat, common pipistrelle and soprano pipistrelle are likely to be more limited. The impact of this lighting disturbance would occur over the duration of the construction period (9-12 years) this impact would be temporary and reversible following completion of the construction phase.

Assessment

14.13.463 Details of the primary mitigation (**section 14.4** of this chapter) include a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).

14.13.464 Given the duration of the construction phase and the various responses of these species to lighting, there is the potential for an increase in lighting to reduce the ability, to varying degrees, of these species to use and move between habitats within the site and the immediate surroundings. This impact would have a medium magnitude.

14.13.465 In addition, control measures, including directional lighting, light attenuation and monitoring are proposed as outlined in the bat non-licensed method statement (**Appendix 14C1B** of this volume.

14.13.466 Overall, the impact of lighting on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle populations would have a **minor adverse** effect, which is considered to be **not significant**.

Inter-relationship effects

14.13.467 This section assesses the likelihood of inter-relationship effects on bats, i.e. where two or more impact pathways (which may not be significant in isolation) combine to result in a significant effect. Although the extent of any effect will vary between bat species, these are considered for all bat IEFs combined.

14.13.468 In principle, there is potential for an inter-relationship between loss of roosting habitat and foraging in two ways. Firstly, loss of a high proportion of roost sites from an area could result in an effective loss of foraging habitat if by doing so it forced bats to roost so far from the foraging area that commuting journeys between roost and foraging area were energetically unsustainable. If so, it is likely that the foraging area would be abandoned (or its use would become more infrequent depending on food availability and/or weather conditions) unless roost sites nearer became available. It is also possible that loss of a high proportion of foraging habitat from an area could render retained roosts in that area unviable, for similar reasons of energetic cost during commuting. However, as bats regularly forage beyond the CSZ radii that have been defined for each species, and as for all bats recorded the CSZ are at least 2km radius, it would be necessary for roost or foraging habitat loss to take place on at least that geographic scale in order for these inter-relationship effects to be significant. This is not the case for the proposed development and consequently it is not considered likely that the inter-relationship between loss of roosting habitat and foraging habitat would be significant.

14.13.469 Habitat fragmentation, either directly or through effective isolation by being surrounded with lighting, could potentially render roosts unviable. The extent to which this could occur would be species-specific, with bats able to commute across open or lit areas less likely to be affected. The only roost sites within the site which could be affected in this way are at Upper Abbey Farm, but as the primary mitigation includes measures to maintain a dark corridor along the Upper Abbey Bridleway, and soil storage areas to the east of the bridleway will not be lit except when required for task-specific activities, it is not anticipated that any habitat fragmentation impacts sufficient to render roosts unviable would occur.

14.13.470 Effects of construction site noise on both roosts and foraging areas is covered above for each bat IEF, as is effects of construction site lighting. Potential inter-relationship effects between construction site noise and lighting on bats are complex, as the lighting required would vary both between working areas within the proposed development site and over time, as the majority of working areas have ambient light levels proposed which would need to be exceeded for specific activities, the duration of which would also be variable. Activities resulting in construction site noise would often not correlate with task-specific increased levels of lighting, if the activities are restricted to daylight hours, but sometimes may do. Both impact pathways can therefore vary from background levels to the most intense proposed during construction independently of each other both temporally and spatially within the site. However, it is possible to state that when increased levels of task-specific lighting do correlate with higher noise levels, these events are likely to be of short duration relative to the construction period and are unlikely to be more significant than either impact pathway in isolation.

ii. Operation

14.13.471 Incidental mortality to bat species has been ruled out as an operational impact pathway as, although the access road would be a permeant feature, the magnitude of this impact is considered to be small, resulting in a non-significant effect. Operational works would entail the movement of vehicles in and out of the site along the access road although these movements would be at low speed and intermittent and primarily associated with shift start and end times. As a result, the likelihood of incidental mortality from vehicles would be minimised.

14.13.472 Habitat fragmentation has been ruled out as an operational impact pathway due to the measures included in the **oLEMP**, and therefore comprising primary mitigation, which would maintain and improve both the habitat extent and connectivity of the site for bats. These include woodland planting to the west of parking areas and the Training Centre at Goose Hill, planting up of gaps in hedgerows bordering the Upper Abbey Bridleway, planting of hedgerows on the field boundary connecting Upper Abbey Bridleway to Ash Wood, and re-planting of woodland at Fiscal Policy. Mitigation to avoid habitat fragmentation during the construction period, described above, would remain in place (e.g. the culvert at the SSSI crossing), so that connectivity would be maintained and eventually enhanced as the planting establishes.

14.13.473 Disturbance from noise has been ruled out as an operational impact pathway as the noise environment is unlikely to differ substantially from the existing situation which is tolerated by bats.

IEF: Barbastelle

Disturbance from lighting

14.13.474 Operational lighting of the main platform and a small number of other areas, detailed below, would increase light levels and could cause light intrusion into adjacent habitats. Generic details of the potential impacts of increased lighting and light spillage on this species are provided in the construction impacts of barbastelle.

14.13.475 During the operational phase, lighting would be present on the main platform, comprising perimeter lighting on fences of 10-20 lux and lighting within the main platform of 5-20 lux. Outside this area the access road to the main platform, at the location of the SSSI crossing and adjacent land to the north would be lit at 5-10 lux, the car park (within former Goose Hill area) would be also lit at 5-10 lux. Lighting at the roundabout on Abbey Road would be at 10-30 lux, in line with highways requirements, but the access road between this roundabout and the car park would not be lit, except for one area at the north edge of Goose Hill where lighting (ambient levels of 10-20 lux, occasionally up to 100 lux) would be required for a vehicle search area. The proposed sub-station south of the access road, between Leiston Old Abbey and the Upper Abbey Bridleway would be lit at 5-20 lux, and the Back-up Emergency equipment Store and Back-up Generator buildings next to Upper Abbey Farm would be lit at 5-20 lux. Consequently, no part of the site would be subject to ambient light levels above 30 lux, and there would be no lighting between the Upper Abbey Bridleway and Goose Hill.

Roosts

14.13.476 Thirteen barbastelle tree roosts have been identified on the edge or, or in close proximity to, the site boundary. Of these the closest is located approximately 130m from the nearest operationally lit area (R4 located to the west of main platform). As detailed under the construction impacts for barbastelle above, barbastelle do not show high inter-annual roost fidelity and the impacts of lighting on barbastelle roosts need to be assessed for the wider tree roost resource. With operational lighting focussed around the main platform, retained areas of woodland would largely revert to their pre-construction unlit state during the operational phase.

14.13.477 Lighting at Upper Abbey Farm would continue during the operational phase due to siting of a sub-station and Back-up Emergency Equipment Storage building within the farm complex, as well as lighting associated with ongoing use of the farm buildings. However, operational lighting of those facilities would be at lower levels (up to 20 lux) than those that would occur during the construction phase (up to 100 lux for task specific activities). While lighting around these buildings would continue, impacts are therefore likely to be reduced compared to those experienced during construction.

Foraging

14.13.478 Key retained barbastelle foraging areas are detailed in **Table 14.45**. With the exception of the eastern parts of Goose Hill, these areas would not be lit and are not located in close proximity to lit areas. Some lighting would be retained at Upper Abbey Farm during the operational phase; however, as detailed above, this lighting would be at only low lux levels, and is unlikely to result in notable levels of light spill onto the Upper Abbey Bridleway.

