West Winch Housing Access Road

Environmental Statement – Chapter 8 Ecology

Author: WSP

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1 Introduction

1.1.1 This chapter provides the identification and assessment of likely significant environmental effects arising from the construction and operation of the Proposed Scheme on Biodiversity, hereafter referred to as 'Ecological Impact Assessment (EcIA)'.

1.1.2 This report, its associated figures and appendices are intended to be read as part of the wider ES.

1.1.3 This assessment has relied on the baseline ecological information contained in the following documents:

- Annex 8.1 - Habitat Survey Report.
- Annex 8.2 - National Vegetation Classification Survey Report.
- Annex 8.3 - Hedgerow Survey Report.
- Annex 8.4 - Aquatic Ecology Scoping Report.
- Annex 8.5 - Aquatic Ecology Survey Report.
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- Annex 8.16 - Great Crested Newt Survey Report.

1.1.4 A Biodiversity Net Gain (BNG) Assessment has been completed for the Proposed Scheme and the results of this assessment are presented in the Biodiversity Net Gain Assessment (Annex 8.17) (WSP, 2023p). This assessment measures the change in biodiversity through development (expressed as biodiversity units), with a target to achieve a minimum of 10% net gain in biodiversity units. The 10% BNG requirement has not been met within the Scheme Boundary, therefore offsite habitat creation will need to be secured. This is discussed further within the BNG Assessment.

1.1.5 This assessment also includes or refers to information prepared as part of the Habitats Regulations Assessment (HRA) that has been completed for the Proposed Scheme, which in turn is informed by this assessment, technical reports and other chapters of the ES. The West Winch Housing Access Road Habitats Regulations Assessment: No Significant Effects Report (Appendix 8.18) should therefore be read in conjunction with this chapter.

1.1.6 This chapter aims to accomplish the following:

- Summarise the legislative and policy framework;
- Describe consultation undertaken to date;
- Describe the methodology followed for the assessment;
- Identify the potential impacts from the Proposed Scheme;
- Detail the mitigation and enhancement measures that have been identified;
- Report the assessment of likely significant effects of the Proposed Scheme; and
- Detail the monitoring that is recommended to be carried out for the Proposed Scheme.

2 Legislative and Policy Framework

2.1 Legislative Framework

2.1.1 The applicable legislative framework is summarised as follows.

International

2.1.2 Within English law, international law obligations are given effect through government policy and legislation enacted or approved by Parliament.

2.1.3 The United Nations Convention on Biological Diversity 1992 was ratified by the UK in 1994. Under the Convention, the Strategic Plan for Biodiversity 2011–2020 (the 'Aichi' targets) established a legal framework for biodiversity conservation with the goals of conserving biological diversity, sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources. Within England the 2011 strategy "Biodiversity 2020" aligned with the Aichi targets. Other related policies published for England include the 25-year environment plan and the target to protect 30% of UK land by 2030.

2.1.4 The Bern Convention on the Conservation of European Wildlife and Natural Habitats came into force in 1982 and is concerned with the conservation of wild flora and fauna and their natural habitats. Within the European Union, whilst the UK was a member state, the Bern Convention was implemented by the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC). Within the UK the Bern Convention is implemented for species protection by the Wildlife and Countryside Act 1981.

2.1.5 The Bonn Convention on the Conservation of Migratory Species of Wild Animals aims to conserve terrestrial, marine and avian migratory species throughout their ranges. Within the European Union, whilst the UK was a member state, the Bonn Convention was partly implemented by the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC). Within the UK the Bern Convention is implemented for species protection by the Wildlife and Countryside Act 1981. EU and EU-derived legislation is retained EU law

under the European Union (Withdrawal) Act 2018 - not yet superseded by the Retained EU Law (Revocation and Reform) Bill.

2.2 National

The Environment Act 2021

2.2.1 The Environment Act 2021 requires the Secretary of State to produce environmental targets for specific measures and an environment improvement plan for England and Wales that must seek to significantly improve the natural environment over at least 15 years. One of the new, legally binding targets is in respect of increasing species abundance of British species by 2030. Most planning permissions granted pursuant to applications submitted after January 2024 will be subject to a deemed planning condition requiring the provision of 10% biodiversity net gain.

Conservation of Habitats and Species Regulations 2017 (as amended) (Habitats Regulations)

2.2.2 In the UK, the Habitats Directive was originally transposed into national law by means of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended). The Conservation Regulations came into force on 30 October 1994 and have been amended several times. Subsequently the Conservation of Habitats and Species Regulations 2010, were created which consolidated all the various amendments made to the 1994 Regulations in respect of England and Wales. The 2010 regulations have now been superseded by the 2017 regulations, which have also been subject to amendment including as a result of the UK's exit from the European Union. The 2017 Regulations (hereafter referred to as the Habitats Regulations) provide for the designation and protection of 'European Sites' in England, the protection of 'European Protected Species', and the adaptation of planning and other controls for the protection of European Sites.