14.13.479 Retained areas of Goose Hill would be in close proximity to the new main platform, access road and car park which would have operational lighting at up to 10 lux, with a small area around the proposed vehicle search area at ambient levels of 10-20 lux and occasional task-specific lighting of up to 100 lux, but these areas would comprise a small proportion of the foraging area available to barbastelle in the operational phase.

Commuting

14.13.480 Retained areas of significant barbastelle movement are detailed in **Table 14.46**. None of the retained areas would be subject to operational lighting, with the exception of the eastern edges of Goose Hill adjacent to the car park, SSSI crossing and vehicle search area (as detailed above) and of the Sizewell Marshes SSSI which would be adjacent to the main platform and associated lighting of up to 20 lux.

14.13.481 Even if barbastelle avoid these areas, this is unlikely to restrict the movement of barbastelle across the landscape in the operational phase.

Assessment

14.13.482 The impacts of lighting without mitigation are detailed in under the construction impacts for barbastelle above. The implementation of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) as part of the primary mitigation (**section 14.4** of this chapter) would limit the extent to which these impacts occur. Barbastelle have a high sensitivity to lighting impacts which would be of a low magnitude. Overall, the impact of operational lighting on the barbastelle population would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Natterer's bat

Disturbance from lighting

14.13.483 Operational lighting of the main platform and a small number of other areas, as detailed above for barbastelle would increase light levels and could cause light intrusion into adjacent habitats. Generic details of the potential impacts of increased lighting and light spillage on this species are provided in the construction impacts for Natterer's bat.

Roosts

14.13.484 Known and/or potential retained Natterer's bat roost locations are summarised in **Table 14.51**. Of these, only Upper Abbey Farm would continue to experience lighting impacts during the operational phase of the proposed development. All other areas would be unlit and at sufficient distance from lit areas that significant effects from light spill are unlikely to occur.

14.13.485 Upper Abbey Farm would continue to be lit during the operational phase, as detailed above. Natterer's bat have been recorded roosting here on numerous occasions including maternity, mating, hibernation and occasional roosts. Continued lighting at this location, albeit at low levels, have the potential to reduce the value of this roost location for Natterer's bat or impact the manner in which this location is used. This impact, while reversible, would occur over the lifetime of the proposed development (approximately 60 years).

Foraging

14.13.486 Key retained Natterer's bat foraging areas are detailed in **Table 14.52**. With the exception of the eastern parts of Goose Hill and Sizewell Marshes, these areas would not be lit or in close proximity to lit areas. As detailed above, light spill from Upper Abbey Farm onto Upper Abbey Bridleway is unlikely to be significant. However, the retained eastern edge of Goose Hill would be in close proximity to lighting from the main platform, access road and car park, while Sizewell Marshes SSSI, at the eastern extent is located in close proximity to the main platform. As a light-adverse species, Natterer's bat may continue to actively avoid these areas during the operational phase of the proposed development thereby limiting the extent of suitable foraging habitat available.

Commuting

14.13.487 As detailed under the construction phase, the clearest indication of a Natterer's bat commuting route was located along the track at the northern edge of Kenton Hills. This area would not be lit during the operational phase. Similarly, other areas noted as important for Natterer's commuting, including the crossroads at Fiscal Policy and the Upper Abbey Bridleway, would be unlit. The crossroads at Fiscal Policy are at a distance to any areas of operational lighting and, while parts of the Upper Abbey Bridleway are located in close proximity to Upper Abbey Farm, significant light spill onto the bridleway is unlikely to occur.

Assessment

14.13.488 The impacts of lighting without mitigation are detailed under the construction impacts for Natterer's bat above. The implementation of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) as part of the primary mitigation (**section 14.4** of this chapter) would limit the extent to which these impacts occur.

14.13.489 Natterer's bat has a medium sensitivity to this impact which would be of a medium magnitude. Overall, the impact of operational lighting on the Natterer's bat population would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Leisler's bat and Nathusius' pipistrelle

Disturbance from lighting

14.13.490 Operational lighting of the main platform and a small number of other areas, detailed above under barbastelle, would increase light levels and could cause light intrusion into adjacent habitats. Generic details of the potential impacts of increased lighting and light spillage on these species are provided in the construction impacts for Leisler's bat and Nathusius' pipistrelle.

Roosts

14.13.491 Neither species is considered likely to roost in significant numbers within the site boundary or in close proximity to the site. Operational lighting would be limited and largely located away for woodland areas and is therefore unlikely to impact the overall roost resource available for either species.

Foraging

14.13.492 Both species are present within the site boundary to only a limited degree and no specific parts of the site appear to be of particular importance. Both species are generalists and are able to opportunistically use lit areas when foraging. Therefore, in combination with the limited nature of operational lighting, it is unlikely that this lighting would impact the ability of these species to forage within the site and Zol.

Commuting

14.13.493 Both species show a limited reliance on linear features and an ability to cross open areas, along with a tolerance for lit areas when commuting. Therefore, in combination with the limited nature of operational lighting, it is unlikely that this lighting would impact the ability of these species to move within the site and Zol.

Assessment

14.13.494 The impacts of lighting without mitigation are detailed in under the construction impacts for Leisler's and Nathusius' pipistrelle bat above. The implementation of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) as part of the primary mitigation (**section 14.4** of this chapter) would limit the extent to which these impacts occur.

14.13.495 Leisler's bat and Nathusius' pipistrelle have a very low sensitivity to this impact which would be of a very low magnitude. Overall, the impact of operational lighting on these species would have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: Noctule and serotine

Disturbance from lighting

14.13.496 Operational lighting of the main platform and a small number of other areas, as detailed above for barbastelle, would increase light levels and could cause light intrusion into adjacent habitats. Generic details of the potential impacts of increased lighting and light spillage on these species are provided in the construction impacts for noctule and serotine bat.

Roosts

14.13.497 **Table 14.66** summarises retained, known and potential noctule roosts. With the exception of Upper Abbey Farm, eastern Goose Hill and Grimseys, these locations would be unlit and located at a distance from lit from areas lit during the operational phase.

14.13.498 Eastern Goose Hill (with the potential to support roosting noctule) would be in close proximity to lighting from the main platform, access road and car park, while Grimseys (also with the potential to support roosting noctule) would, at its eastern end, be located in close proximity to the main platform. While the continued lighting and/or proximity to operational lighting of these locations may impact the suitability of these locations for roosting noctule, these impacts are likely to be reduced compared to those experienced during construction.

Foraging

14.13.499 Key retained noctule and serotine foraging areas are detailed in **Table 14.66**. With the exception of the eastern edge of Goose Hill and wet grassland to the east, these areas would not be lit and are not located in close proximity to lit areas. Both the eastern edge of Goose Hill and the wet grassland to the east would be in close proximity to lighting from the main platform, access road and car park. Neither species is considered to be light adverse and would opportunistically use lit areas for foraging. Operational lighting is therefore unlikely to significantly impact the ability of these species to forage within the site and ZoI.

Commuting

14.13.500 The absence of operational lighting across the majority of the site and the ability of both species to cross open areas with limited reliance on linear features means that movement across the site is unlikely to be limited by operational lighting.

Assessment

14.13.501 The impacts of lighting without mitigation are detailed under the construction impacts for noctule and serotine above. The implementation of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) as part of the primary mitigation (**section 14.4** of this chapter) would limit the extent to which these impacts occur.

14.13.502 Noctule and serotine have a medium sensitivity to this impact which would be of a very low magnitude. Overall, the impact of operational lighting on the noctule and serotine bat populations would have a **minor adverse** effect, which is considered to be **not significant**.

IEF: Daubenton’s bat, brown long-eared bat, common pipistrelle and soprano pipistrelle

Disturbance from lighting

14.13.503 Operational lighting of the main platform and a small number of other areas, detailed above under barbastelle, would increase light levels and could cause light intrusion into adjacent habitats. Generic details of the potential impacts of increased lighting and light spillage on these species are provided in the construction impacts for Daubenton’s, brown long-eared, common pipistrelle and soprano pipistrelle bat.

Roosts

14.13.504 Retained confirmed and potential roost locations for these species are summarised in **Table 14.64**. With the exception of Upper Abbey Farm, these areas would not be lit and would not be located in close proximity to lit areas. Upper Abbey Farm would continue to be lit during the operational phase, as detailed above. Buildings in this complex have been used by all four species for a variety of roost types. While the continued lighting and/or proximity to operational lighting of these locations may impact the suitability of these locations for roosting bats, these impacts are likely to be reduced compared to those experienced during construction.

Foraging

14.13.505 Key retained foraging areas are detailed in **Table 14.65**. With the exception of the eastern edge of the Sizewell Marshes SSSI and retained parts of Goose Hill, these areas would not be lit or in close proximity to lit areas. As detailed above, light spill from Upper Abbey Farm onto Upper Abbey Bridleway is unlikely to be significant. However, eastern Goose Hill would be in close proximity to lighting from the main platform, access road and car park, while Sizewell Marshes SSSI, at the eastern extent is located in close proximity to the main platform.

14.13.506 Sizewell Marshes SSSI was identified as a foraging area for Daubenton’s bat and, as a light-adverse species, Daubenton’s bat may continue to avoid parts of Sizewell Marshes SSSI in close proximity to the lit main platform, thereby limiting the extent of suitable foraging habitat available.

14.13.507 Woodland rides at the south-eastern corner of Goose Hill were identified as key foraging areas for common and soprano pipistrelle. While these areas would experience an increase in lighting levels, compared to pre-construction conditions, this would be at a reduced level compared to the construction phase, and both common and soprano pipistrelle demonstrate opportunistic use of lit areas for foraging. As such, operational lighting in this location is likely to have a more limited impact on the ability of these species to forage.

Commuting

14.13.508 The absence of operational lighting across the majority of the site, including areas identified as commuting routes for one or more of the species considered in this IEF, means that movement across most of the site is unlikely to be limited by operational lighting, although a reliance (to varying degrees) on linear features means changes in these movements may occur during the operational phase, as detailed above.

Assessment

14.13.509 The impacts of lighting without mitigation are detailed in under the construction impacts for Daubenton's, brown long-eared, common pipistrelle and soprano pipistrelle above. The implementation of a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) as part of the primary mitigation (**section 14.4** of this chapter) would limit the extent to which these impacts occur.

14.13.510 Daubenton's bat and brown long-eared bat have a medium sensitivity to lighting impacts which would be of a medium magnitude. Common pipistrelle and soprano pipistrelle have a low sensitivity to lighting impacts which would be of a low magnitude. Overall, the impact of operational lighting on the Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle populations would have a **minor adverse** effect, which is considered to be **not significant**.

d) Mitigation and monitoring

i. Mitigation

14.13.511 Primary and tertiary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter. Residual significant effects are predicted for habitat fragmentation impacts on barbastelle and Natterer's bat, due to the unavoidable loss of connectivity north-south across the site, associated with the location of the temporary construction area and to a lesser extent reduced connectivity east-west across the site between Fiscal Policy and the west. Additional secondary mitigation measures are not proposed as there is no practical way to avoid the impacts described beyond the measures proposed as primary mitigation, which reduce the magnitude of the impact but to the extent that an adverse significant effect could be eliminated. However, this impact would be entirely reversible post-construction.

14.13.512 Full details of mitigation measures for bats are provided in the **Bat Mitigation Strategy** (Ref. 14.1, **Appendix 14C1A** of this volume).

ii. Enhancement

14.13.513 Once construction is complete and the temporary construction area has been removed, landscape-scale habitat creation measures to create acid grasslands would have developed in accordance with the **oLEMP**. The general pattern of the EDF Energy estate would be maintained as an open landscape with small woodland blocks but fields which are currently intensively managed as arable or improved grassland would be converted to open acid grassland that would result in a greater invertebrate prey biomass (and would establish more rapidly than woodland). Supplementary scrub planting and strengthening of hedgerows and woodland margins and some new woodland blocks are included within the outline landscape design proposals which would enhance connectivity for bats. The measures as a whole would provide a net biodiversity gain compared to the largely arable landscape currently present across the site (further information is presented in **Chapter 14, Appendix 14.E: Biodiversity Metric Net Gain Calculations Report** of this volume).

iii. Monitoring

14.13.514 There would be regular checks of lighting during both construction and operation to monitor and adjust for any light spill into the surrounding habitats. Details of this approach for construction are outlined in the CoCP (Doc Ref 8.11).

14.13.515 Bat boxes would be monitored on an annual basis during the construction phase from one year after installation. Boxes would continue to be monitored beyond the completion of construction. This monitoring would aim to confirm the presence/absence of bats and the use of the bat boxes. If bat boxes have not been occupied within three years of installation, consideration would be given to moving them to alternative sites nearby, to be determined by a licensed bat ecologist.

e) Residual effect

14.13.516 The following tables present a summary of the bat assessment. The tables identify the species or group of species likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

Table 14.66: Summary of effect arising from the construction phase for bats

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Residual Effect
Barbastelle	Habitat loss – roosts.	Retention of woodland where possible, provision of bat boxes in advance of construction in woodland to north and south of site.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat loss – foraging.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat fragmentation.	SSSI crossing suitable for use by bats, retention of much of Upper Abbey Bridleway with dark crossing points where severed by haul routes, dark crossing at Fiscal Policy.	Moderate adverse (significant - in the short term (construction phase), reducing to no-significant after construction and suite restoration).	None proposed.	Moderate adverse (significant) in the short term (construction phase), reducing to no-significant after construction
	Noise disturbance.	Provision of bat boxes in advance of construction in woodland to north and south of site, advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Natterer's	Habitat loss – roosts.	Retention of woodland where possible, provision of bat boxes in	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Residual Effect
		advance of construction in woodland to north and south of site.			
	Habitat loss – foraging.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap.	Minor adverse (not significant).	None required	Minor adverse (not significant).
	Habitat fragmentation.	SSSI crossing suitable for use by bats, retention of much of Upper Abbey Bridleway with dark crossing points where severed by haul routes, dark crossing at Fiscal Policy	Minor adverse (not significant).	None proposed	Minor adverse (not significant).
	Noise disturbance.	Provision of bat boxes in advance of construction in woodland to north and south of site, advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**)	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Leisler's bat and Nathusius' pipistrelle.	Habitat loss – roosts.	Retention of woodland where possible, provision of bat boxes in advance of construction in woodland to north and south of site	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
	Habitat loss – foraging.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Residual Effect
		improvement areas and reptile receptor area at Sizewell Gap			
	Habitat fragmentation.	SSSI crossing suitable for use by bats, retention of much of Upper Abbey Bridleway with dark crossing points where severed by haul routes, dark crossing at Fiscal Policy	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
	Noise disturbance.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**)	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
Noctule and serotine.	Habitat loss – roosts.	Retention of woodland where possible, provision of bat boxes in advance of construction in woodland to north and south of site	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat loss – foraging.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat fragmentation	SSSI crossing suitable for use by bats, retention of much of Upper Abbey Bridleway with dark crossing points where severed by haul routes, dark crossing at Fiscal Policy.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant).