2.2.3 Amendments to the Habitats Regulations made as a result of the United Kingdom's exit from the European Union include the transferring of powers from the European Commission to the appropriate authorities in England and

Wales. The process for HRA and the duties of Competent Authorities as defined in the Habitats Regulations remain largely unchanged Other amendments include:

- The creation of the National Sites Network, which comprises the sites previously designated as European sites. The establishment of management requirements for the National Site Network.
- Amendments to the Imperative Reasons of Overriding Public Interest (IROPI) test to replace the European Commission's former role.

Wildlife and Countryside Act 1981 (as amended)

2.2.4 The Wildlife and Countryside Act 1981 (hereafter referred to as the 'WCA') is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Bern Convention and (partially) the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Habitats Directive have been implemented in the UK. The WCA includes provisions, amongst others, for the identification and designation of protected species; for the safeguarding and designation of Sites of Special Scientific Interest (hereafter referred to as SSSI); and for the designation of invasive non-native species (INNS) and measures to control the spread of these.

The Natural Environment and Rural Communities (NERC) Act 2006 (as amended)

2.2.5 The Natural Environment and Rural Communities Act 2006 (NERC Act) provides that any public body or statutory undertaker in England must have regard to the purpose of conservation of biological diversity in the exercise of their functions. The intention is to help ensure that biodiversity becomes an integral consideration in the development of policies and plans.

2.2.6 The Environment Act 2021 makes changes to the NERC Act which updated the general duty to conserve biodiversity by adding a duty to not only conserve but also enhance biodiversity. Public authorities are expected to

produce reports on the action they have taken under this duty when designated by the Secretary of State.

2.2.7 A list of Habitats of Principal Importance (HPI) and Species of Principal Importance (SPI) is published as a legal duty under Section 41 of the NERC Act. This list is aimed at helping public bodies meet their 'biodiversity duty' to be aware of biodiversity conservation in their policy or decision making. The full lists are published on the Joint Nature Conservation Committee website.

The Hedgerow Regulations

2.2.8 Under the Regulations it is an offence to remove a hedgerow (as defined within the Regulations) without applying to the local planning authority (LPA) for permission. Should the hedgerow be deemed unimportant according to the criteria within the Regulations the LPA is obliged to allow removal; however, if the hedgerow qualifies as 'Important' under the Regulations the LPA must decide whether the reasons for removal justify the loss of an 'Important Hedgerow', with a presumption for retention.

The Protection of Badgers Act 1992

2.2.9 The Protection of Badgers Act makes it an offence to kill or take a Badger *Meles meles*, or to interfere with a Badger sett unless such action is licenced by Natural England. Sett interference includes damaging or destroying a sett, obstructing access to a sett, and disturbing a Badger whilst it is occupying a sett. The Act defines a Badger sett as 'any structure or place, which displays signs indicating the current use by a Badger' and Natural England takes this definition to include seasonally used setts.

2.3 Policy Framework

2.3.1 The applicable policy framework is summarised as follows.

National

National Planning Policy Framework 2023

2.3.2 At a national context, planning policy is driven by the NPPF which was updated in 2023 and sets out, amongst other points, how at an overview level

the 'planning system should contribute to and enhance the national and local environment by:

- *'…recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services;*
- *minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures…'*

2.3.3 The NPPF states that this should be achieved through local planning development frameworks and gives recommendations for criteria based policies which recognise the hierarchy of designated sites which range from internationally important habitat, to sites of importance at a local level and ensure that they are protected 'in a manner commensurate with their statutory status or identified quality in the development plan.'

2.3.4 A list of principles which planning authorities should follow when determining planning applications is included in the NPPF which includes the following:

- *'If significant harm to biodiversity resulting from a development cannot be … adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;'*
- *development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and*
- *development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate.*

Local

Borough Council of King's Lynn and West Norfolk Local Development Plan

King's Lynn & West Norfolk Borough Council Local Development Framework - Core Strategy

2.3.5 The following policies within the Core Strategy are relevant to ecology and biodiversity.

- CS12 Environmental Assets.

2.3.6 In addition, Norfolk County Council's Environmental Policy, approved by Full Council on 25 November 2019 contains additional relevant objectives regarding the protection and enhancement of biodiversity by ensuring a net improvement ('net gain') to biodiversity and habitat creation.

North Runcton & West Winch Neighbourhood Plan 2018

2.3.7 The following polices within the neighbourhood plan are relevant to ecology and biodiversity.

- Policy WA03: Protecting and replacing natural features.
- Policy GA02: Providing 'green infrastructure'.

2.3.8 The polices state that developments within the plan will be supported where green infrastructure is retained or compensated for, and where suitable levels of green infrastructure are provided.