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Residual Effect
	Noise disturbance.	Provision of bat boxes in advance of construction in woodland to north and south of site (noctule only), and advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap.	Negligible adverse (not significant)	None required.	Negligible adverse (not significant).
	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**)	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle.	Habitat loss – roosts.	Retention of woodland where possible, provision of bat boxes in advance of construction in woodland to north and south of site.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat loss – foraging.	Advanced mitigation areas at Aldhurst Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat fragmentation.	SSSI crossing suitable for use by bats, retention of much of Upper Abbey Bridleway with dark crossing points where severed by haul routes, dark crossing at Fiscal Policy.	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Noise disturbance.	Provision of bat boxes in advance of construction in woodland to north and south of site (noctule only), and advanced mitigation areas at Aldhurst	Minor adverse (not significant).	Monitoring as outlined in the Bat Mitigation Strategy	Negligible adverse (not significant).

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Residual Effect
		Farm, marsh harrier habitat improvement areas and reptile receptor area at Sizewell Gap.			
	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**)	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Table 14.67: Summary of effect arising from the operational phase for bats

Receptor	Impact	Primary or Tertiary Mitigation	Classification of Effect	Additional Mitigation	Classification of Residual Effect
Barbastelle	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Natterer's bat.	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Leisler's bat and Nathusius' pipistrelle.	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
Noctule and serotine.	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Minor adverse (not significant).	None required.	Minor adverse (not significant).
Daubenton's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle.	Lighting disturbance.	**Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**).	Minor adverse (not significant).	None required.	Minor adverse (not significant).

14.14 Terrestrial mammals

a) Current baseline

14.14.1 A detailed description of the terrestrial mammal baseline of the site has been provided in **Appendix 14A9 – Terrestrial Mammals** of this volume and a summary of the baseline conditions has been provided below. Where there are terrestrial mammals of conservation concern, this is stated, and the conservation status provided along with the appropriate legislation.

14.14.2 **Section 14.6** of this chapter details the designated sites that have been identified within the ZoI of the site. No designated site (statutory or non-statutory) cite terrestrial mammals as qualifying features.

14.14.3 Desk-study data from SBIS was obtained for notable species of conservation concern within 2km of the site boundary. All terrestrial mammals discussed in the appendix were found within the site boundary.

14.14.4 Surveys carried out between 2007 and 2015 indicate that there are two [redacted] social groups resident within the site and wider study area: the [redacted] social group and the [redacted] social group. Nationally and in Suffolk, badger populations are increasing (Ref 14.114 and Ref 14.115).

14.14.5 Otter (*Lutra lutra*) is widely distributed across the survey area in Sizewell Marshes SSSI, Lower Abbey Farm marshes and Minsmere South Levels areas (part of the Minsmere to Walberswick Heaths and Marshes SSSI) and are present in the wider landscape. Sightings from SWT indicate a year-round presence. Otter populations are recovering both nationally and in Suffolk (Ref 14.116 and Ref 14.117).

14.14.6 Water vole (*Arvicola amphibius*) is present, particularly in Sizewell Marshes SSSI, and this area, along with the Minsmere site (linked via the Leiston Drain), form two of 15 National Key Sites for water vole in England; similar population trends for both populations suggest these two populations may have similar population dynamics or may be acting as a single meta-population. There is a sizeable area of suitable habitat within the EDF Energy estate that has been managed proactively since 1992, and surveys suggest a stable population in the absence of mink. Although considered to be one of the most endangered mammal species in the UK (primarily as a result of mink (*Neovison vison*) predation, habitat loss and fragmentation causing long term population declines), reintroduction schemes, mink control and habitat management could result in population recovery (Ref 14.117). Surveys in Suffolk indicate healthy water vole populations at key coastal sites (see **Appendix 14A9 – Terrestrial Mammals** of this volume).

14.14.7 Brown hare (*Lepus europaeus*), western European hedgehog (*Erinaceus europaeus*) (hedgehog) and harvest mouse (*Micromys minutus*) have all been recorded on the EDF Energy estate. East Anglia was considered to be a stronghold for brown hare (Ref 14.118), but brown hare populations seem largely absent from within the majority of the EDF Energy estate (despite the ongoing availability of suitable habitat in these areas).

14.14.8 Hedgehog and harvest mouse exist within some habitats of the EDF Energy estate. Both are considered to be distributed widely throughout Suffolk, although populations of both are declining nationally (Ref 14.116 and Ref 14.117). Polecat (*Mustela putorius*) populations are increasing nationally as a result of range expansion (Ref 14.116). This species was considered extinct in Suffolk until records from 2010 onwards indicated recolonization from the west. A single record was reported at the south-west of the EDF Energy estate in 2018.

14.14.9 Red deer (*Cervus elaphus*) and muntjac (*Muntiacus reevesi*) are widespread and common across the EDF Energy estate, with occasional sightings of fallow deer (*Dama dama*) and Chinese water deer (*Hydropotes inermis*).

14.14.10 Badgers and their setts are protected under Schedule 6 of the W&CA (Ref 14.7) and the Protection of Badgers Act (Ref 14.12). Otters are protected under Schedule 5 and 6 of the W&CA (Ref 14.7), and Schedule 2 of the Conservation of Habitats and Species Regulations (Ref 14.8). Water vole is protected under Schedule 5 of the W&CA (Ref 14.7). Hedgehog is protected under Schedule 6 of the W&CA (Ref 14.7). Polecat is protected under Schedule 4 of the Conservation of Habitats and Species Regulations (Ref 14.8) and Schedule 6 of the W&CA (Ref 14.7).

14.14.11 Otter, water vole, brown hare, hedgehog, harvest mouse and polecat are included within Section 41 of the NERC Act (Ref 14.10). Brown hare, harvest mouse, hedgehog, otter, polecat, water vole and water shrew are also all identified as a priority species for conservation action within the Suffolk BAP (Ref 14.20) and Suffolk’s Priority Species and Habitats list (Ref 14.21).

14.14.12 Badger is considered to be an IEF at the local level under the CIEEM guidelines (Ref 14.24) and of low importance following the EIA-specific assessment methodology. They are considered an IEF due to their legal protection rather than their status and so they are not considered within the detailed assessment of this **ES** (Doc Ref. Book 6), but appropriate mitigation has been described, which when deployed, would avoid any breach of legislation.

14.14.13 Otter is considered to be of county importance under the CIEEM guidelines (Ref 14.24) and of medium importance following the EIA-specific assessment methodology. Water vole is considered to be of national importance under the CIEEM guidelines (Ref 14.24) and of high importance following the EIA-specific assessment methodology.

14.14.14 All other terrestrial mammal species are scoped out of the detailed assessment. Tertiary mitigation measures outlined in **section 14.4** of this chapter describe best practice methods for searching of any refugia likely to be used as hedgehog nest prior to site clearance.

14.14.15 Following a review of the terrestrial mammal baseline within the ZoI, **Table 14.68** lists the terrestrial mammal IEFs which have been carried forward into the detailed assessment. A detailed justification for these features is also found within **Appendix 14A9 – Terrestrial Mammals** of this volume.

Table 14.68: Terrestrial mammal IEFs taken forward for detailed assessment

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
Badger.	Local/Low	Two badger social groups are found [redacted], where habitat is considered to be sub-optimal. Badgers are widespread across England and Wales, and populations are increasing both in England and Wales and in Suffolk. Badgers have therefore been scoped out of the assessment. However, badgers are considered an IEF owing primarily to their legal protection rather than their conservation status on site. Appropriate tertiary mitigation that should be employed to safeguard badgers is described within the **ES** (Doc Ref. Book 6) (see **section 14.4** of this chapter).	IEF Scoped out
Otter.	County/Medium	Otters are widely distributed across the EDF Energy estate, breed within the local vicinity and have good quality habitat within the EDF Energy estate. The population is increasing in Suffolk, but is still considered to be vulnerable, threatened by: lack of safe and suitable habitat along rivers; poor water quality and pollution; and road traffic accidents. With the loss of part of Sizewell Marshes SSSI and with works planned boarding Sizewell Marshes SSSI, this species would be directly and indirectly affected by the proposed development. This species has therefore been scoped into the detailed assessment.	IEF Scoped in
Water vole.	National/High	are present within the EDF Energy estate, at densities higher than the national average for this species. There is a sizeable area of suitable habitat in the EDF Energy estate, including within the site, and also in the adjacent Minsmere. Both the EDF Energy estate and Minsmere have been recognised as National Key Sites. The water vole is considered one of the most endangered mammals in the UK. With the loss of part of Sizewell Marshes SSSI and	IEF Scoped in

Feature	Importance (CIEEM/EIA Methodology	Justification	Scoped in or out
		with works planned bordering Sizewell Marshes SSSI, this species would be directly and indirectly affected by the proposed development. This species has therefore been scoped into the detailed assessment.	
Brown hare.	Local/Low	The population of brown hare found within the site is not a significant contribution to the potential wider population within the ZoI, given the recent absence of records within the bulk of the EDF Energy estate. The effects of the proposed development on this highly mobile species are unlikely to be significant and brown hare have therefore been scoped out.	Scoped out
Hedgehog.	Local/Low	Hedgehogs are found within the site and wider area, with suitable habitats present such as field margins, broadleaved woodland and open grassland/mixed woodland. This species is considered to be distributed widely throughout Suffolk and has therefore been scoped out of the detailed assessment. Appropriate tertiary mitigation that should be employed to safeguard hedgehogs in nests/hibernacula has been detailed within the **ES** (see **section 14.4** of this chapter).	Scoped out
Harvest mouse.	Local/Low	Harvest mice exist within some habitats of the EDF Energy estate, and has suitable habitat such as rough and tussocky grassland, ungrazed grassland, reed bed and riparian margins. This species is considered to be distributed widely throughout Suffolk and has therefore been scoped out of the detailed assessment.	Scoped out
Polecat.	Local/Low	This species has not been recorded within the majority of the EDF Energy estate. As such, it has been scoped out of the detailed assessment.	Scoped out
Small mammals.	Water shrew: Local/Low All others: Local/Very Low	These species existing within some suitable habitat within the EDF Energy estate; however, will largely be unaffected by the proposed development. These species have therefore been scoped out of the detailed assessment.	Scoped out

14.14.16 Therefore, the terrestrial mammals taken forward for detailed assessment are:

- IEF: otter; and
- IEF: water vole.

b) Future baseline

14.14.17 **Table 14.69** summarises a projection of future baseline conditions for terrestrial mammals, categorised into those species whose populations may increase, are likely to be stable, or to decrease.

14.14.18 The impacts that climate change may have on UK species are summarised in Report Cards published by the Living with Environmental Change Network (Ref 14.59). Mammals that rely on hibernation (e.g. hedgehogs) are reducing their period of hibernation. Warmer winters mean that an animal's metabolic rates cannot remain suppressed effectively; this can reduce body condition, breeding success and survival rates. Breeding success and/or overwinter survival of mammals, including badgers, rodents, and hares, tend to be higher during warmer winters. Periods of drought can reduce the survival of worm-specialist foragers such as badgers and hedgehogs. Reduced water flow in rivers would adversely affect mammals such as water vole and otter.

Table 14.69: Future baseline for terrestrial mammals

Receptor	Future baseline
Increase	
Otter.	Otter is now widely distributed over the whole Anglian region and are considered to be increasing in Suffolk. The newly created aquatic habitat at Aldhurst Farm should provide additional suitable habitat for otter locally, and with ongoing habitat management and water quality control, the local population is likely to increase slightly or at least remain stable.
Water vole.	Water vole populations in the Sizewell and Minsmere National Key Site Monitoring Programme (NKSMP) sites appear stable, the habitat is 'one of the best sites in Suffolk for these animals' and is actively managed. With continuing mink control and the additional habitat created at Aldhurst Farm, water vole populations would be expected to expand their range (into Aldhurst Farm), and (due to their metapopulation dynamics) increase the likelihood of local colonies persisting through dispersal and colonisation.
Polecat.	The woodland and field edges of the EDF Energy estate provide suitable habitat for polecat and, with a nationally expanding range and recolonization westward in Suffolk (as witnessed by a recent record on the south-west edge of the EDF Energy estate), polecat would be expected to colonise this area.
Stable	
Badger.	Although badger populations are expanding nationally, the apparent stability of the current social groups and the limit amount of habitat available on the EDF Energy estate under current management, means that the badger population is unlikely to change substantially.
Hedgehog.	Although populations are nationally declining, hedgehog ranges are considered stable. Given the availability of suitable habitat on the EDF Energy estate, and its current management (reducing risks of habitat loss or fragmentation) and given the likely stability of the local hedgehog

Receptor	Future baseline
	population, there is no reason to suggest local population size should change in the absence of development.
Harvest mouse.	Harvest mouse is considered to be widespread within Suffolk and Essex. Changes in habitat management and agricultural methods are thought to be the main cause for the loss of populations from certain areas. Given the availability of suitable habitat on the EDF Energy estate, and its current management (reducing risks of habitat loss or fragmentation), there is no reason to suggest local population size should change.
Deer.	Deer populations are growing nationally, but there is active management of red deer and muntjac on the EDF Energy estate. Deer populations are therefore likely to remain stable, unless management practices change.
Decrease	
Brown hare.	Brown hare is relatively widespread in East Anglia. Arable fields and areas of grassland on the EDF Energy estate provide suitable foraging habitat for brown hare, and the arable hedgerow margins and woodland provide sites for shelter. However, there is clear evidence of reduced sightings since 2014, and the threat to the population from disease means brown hare may be heading towards local extinction. If the same population trajectory occurs that followed rabbit numbers after the introduction of myxomatosis in the 1950s, a dramatic population crash of brown hares might be followed by recovery by disease-resistant hares.

c) Assessment

i. Construction

14.14.19 During the construction phase of works, the main impact pathways to terrestrial mammals would be associated with:

- direct land take resulting in habitat loss;
- habitat fragmentation (including connectivity);
- incidental mortality of species; and
- disturbance effects on species population (comprising light, noise and visual effects).