West Winch Growth Area Framework Masterplan SPD

2.3.9 The growth area masterplan provides further relevant policy regarding biodiversity, including the following.

2.3.10 The development must make the most of opportunities to create or improve habitats. This includes the retention of hedgerows and mature trees, use of native species in landscaping, installation of bird and bat boxes and design of lighting schemes to encourage habitat creation and enhancement.

2.3.11 Development will also be expected to contribute towards enhanced biodiversity with parts of the Green Infrastructure being identified for uses/

activities; these will need to be maintained at an appropriate level to meet these objectives.

3 Consultation

3.1.1 Consultation with Norfolk County Council was undertaken through the provision of an EIA Scoping Report produced by WSP in March 2021 (Appendix 1.1). A consultation response to the EIA Scoping Report was received in May 2021 that was followed up with a virtual meeting with the Norfolk County Ecologist to discuss the proposed survey methodology for the Proposed Scheme. Methodologies were agreed and undertaken following this consultation.

3.1.2 Consultation was also undertaken in 2023 with the NCC Natural Environment Team regarding the validity of survey undertaken to inform the impact assessment and planning application. The outcome of the discussions is addressed within this assessment.

4 Scope of the Assessment

4.1.1 The scope of this assessment has been established through an ongoing process and is based on the scoping opinion. Further information can be found in Chapter 5 (Biodiversity) of the WWHAR Environmental Impact Assessment Scoping Report (WSP, 2021).

4.2 Elements Scoped into the Assessment

Construction Phase

4.2.1 The following are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have therefore been considered within this assessment.

- Permanent and temporary loss of habitats which result in damage or loss of HPI or habitats otherwise of conservation importance including

the interruption and fragmentation of ecological networks and wildlife corridors.

- Water-borne pollution (sediment loading and accidental release of chemicals) leading to deterioration of habitats including their supporting role for protected and otherwise notable species.
- Killing and / or injury of protected species and damage and / or loss of their supporting habitats due to site clearance and construction activities (including excavations and lighting).
- Disturbance and displacement of protected species and their supporting habitats due to site clearance and construction activities (through visual disturbance, noise, vibration and lighting).
- Airbourne pollution through dust emissions during construction leading to deterioration of habitats.
- Spread of INNS.

Operational Phase

4.2.2 The following elements are considered to have the potential to give rise to significant effects during operation of the Proposed Scheme and have therefore been considered within this assessment.

- Changes in air quality potentially affecting habitats and certain species through air pollution.
- Disturbance and displacement of protected species and loss of their supporting habitats due to increased additional lighting, noise and visual disturbance.
- Water-borne pollution from road run-off leading to deterioration of aquatic habitats including their supporting role for protected and otherwise notable species.
- Killing and / or injury of protected species through increase risk of traffic collision and road mortality.

- Habitat interruption and fragmentation with the potential affect the distribution of protected and notable species.

4.3 Zones of Influence

4.3.1 The Proposed Scheme has been reviewed to identify the spatial scale at which Important Ecological Features (defined in Section 5.1.4) could be affected as a result of the Proposed Scheme's construction and operation. This is defined as the Ecological Zone of Influence (EZoI). These EZoI are defined within the WWHAR Environmental Impact Assessment Scoping Report (WSP, 2021). However, since these EZoI were adapted through the consultation with Norfolk County Council, they are summarised below.

4.3.2 The desk study will take in an extended study area in keeping with current guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM) (CIEEM, 2018) and guidance within the Design Manual for Roads and Bridges (DMRB, 2020). These distance criteria are for guidance purposes, however impacts beyond these distances are considered highly unlikely. The following Study Areas apply to statutory and non-statutory designated sites:

- European (In relation to the UK's exit from the European Union, the Department for Environment Food and Rural Affair published a policy paper in January 2021 detailing changes to the Habitats Regulations (2017). This refers to the establishment of a national site network of 'protected sites'.) and internationally designated Sites: Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites: 10km from the Proposed Scheme Boundary.
- All SACs designated for bats: 30km from the Scheme Boundary.
- Nationally designated sites, such as Sites of Special Scientific Interest and National Nature Reserves (NNRs): 10km from the Scheme Boundary; and

- Locally designated sites (e.g. County Wildlife Sites): 2km from the Scheme Boundary.

4.3.3 In addition, sites that fall within 200m of the affected road network (ARN) are also assessed where they could be impacted by changes in air quality (refer to Chapter 6: Air Quality).