14.14.20 A number of the construction impact pathways have been scoped out of this assessment, due to the primary and tertiary mitigation detailed in **section 14.4** of this chapter, or where it is considered that the magnitude of the impact would be small, resulting in a non-significant effect. The impact pathways that have been scoped out of this assessment, along with the rationale for scoping them out, are as follows:

- **Alteration of coastal processes (erosion, accretion and sedimentation).** This impact could arise through the addition of temporary or permanent structures which may have direct or indirect effects on the integrity of coastal dune systems. However, as outlined in the Plants and Habitats Synthesis Report (**Appendix 14B1** of this volume) the site is forecast to have a minimal impact from coastal processes and therefore no significant effects on terrestrial habitat are envisaged (other than changes that would occur by purely natural processes). Therefore, this impact pathway has been scoped out.

- Disturbance effects on species populations as a result of recreational pressure (through trampling of supporting habitats). This impact could arise through the displacement of recreational users from the beach frontage at Sizewell and/or the influx of workers into the area during the construction phase. Construction workers would generally be restricted by the site security fence. However, as outlined in the Plants and Habitats Synthesis Report (**Appendix 14B1** of this volume) there is likely to be a displacement of up to 30% or existing recreational users away from the Sizewell area once construction starts. Therefore, no impacts on terrestrial mammal populations are considered likely as a result of this impact pathway.

- Effects of changes in local hydrology and hydrogeology, air quality and water quality on terrestrial mammals. The mammals discussed here are primarily terrestrial, although water vole and otter do spend time in aquatic environments. Due to the embedded primary and tertiary mitigation, it is considered unlikely there would be an impact on the water quality, or the water levels of waterbodies used by otter and water vole within the ZoI would be experienced (see **ES** (Doc Ref. Book 6) Chapter 19: Groundwater and Surface Water), and so there would be no significant effect on these receptors. Tertiary mitigation includes measures to minimise dust pollution and air quality changes that may impact aquatic and terrestrial habitat and associated vegetation.

14.14.21 Of the impact pathways taken forward within the assessment, the specific impact pathways that could be experienced by each terrestrial mammal species within the assessment have been identified and are detailed within the subsequent sections.

IEF: otter

14.14.22 During construction, the main impact pathways experienced by otter would be associated with:

- land take resulting in habitat loss;
- habitat fragmentation (including connectivity);

- incidental mortality of species; and
- disturbance effects on species population (comprising light, noise and visual effects).

14.14.23 The characterisation of the above impacts is described in detail below.

Land take resulting in habitat loss

14.14.24 Establishment of the site would result in the permanent loss of access to 7.0ha and temporary loss of access to 2.9ha of suitable otter habitat along the Sizewell Drain, Leiston Drain and the Goodrum's Fen portion of Sizewell Marshes SSSI, as a result of the Phase 1 site clearance works, diversion of the Sizewell Drain within Sizewell Marshes SSSI, installation of a sheet pile barrier between Sizewell Marshes SSSI and the main platform, and construction of the causeway to provide access to the main construction area. This temporary loss is partly the result of habitat being re-instated and also the long-term retention of habitats underneath the proposed overhead lines. The installation of the overhead lines would result in the underlying habitats suffering temporary negative impacts during the construction phase, but these habitats would remain in place.

14.14.25 Otter breeding and resting places ("holts") are typically tunnels under water-side trees, and are legally protected. Natal or breeding holts may be used at any time of the year (Ref 14.119). The same natal holt may be used in consecutive years, or different sites may be used in each year. Although no natal holts have been found within the site, there remains the possibility that otter may set up a new natal den site. Otter are strongly territorial and use many above ground lie-up sites or "holts".

14.14.26 With limited information available on the home range boundaries of any otter potentially affected by the proposed development, it is difficult to quantify the magnitude of any impact on otter. With average densities in England and Wales estimated at between one otter per 15km of water and one otter per 27km of water (Ref 14.119), this means, depending where boundaries between adjacent otter territories are situated, there could be several territories affected by the proposed development. Males have larger ranges than females, overlapping those of several females (Ref 14.120).

14.14.27 The suitable habitat to be lost is likely to be a small proportion of an average otter home range size and in the context of the total extent of habitat in the Sizewell and Minsmere areas, most of which would be retained. As detailed in the tertiary mitigation (**section 14.4** of this chapter), a pre-construction survey would be required to provide up-to-date information as to whether any holts are present within the construction footprint or in the ZoI.

14.14.28 The duration of the effect would be for the 9-12 years of the construction programme, and reversible for habitat that is not permanently lost. Land take would have a minor adverse effect, which is considered to be **not significant**.

Habitat fragmentation (including connectivity)

14.14.29 The construction of the SSSI crossing could lead to habitat fragmentation for otter, preventing access to part of their territory, and preventing dispersal movements between Sizewell Marshes SSSI and Minsmere South Levels, along the Leiston Drain. The causeway would be approximately 68m wide at its base, and would therefore include a culvert of similar length. Construction of the crossing would take place in Phase 1 of the construction programme (Years 1 to 2 of the Construction Phase). A temporary bailey bridge might also be used for the early months of site establishment.

14.14.30 This potential habitat fragmentation would be at its most extensive during the Phase 1 construction period, when the site clearance and construction work associated with the establishment of the SSSI crossing is taking place and would then reduce once both the SSSI crossing and the Sizewell Drain diversion are in place. The fragmentation impact would lessen further as re-instated habitats become better established on either side of the SSSI crossing and the planting on the slopes of the embankment establishes to provide screening and soft approaches to the culvert entrance.

14.14.31 Primary mitigation (outlined in **section 14.4** of this chapter) 1 would ensure that the culvert is of sufficient dimensions not to interfere with the geomorphology of the Leiston Drain, leaving the banks and bed intact, and provide an otter ledge or similar to permit the passage of otter during periods of high flow, complete with fencing to guide otter to the SSSI crossing. Given these measures, a barrier to otter movement is only likely during the construction of the culvert. This may not provide a complete barrier during the construction s works would be primarily undertaken during the day, which would allow otters to pass along the drain at night. Following completion of the SSSI Crossing, otters would be able to move along the realigned Leiston Drain unimpeded. Disruption to dispersal or movement over land between Sizewell Marshes SSSI and Minsmere South Levels would last the length of the construction activities (9-12 years) but would be reversible once construction is complete.

14.14.32 Habitat fragmentation would have a **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality of species

14.14.33 There is the potential for incidental injury or mortality to otter from construction plant carrying out vegetation and ground clearance works, and ditch realignment during the preliminary works and site establishment phases of construction. However, given the nature of the site and security fencing requirements, the site construction site boundary fencing would largely exclude otters from areas of the site and reduce the risk of injury or incidental mortality.

14.14.34 Otters are largely but not exclusively nocturnal, as evidenced by many recent diurnal sightings at RSPB Minsmere in 2019, as well being highly mobile and "secretive" (Ref 14.119). Radio-tracking studies have shown that otter move away from an area of disturbance, reducing the risk of accidental injury or mortality. Such an impact is likely to be short-term during the initial site clearance phase.