4.3.4 Defined Surveys Areas for individual ecological features have been informed by published guidance on likely EZoIs. These are as follows:

- Habitats and botanical features: within the Scheme Boundary.
- Aquatic ecological features: within Pierpoint Drain (180m north of the Proposed Scheme).
- Wintering and breeding birds: 250m from the Scheme Boundary.
- Bats: within the Scheme Boundary and up to 25m for tree roosts and all buildings within 50m of the Scheme Boundary that are considered likely to impacted by the Proposed Scheme.
- Badger: Up to 250m from the Scheme Boundary.
- Water Vole: within the Scheme Boundary but extended up to 250m to nearby water courses where directly connected.
- Otter: Within the Scheme Boundary but extended up to 250m to nearby water courses where directly connected.
- Great Crested Newts (GCN): within and up to 500m beyond the Scheme Boundary.
- Reptiles: within the Scheme Boundary; and
- Invertebrates: within the Scheme Boundary.

5 Assessment Methodology

5.1 Overview

5.1.1 The EcIA has been carried out pursuant to the relevant legislation, planning policy detailed in Section 2 and appropriate ecological guidance. The assessment will determine the potential effects arising from the construction and operational phases of the Proposed Scheme on Important Ecological Features (as defined below).

5.1.2 The assessment has been carried out with consideration of embedded mitigation measures (described in Section 8) while additional mitigation measures are considered in (Section 9) where there is a need for implementation at later stages in the design and development of the Proposed Scheme.

5.1.3 The following guidance documents and data sources have been used during the preparation of this impact assessment:

- Guidelines on Ecological Impact Assessment (CIEEM, 2018);
- Advice Note on Lifespan of Ecological Reports and Surveys (CIEEM, 2019); and
- Guidelines for Accessing, Sharing and Using Biodiversity Data in the UK (CIEEM, 2020)

5.1.4 In accordance with the CIEEM EcIA Guidelines (2018), the assessment carried out collates relevant baseline information to predict the effects of the Proposed Scheme on Important Ecological Features. These are defined as:

- Statutory designated sites;
- Non-statutory designated sites;
- HPI and SPI; and
- Protected habitats and species, including those of conservation importance.

5.1.5 This assessment is based on the Scheme Boundary presented in separate document Appendix A. The Scheme Boundary comprises the land required for the Proposed Scheme and its construction and includes areas of land that will be used permanently by the Proposed Scheme and temporarily during its construction.

5.1.6 A significant effect is defined as an effect that could have an impact upon the structure, form, function and conservation status of a designated site, habitat and ecosystem or species population where these are defined as Important Ecological Features. The relative importance of ecological features is valued against a geographic frame of reference.

5.1.7 Mitigation is developed on an iterative basis, with the mitigation hierarchy followed; preference is first given to avoiding effects, then reducing remaining effects, before applying targeted mitigation where necessary. Where residual effects remain after application of targeted mitigation measures, compensation is then implemented.

5.2 Assessment of Importance/Sensitivity

5.2.1 Sensitivity is a means to measure how affected receptors/processes and/or the receiving environment is to change. The sensitivity is assigned at the receptor/process level. This may be defined in terms of quality, value, rarity or importance, and be classed as negligible, low, medium, or high. CIEEM use the term “Importance” to reflect value and sensitivity, and this term has been adopted here and represented at geographical scales. Common and widespread features that do not meet the criteria for local importance are considered to be of negligible importance and will not be assessed.

5.2.2 An Important Ecological Feature is determined using the geographical scale described below:

- International (within Europe);
- National (relating to the UK, specifically England);

- County (Norfolk); and
- Local (features that are of importance at a local level such as District).

5.2.3 This assessment methodology expands upon the approach detailed within the EIA Scoping Report (Appendix 1.1). The assessment of importance now excludes District importance, which was included in the scoping methodology. This is in part because there are no district level designations that can be referred to when assessing the importance of features, and because it is rare that species and habitat data is compiled at a district level and so there is no context for assessments to be made against at this scale.

5.2.4 The geographical scale of importance for statutory and non-statutory designated sites is assigned based on their designation. For example, sites designated under the National Sites Network and Ramsar Sites are considered of international importance, because they are designated on the basis of supporting habitats and / or species which are of importance for nature conservation at an international level (pursuant to the Habitats Regulations). Sites of Special Scientific Interest and National Nature Reserves are considered to be of 'National' importance because they are designated for supporting habitats, species, and other features of importance for nature conservation at a UK level.

5.2.5 The geographical scale of importance for habitats and species is assigned with reference to any designations or policy provisions that apply. For example, HPI are considered of particular importance to the conservation of biodiversity in England. That is not to say that all HPI are considered of 'National Importance'. Extents of such habitats that form an appreciable part of the English resource, would however be considered of 'National Importance'.

5.2.6 The same approach applies to protected or otherwise notable species. For example, the Great Crested Newt *Triturus cristatus* is recognised as a priority for nature conservation at an international level, by way of its identification as a protected species under the Habitats Regulations. Very large populations

that make up an appreciable proportion of the European population might rightly be identified as of 'International Importance'. Smaller populations that are not exceptional in the locality where they occur and do not contribute particularly to the maintenance of wider populations would be of lesser importance.