14.14.35 As outlined in **paragraph 14.14.31**, primary mitigation details a ledge would be provided to allow otter passage along the culvert in times of high flow with fencing either side to guide otter to the ledge. This would reduce the need for otter to leave the confines of the Leiston Drain and cross the access road. In addition, the CoCP (Doc Ref 8.11) also details measures to be implemented during the construction to reduce the risk of mortality or injury to otters such as the inclusion of security fencing.

14.14.36 Therefore, incidental mortality would have a **minor adverse** effect, which is considered to be **not significant**.

Disturbance effects on species population (comprising light, noise and visual effects)

14.14.37 Establishment of the site would result in increases in light, noise and visual disturbance to otters close to the construction footprint and particularly in areas close to the SSSI crossing, through construction activities, increased vehicle movements and increased human presence.

14.14.38 Chanin (Ref 14.119) noted in Shetland, where the otter population is considered to be healthy, that otter regularly breed under the islands' ferry terminals and under the jetties of Europe's largest oil terminal at Sullom Voe.

14.14.39 The primary mitigation (see **section 14.4** of this chapter) includes boundary treatments aimed at minimising noise, lighting and visual disturbance to surrounding habitats including Sizewell Marshes SSS. The majority of construction work would take place between 07:00 and 22:00.

14.14.40 Overall, it is not possible to accurately quantify the magnitude of the disturbance effect from the available literature, but it is reasonable to conclude that disturbance would have a limited effect on the otter population, given also that the area of otter habitat likely to be disturbed is relatively small compared to an average otter territory. Disturbance effects could potentially last for the duration of the construction phase (9-12 years).

14.14.41 Disturbance is considered to have a **negligible adverse** effect, which is considered to be **not significant**.

IEF: water vole

14.14.42 During construction, the main impact pathways experienced by water vole would be associated with:

- land take resulting in habitat loss;
- habitat fragmentation (including connectivity); and
- incidental mortality of species.

14.14.43 The characterisation of the above impacts are described in detail below, and are discussed in more detail in the **Water Vole Mitigation Strategy** (**Appendix 14C6A** of this volume).

Land take resulting in habitat loss

14.14.44 The water vole population within the site would experience habitat loss through the following: vegetation clearance and site preparation (for the SSSI crossing); preparation of the land at the north-west corner of the main platform that is located within the Sizewell Marshes SSSI; installation of a sheet pile barrier between Sizewell Marshes SSSI and the main platform; and infilling of part of Sizewell Marshes SSSI to form the north-west corner of the main platform.

14.14.45 This land take would result in approximately 7.0ha of permanent habitat loss and 2.9ha of temporary habitat loss. This temporary loss is partly the result of habitat being re-instated and also the long-term retention of habitats within the wayleave area underneath the proposed overhead lines. The installation of which will result in the underlying habitats suffering temporary negative impacts during the construction phase, but subsequently these habitats will remain in place. Of the 7.0ha of permanent habitat loss from the SSSI, water vole foraging and burrowing habitat is represented by 3.6ha of dry reedbed and 670m of permanent habitat loss along the Sizewell Drain, Leiston drain and other ditches. However, 1990m of ditch is only temporarily lost. The Sizewell Drain running south to the east of the existing Sizewell B power station is considered poor water vole habitat as it is heavily shaded within woodland. Water voles would need to be removed from these areas prior to the works commencing. The temporary loss due the Phase 1 construction of the realignment of the watercourses would be reversible, as they would be re-instated but the habitat loss, including the reedbed area, under the main platform and the SSSI crossing would be permanent.

14.14.46 The length of a water vole home ranges varies between 30 to 150m for females and 60 to 300m for males (Ref 14.121). The lower ends of the ranges are appropriate assumptions in the context of the proposed development given the favourability of the habitat and so densities can be assumed to be high and home range sizes correspondingly low. Females are territorial, although they may share territories with their offspring (Ref 14.122). Males are not territorial but have ranges which overlap with those of many females and other males.

14.14.47 Primary mitigation (outlined in **section 14.4** of this chapter) has created 1.4ha of water-vole free reedbed habitat within lagoon A of Aldhurst Farm, maintained as water vole free using exclusion fencing. This established habitat would act as a receptor site for the translocation of water voles from the areas subject to land take. In addition, a further 2.6ha of reedbed habitat has been created in three adjacent lagoons at Aldhurst Farm.

14.14.48 Therefore, land take would have a **minor adverse** effect, which is considered to be **not significant**.

Habitat fragmentation

14.14.49 The construction of the SSSI crossing would change the current habitat conditions on site and could theoretically lead to habitat fragmentation for water voles, limiting dispersal movements between Sizewell Marshes SSSI and Minsmere South Levels, along the Leiston Drain. This potential is assessed in subsequent paragraphs.

14.14.50 Populations of water vole typically consist of discrete colonies comprising a few individuals and having a finite lifespan. Groups of colonies persist through dispersal and colonisation, and genetic interchange is a feature in the successful survival of water vole meta-populations. Dispersal movements are frequent and extensive and can take place both along waterways and across land. Survival of populations of water vole can only be ensured through connectivity between various colonies, allowing range expansion and dispersal of water vole (Ref 14.121).

14.14.51 There is limited evidence as to whether culverts act as a barrier to water vole movement along watercourses. The Water Vole Conservation Handbook (Ref 14.121) states that "*culverting does not seem to provide a major problem to water vole movement or fragmentation*", although it also says that "*length may present a problem to water vole daily movement and dispersal*". A former project officer at the Northumberland Wildlife Trust who has undertaken studies on water voles and culverts, has stated that a 70m culvert should not be considered a major barrier to the movement of water voles. Whilst water voles are unlikely to inhabit culverted structures, animals will disperse through them and move along watercourses thereby demonstrating that long stretches of culvert do not pose a barrier to movement or fragment populations. Further details are included in the literature review and where relevant , are described in the **Water Vole Mitigation Strategy** (**Appendix**

14C6A of this volume). It is concluded here that a dispersing water vole could readily move through a 70m length culvert (i.e. the length of the SSSI crossing culvert) although such a culvert is likely to dissuade regular daily movements.

14.14.52 In discussions in June 2016, both Natural England and the Environment Agency confirmed that, subject to SZC Co. making a compelling economic case for the SSSI crossing option, comprising an embankment and culvert, neither body would be likely to object to the proposals subject to the following: appropriate sizing and design of the culvert including a large aperture; retention of existing ditch channel in situ; incorporation of appropriate dry ledges for voles/otters as well as potentially, dry runs for otters; and the landscape scheme to incorporate tree planting on the embankment to provide landscape screening and ecological mitigation in the form of hop-overs for bats and birds that may need to cross. It was stated that SZC Co. would need to demonstrate that the proposals have been designed in a manner that minimises land take from Sizewell Marshes SSSI.

14.14.53 As outlined under consideration of otters and in primary mitigation (**section 14.4** of this chapter), the dimension of the culvert would be sufficient not to interfere with the geomorphology of the Leiston Drain and would leave the banks of the drain intact at the crossing point. Disruption to dispersal or movement over land between Sizewell Marshes SSSI and Minsmere South Levels would likely be for the duration of the construction of the SSSI crossing, after which access along the culvert would be unimpeded. Even if fragmentation effects were more substantive, given the size of the local water vole population, it is considered likely that the population of the Sizewell Marshes could be sustained even without genetic interchange with the populations on the Minsmere South Levels.

14.14.54 Primary mitigation outlined in **section 14.4** of this chapter also details how additional water vole habitat has been created, and established, at Aldhurst Farm, in advance of works, adjacent to the western end of Sizewell Marshes SSSI.