5.2.7 The geographical scale of importance for habitats and species is reliant upon expert judgement and accounts for the following considerations:

- Legal protection;
- Planning policies;
- Distribution including relative to the Proposed Scheme;
- Conservation status (i.e., is the habitat/species common and widespread, or rare with a highly localised distribution); and
- Population trends.

5.3 Characterising Ecological Impacts and Effects

5.3.1 When describing ecological impacts and effects, reference will be made to the following characteristics as required:

- Beneficial or adverse;
- Extent;
- Duration (short-term (< 1 year), medium-term (1 - 5 years) or long-term (5 or more years);
- Reversibility (whether the impact is naturally reversible or reversible through mitigation measures or permanent).

Magnitude

5.3.2 The magnitude relates to the level at which the receptor will be impacted, using the duration of the impact, timing, scale, size and frequency to

determine the magnitude of the impact to each feature. Magnitude of impact is evaluated in accordance with the definitions set out in Table 5-1.

Table 5-1 Definitions of Impact Magnitude

Magnitude	Definition
High	Total loss or large alteration to key elements/features of the baseline (i.e., pre-development) conditions.
Medium	Partial loss or alteration to one or more key elements/features of the baseline (i.e., pre-development) conditions
Low	Small shift away from baseline (i.e., pre-development) conditions.
Negligible	Very slight change from baseline (i.e., pre-development) conditions.

5.4 Assessment of Significant Effects

5.4.1 In the context of the EcIA, the significance of an effect is assessed as either significant (an appreciable effect on the structure, form, function and conservation status) or not significant (no or negligible effect on structure, form, function and conservation status).

5.4.2 Significant effects on Important Ecological Features are assessed as either beneficial or adverse. Where an effect is neither beneficial nor adverse (neutral), this is assessed as not significant. Each significant effect is assessed based on a number of factors including the magnitude of potential impacts (incorporating intensity, frequency and spatial range) and the sensitivity of habitats and species to developmental changes. The significance of an effect is defined against the geographical scale described in Section 5.2. For the purposes of this assessment, ecological features of 'Local' importance or higher are assessed as being "Important Ecological Features" that can therefore experience significant effects.

5.4.3 The significance of an effect is determined based on the extent to which the integrity or conservation status of an Important Ecological Feature is compromised (i.e. the magnitude of the effect) and the importance of the Important Ecological Feature, defined though the geographical scale.

5.4.4 Table 5-2 sets out how an effect can be classified using the EIA classification terminology and how it relates to the geographical scale used in this assessment. These significance criteria are referred to in the conclusion of this assessment once cumulative effects have been assessed. For the purposes of this assessment significant effects that are 'moderate' or higher would be considered significant in EIA.

Table 5-2 Matrix to Assess Significance

Magnitude	**High**	**Medium**	**Low**	**Negligible**
International Importance	Major	Major to Moderate	Moderate	Negligible
National Importance	Major	Major to Moderate	Moderate	Negligible
County Importance	Major to Moderate	Moderate	Minor to Moderate	Negligible
Local Importance	Moderate	Minor	Minor	Negligible

5.5 Biodiversity Net Gain

5.5.1 A BNG Assessment (WSP, 2023p) has been carried out for the Proposed Scheme. The BNG assessment has been completed using the Biodiversity Metric 4.0 and associated guidance material published by Natural England. These documents and methodologies have informed the qualitative measurement in biodiversity unit change through development of the Proposed Scheme.

5.5.2 The BNG Assessment also assesses the Proposed Scheme against the best practice guidance detailed in CIEEM, IEMA and CIRIA's BNG: Good Practice Principles for Development (2016), British Standard 8683:2021: Process for designing and implementing Biodiversity Net Gain.

5.5.3 Baseline habitat data collected through habitat surveys have been used to inform the habitat calculations for the BNG assessment. This included an updated habitat condition assessment undertaken in June 2023.

5.5.4 It should be noted that any offsite habitat creation requirements set out in the BNG Assessment Report does not contribute to mitigation measures within this EcIA. These measures have not yet been committed to, although they will be committed through the application process and secured by planning condition. Regulations for Biodiversity Net Gain, required through the Environment Act, are not yet released and there is uncertainty regarding the length of time that offsite habitat creation measures will be secured. Offsite habitat creation and management to achieve BNG will need to be committed to for at least of 30 years in line with the requirements of the Environment Act, however it is currently not clear whether these offsite habitat creation areas will be secured beyond this timeframe (for example by Conservation Covenants). Compensation measures to mitigate significant effects of the Proposed Scheme would need to be for the lifespan of the Proposed Scheme and as such any offsite habitat creation measures are not considered as mitigation for significant effects within this assessment.

5.6 Method of Baseline Data Collection

Desk Study

5.6.1 A desk-based assessment was undertaken to inform this ES in September 2023. As part of the desk-based assessment a request for biological records was made to Norfolk Biodiversity Information Service (NBIS) for locally designated sites and protected and notable species up to 2km from the Scheme Boundary. This buffer was extended to 5km for bats. The request included non-statutory designated sites, ancient woodland, Habitats and Species of Principal Importance under the NERC Act, internationally and nationally protected species and species of local conservation interest.

5.6.2 Relevant species records within the last 10 years are presented within the baseline assessment in Section 6.

5.6.3 Freely available Natural England datasets were used to search for internationally designated sites within 10km of the Scheme Boundary. This distance was extended up to 30km from the Scheme Boundary for sites designated for bats, specifically Barbastelle bat *Barbastella barbastellus* (as defined by DMRB guidelines (DMRB, 2020)) and decreased to 5km for sites designated for aquatic habitats or species.

5.6.4 Fish, aquatic macroinvertebrate and macrophyte survey data for relevant watercourses was obtained from the Environment Agency's Ecology and Fish Data Explorer (Environment Agency, 2023a).

5.6.5 The current Water Framework Directive (WFD) status for the catchment was obtained from the Environment Agency's Catchment Data Explorer website (Environment Agency, 2023b).

Field Surveys

5.6.6 A range of habitat and species surveys were undertaken within the areas impacted by the Proposed Scheme (EZoI). The full methodologies can be found within the individual survey reports listed in Section 1.1.3.

Habitats and Botany

5.6.7 To inform the assessment of the Proposed Scheme, a range of habitat surveys have been undertaken between 2019 and 2023. These surveys have included a Phase 1 Habitat Surveys undertaken in 2019. The results of these surveys were updated to the UK Habitat Classification in 2021 which is now the industry standard for habitat surveys. The UK Habitat Classification is also more closely aligned to the habitat types described in the BNG Metric. The habitat survey was updated during an update Preliminary Ecological Appraisal (PEA) site survey and habitat condition assessment in June 2023.

5.6.8 The habitat surveys included all habitats within the Scheme Boundary. Surveys were completed with reference to the following guidelines:

- Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit (JNCC, 2010);

- UK Habitat Classification User Manual Version 1.1 (Butcher, Carey, Edmonds, Norton, & Treweek, 2020); and
- DEFRA Biodiversity Metric 4.0 (Natural England, 2023).

5.6.9 The UK Habitat Classification System has been used when referring to broad habitat types within this impact assessment, as this is widely considered to the industry standard for habitat surveys of this type, is the most up to date habitat assessment for the Proposed Scheme and is the closest likeness to the habitat types used in the Biodiversity Metric.

5.6.10 In addition to the habitat survey classifications above, National Vegetation Classification (NVC) surveys of grasslands and woodland within the Scheme Boundary were undertaken along with botanical surveys to assess for the presence of important arable field margins. These surveys were undertaken to determine the presence (and absence) of HPI with the Scheme Boundary. These surveys were undertaken with reference to the following guidance material:

- British Plant Communities Volume 3: Grasslands and Montane Communities. (Rodwell, 1998b);
- Important Arable Plant Areas. (Plantlife, 2022a);
- Important Arable Plant Areas Threatened Species (Criterion A). (Plantlife, 2022b); and
- Important Arable Plant Areas Outstanding Assemblages (Criterion B). (Plantlife, 2022c)

5.6.11 Hedgerow surveys were undertaken for all hedgerows likely to be directly affected by the Proposed Scheme. Surveys included condition assessments to inform the BNG Assessment. Hedgerows were also assessed against the biodiversity criteria for important hedgerows under the Hedgerow Regulations. Hedgerow surveys were undertaken with reference to the following guidelines:

- DEFRA Hedgerow Survey Handbook (2nd edition) (DEFRA, 2007); and

- DEFRA Biodiversity Metric 4.0 (Natural England, 2023).

5.6.12 Throughout the habitat surveys and ecological surveys undertaken for the Proposed Scheme, incidental records of invasive non-native plant species were recorded. This was limited to those species listed in Schedule 9 of the Wildlife and Countryside Act.

Protected and Notable Species

5.6.13 A range of surveys have been undertaken throughout the design and assessment process for the Proposed Scheme. The relevant survey guidelines and baseline reports for each of the Important Ecological Features scoped into this assessment are summarised below.

Aquatic Features

Aquatic Ecology Scoping

5.6.14 Aquatic ecology scoping assessments were conducted on all watercourses and water bodies with potential to be affected by the Proposed Scheme.

5.6.15 Following this scoping survey, further surveys were completed for aquatic macroinvertebrates, macrophytes and fish within the Pierpoint Drain which is located to the northeast of Hardwick Interchange, approximately 180m from the Scheme Boundary.