14.14.55 Overall, habitat fragmentation would have a **minor adverse** effect, which is considered to be **not significant**.

Incidental mortality

14.14.56 There is the potential for incidental injury or mortality to water vole from construction plant carrying out vegetation and ground clearance works, installation of security fencing, ditch realignment during the Phase 1 preliminary works, and site establishment phases of construction. Water vole would be particularly vulnerable when they are in their burrows. The risk of any incidental injury or mortality could have a one-off, non-reversible, permanent impact.

14.14.57 Water vole use a series of burrows with many entrances and interconnecting tunnels. They also occasionally build woven nests in the bases of sedges and reeds. Outside of their burrows, water vole activity is largely confined to runs in dense vegetation with 2-5m of the water's edge (Ref 14.121).

14.14.58 The primary and tertiary mitigation outlined in **section 14.4** of this chapter includes additional water vole habitat which has been created in advance of works (at Aldhurst Farm) and identifies a **Water Vole Mitigation Strategy** (**Appendix 14C6A** of this volume) and **Water Vole Draft Protected Species Licence** (**Appendix 14C6B** of this volume) that aims to minimise incidental mortality by catching and translocating the water vole likely to be directly affected.

14.14.59 Given the additional water vole habitats that have been created and the implementation of the **Water Vole Mitigation Strategy** (**Appendix 14C6A** of this volume) and as detailed in the **Water Vole Draft Protected Species Licence** (**Appendix 14C6B** of this volume), incidental mortality would have a **minor adverse** effect, which is considered to be **not significant**.

Inter-relationship effects

14.14.60 This section provides a description of the identified inter-relationship effects that are anticipated to occur on terrestrial mammals between the individual environmental effects arising from construction of the proposed development.

14.14.61 It is considered that potential changes to local hydrology, water and air quality could act together to cause changes to vegetation structure and composition of aquatic habitat for otter and water vole, particularly within Sizewell Marshes SSSI and Minsmere South Levels. This in turn could reduce the suitability of this habitat to support these two protected species.

14.14.62 As outlined in tertiary mitigation hydrological and botanical monitoring of Sizewell Marshes SSSI and Minsmere South Levels would continue through the construction phase and if a negative trend is found then mitigation such as increased grazing or manipulation of water levels would occur.

ii. Operation

14.14.63 No significant, adverse effects are envisaged during the operational phase. Any impacts of the culvert would be no different in the longer-term than in the construction phase.

14.14.64 The newly established water vole and otter habitats within Aldhurst Farm, which provides a similar area of reedbeds and ditch length to the habitats lost to the main platform and the SSSI crossing, would result in an overall neutral, not significant effect for both species. In the long-term, the reedbed and wet woodland creation to the north eastern extent of the development would also provide further long-term suitable habitat which would be of benefit to both species.

Inter-relationship effects

14.14.65 No inter-relationship effects have been identified for the operational phase.

d) Mitigation and monitoring

i. Mitigation

14.14.66 Primary and tertiary mitigation measures which have been incorporated within the design of the proposed development and considered during the assessment are summarised in **section 14.4** of this chapter. As the assessment concluded no significant effects when considering the primary and tertiary mitigation measures, no further secondary mitigation measures for the terrestrial mammal assessment are required to reduce or avoid a significant effect, for either the construction or operational phase.

ii. Enhancement

14.14.67 Due to the primary and tertiary mitigation in place (see **section 14.4** of this chapter), no additional enhancement is proposed, although landscape-scale habitat creation for the operational masterplan (e.g. acid grassland) would be of benefit to badgers. Further details are provided in the **Badger Mitigation Strategy - Confidential (Appendix 14C3** of this volume).

iii. Monitoring

14.14.68 Monitoring of otter activity would take place before, during and after construction, and would include methods to assess use of the SSSI crossing culvert by otter.

14.14.69 A monitoring programme (see **Water Vole Mitigation Strategy** (**Appendix 14C6A** of this volume) and the **Water Vole Draft Protected Species Licence** (**Appendix 14C6B** of this volume) would be required for water vole to determine any long-term impact on the water vole populations, to assess the effectiveness of the mitigation and to inform any changes that may be required to the management of habitats. Monitoring surveys of water vole would provide information on the establishment and success of the translocated population at the Aldhurst Farm receptor site, the re-colonisation of the realigned Sizewell Drain and the re-colonisation of the Leiston Drain.

14.14.70 Monitoring of badger setts prior to, during and after closing or destruction would take place as described in **section 14.4** of this chapter.

e) Residual Effect

14.14.71 The following tables present a summary of the terrestrial mammal assessment. They identify the receptor/s likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

14.14.72 It should be reiterated that not all such effects are adverse; some are beneficial.

Table 14.70: Summary of effect arising from the construction phase for terrestrial mammals

Receptor	Impact	Primary or Tertiary mitigation	Assessment of effects	Additional mitigation	Residual effects
Otter.	Land take.	Primary mitigation includes pre-construction surveys to avoid disturbance or destruction of otter holts, and habitat creation at Aldhurst Farm.	Minor adverse (not significant.	None required.	Minor adverse (not significant).
	Habitat fragmentation.	Primary mitigation includes SSSI crossing design to allow the passage of otter, with fencing to guide otter to the crossing, as described in the **Water Vole Mitigation Strategy** and **Water Vole Draft Protected Species Licence.**	Minor adverse (not significant.	None required.	Minor adverse (not significant).
	Incidental mortality.	Primary mitigation includes SSSI crossing design to allow the passage of otter, including a ledge to allow passage at times of high flow, as described in the **Water Vole Mitigation Strategy** and **Water Vole Draft Protected Species Licence.**	Minor adverse (not significant.	None required.	Minor adverse (not significant).
	Disturbance effects.	Primary mitigation includes a **Lighting Management Plan for Construction and Operational Sites** (**Volume 2, Appendix 2B**) and boundary treatments.	Negligible adverse (not significant).	None required.	Negligible adverse (not significant).
Water vole.	Land take.	Primary mitigation includes habitat creation at Aldhurst Farm, as described in the **Water Vole Mitigation Strategy** and **Water Vole Draft Protected Species Licence.**	Minor adverse (not significant).	None required.	Minor adverse (not significant).
	Habitat fragmentation.	Primary mitigation includes SSSI crossing design to allow the passage of water vole,	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Receptor	Impact	Primary or Tertiary mitigation	Assessment of effects	Additional mitigation	Residual effects
		as described in the **Water Vole Mitigation Strategy** and **Water Vole Draft Protected Species Licence.**			
	Incidental mortality.	Tertiary mitigation includes trapping and translocation of water vole into a receptor site (Aldhurst Farm), as described in the **Water Vole Mitigation Strategy** and **Water Vole Draft Protected Species Licence.**	Minor adverse (not significant).	None required.	Minor adverse (not significant).

Table 14.71: Summary of effect arising from the operational phase for terrestrial mammals

Receptor	Impact	Primary or Tertiary mitigation	Assessment of effects	Additional mitigation	Residual effects
Otter; Water vole.	Habitat creation. Habitat fragmentation.	Primary mitigation includes habitat creation at Aldhurst Farm as well as further reedbed and wet woodland habitat to the north eastern extent of the site.	Neutral (not significant).	None required.	Neutral (not significant).

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