Aquatic Macroinvertebrates

5.6.16 Aquatic macroinvertebrate surveys were undertaken in November 2022 and March 2023. Surveys were completed with reference to the following guidelines:

- Freshwater macroinvertebrate sampling in rivers: Operational Instruction 018 08. (Environment Agency, 2017).
- BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters. (British Standards Institution, 2012).

Aquatic Macrophytes

5.6.17 Aquatic macrophyte surveys were undertaken in June 2023. Surveys were undertaken with reference to the following guidelines:

- Water Framework Directive UK Technical Advisory Group's methodology for assessing macrophytes in rivers (WFD UKTAG, 2014). This method conforms with CEN 14184: 2003 Water Quality – Guidance standard for the surveying of aquatic macrophytes in running waters.

Fish

5.6.18 Traditional quantitative electric fishing surveys were scoped out due to the channel profile, steep banks and bankside vegetation cover constraining access to the watercourse (WSP, 2022). Instead, to gain an indicative understanding of the fish populations, water samples were taken at three strategic locations within the Pierpoint Drain and analysed for fish environmental DNA (e-DNA) against an extensive reference library.

5.6.19 Environmental DNA (e-DNA) sampling and analysis was conducted in 2023. The surveys and analysis were undertaken with reference to the following guidelines:

- BS EN 17805. Water quality. Sampling, capture and preservation of environmental DNA from water (Bristish Standards Institute, 2023).

Birds

Barn Owl

5.6.20 Barn Owl Tyto alba surveys were undertaken in 2021. Surveys were completed up to 500m from the Scheme Boundary with reference to the following guidelines:

- Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment (Shawyer, 2011).
- Survey Techniques, Leaflet no. 8. (Barn Owl Trust, 2010).

Breeding Birds

- Breeding bird surveys were completed in 2021. These were conducted within and up to 250m of the Scheme Boundary where access was permitted. These surveys were completed with reference to the following guidelines:
- Bird Survey Guidelines for assessing ecological impacts, v.1.1.0 (Bird Survey & Assessment Steering Group, 2023).

Wintering Birds

- Wintering bird surveys were complete in winter 2020 to 2021 within the Scheme Boundary and up to 250m where access was permitted. The surveys were completed with reference to the following guidelines:
- Bird Survey Guidelines for assessing ecological impacts, v.1.1.0 (Bird Survey & Assessment Steering Group, 2023).

Terrestrial Invertebrates

5.6.21 Invertebrate surveys were undertaken for the Proposed Scheme in 2021 which were targeted at potentially important habitats for invertebrates within the Scheme Boundary. Invertebrate surveys were undertaken with reference to the following guidelines:

- Natural England (Drake, Lott, Alexander, & Webb, 2007) Surveying terrestrial and freshwater invertebrates for conservation evaluation.
- English Nature (2005). Organising surveys to determine site quality for invertebrates. A framework guide for ecologists. English Nature.

Mammals

Badger

5.6.22 Badger surveys were undertaken in 2021 which comprised all land up to 250m of the Proposed Scheme where access was possible. Updated Badger surveys were undertaken in 2023 up to 30m of the Scheme Boundary to identify any new setts and field signs and confirm the activity status of

previously identified setts. Surveys were undertaken with reference to the following guidelines:

- Surveying Badgers (Harris, Cresswell, & Jefferies, 1989).
- Guidance on Current Use of a Badger Sett (Natural England, 2009).
- Design Manual for Roads and Bridges: Biodiversity Design (Highways Agency, 2020).

Bats

5.6.23 A range of survey techniques have been deployed to inform that impact assessment for the Proposed Scheme. The surveys have included static bat detector monitoring, tree and structure surveys for roosting bats, and crossing point surveys. These surveys have been undertaken between 2021 and 2022. Surveys were undertaken with reference to the following guidelines.

- Good Practice Guidelines: Bat Surveys for Professional Ecologists. (Bat Conservation Trust, 2016).
- Development of A Cost-Effective Method for Monitoring The Effectiveness Of Mitigation For Bats Crossing Linear Transport Infrastructure. (Berthinussen & Altringham, 2015).

Otter

5.6.24 Surveys for Otter *Lutra lutra* were undertaken in 2021 within all water bodies with potential to be impacted by the Proposed Scheme. Surveys were undertaken for all water bodies within and up to 250 m beyond Scheme Boundary. These surveys were undertaken with reference to the following guidelines:

- Monitoring the Otter. Conserving Natura 2000 Rivers Monitoring Series No. 10. (English Nature, 2003).

Water Vole

5.6.25 Surveys for Water Vole *Arvicola terrestris* were undertaken in 2021 within all water bodies with potential to be affected by the Proposed Scheme. Surveys

were undertaken within and up to 250m from the Scheme Boundary. Surveys were completed with reference to the following guidelines:

- Water Vole Conservation Handbook. (Strachan, Moorhouse, & Gelling, 2006).
- The Water Vole Mitigation Handbook. (Dean, Strachan, Gow, & Andrews, 2016).

Reptiles

5.6.26 Reptile presence/likely absence surveys were undertaken throughout the Scheme Boundary in 2019 and 2021. The 2021 surveys consisted of suitable habitats within the Scheme Boundary whilst previous surveys had been completed over a wider survey area. Surveys were completed with reference to the following guidelines:

- Froglife (1999) Advice Sheet 10: Reptile Survey.

Amphibians

Great Crested Newts

5.6.27 Surveys for Great Crested Newt were completed in 2021 within and up to 500m from the Scheme Boundary. These surveys consisted of a variety of methods include environmental DNA (eDNA) sampling surveys along with traditional survey methods (aquatic funnel traps, nocturnal aquatic and terrestrial searches, and egg surveys) to determine population size.

5.6.28 Surveys for Great Crested Newts were also undertaken to inform the EIA for the adjacent residential development at Land West of Constitution Hill (Hardwick Green). These surveys were also undertaken in spring 2021, and therefore a data sharing agreement was established to ensure that ponds were not being surveyed twice. An additional pond within the Scheme Boundary was not surveyed in 2021 as it was dry. This pond was surveyed in 2023 using eDNA sampling.

5.6.29 The surveys were completed with reference to the following best practice guidelines:

- ARG UK (2010). ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index. UK: Amphibian and Reptile Groups of the United Kingdom.
- English Nature (2001). Great Crested Newt Mitigation Guidelines.
- Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (*Triturus cristatus*) environmental DNA. Freshwater Habitats Trust, Oxford.
- Oldham, R., Keeble, J., Swan, M., and Jeffcote, M. (2000). Evaluating the suitability of habitat for the great crested newt. Herpetological Journal(10), 143-155.

5.7 Assessment Assumptions and Limitations

5.7.1 The following sections describe the assumptions and limitations applied to this chapter.

Assumptions

- Detailed construction information is not yet available for the Proposed Scheme and this assessment therefore draws on the description of the Proposed Development described in Chapter 3: Description of the Proposed Scheme, and professional experience of the assessor of other similar projects.
- Throughout the ongoing design progress of the Proposed Scheme, where feasible, certain measures have been embedded within the design of the Proposed Scheme to mitigate impacts upon ecology and biodiversity. In addition, certain mitigation measures that are considered to be standard industry practice have been assumed for the purpose of the initial impact assessment. These construction measures will be described within an Outline Construction Ecological

Management Plan. It is anticipated that these embedded measures would be secured by an appropriate planning condition. Embedded mitigation has been described in full within Section7.

Limitations

5.7.2 Limitations to individual surveys are described within the relevant technical reports and appendices to this chapter. No limitations are considered to affect this assessment and its conclusions.

5.8 Survey Data Validity

5.8.1 Extensive ecology site surveys and assessment have been undertaken between 2020 and 2022 to inform this Ecological Impact Assessment. In line with the Chartered Institute of Ecology and Environmental Management (CIEEM) advice note on the Lifespan of Ecological Reports and Surveys (CIEEM, 2019), an update PEA site surveys and habitat condition assessment was undertaken in June 2023 to reassess the suitability of the site and surrounding area for Important Ecological Features and provide an update to the ecological baseline information for the Site.

5.8.2 In line with the CIEEM guidance note, a suitably experienced ecologist undertook a site visit and an update desk study in 2023. A statement is provided for each ecological feature within the baseline section of this report to determine whether changes in the habitat composition or condition has changed significantly since the initial surveys were completed. The statement includes appropriate justifications for the validity of survey data or the requirement for any update surveys, if necessary. It is anticipated that a number of surveys will need to be repeated to inform detailed design of the Proposed Scheme and to inform construction related mitigation where more recent data is required (for example nesting birds, Badgers and bat roosts). Updated surveys may be required prior to construction for some ecological features to ensure legal compliance and to inform any mitigation licence applications. Where these surveys are required, they are presented in Section 9, Additional Mitigation.

5.8.3 The following factors were considered within the reassessment:

- Whether the ZoI supports, or may support, a mobile species which could have moved into the ZoI or changed its distribution.
- Whether there have been significant changes to the habitats present (and/or the ecological conditions/functions/ecosystem functioning upon which they are dependent) since the surveys were undertaken, including through changes to land use and management.
- Whether the local distribution of a species in the wider area around the Proposed Scheme has changed (or knowledge of it increased), increasing the likelihood of its presence.
- Whether the original surveys were constrained in any way (in terms of timings, weather conditions, equipment used, number of surveyors, surveyor expertise).
- Whether additional surveys are likely to provide information that is material to the consent decision, the design of mitigation measures, or the impact assessment of the Proposed Scheme.

5.8.4 It is considered that the data collected to date is sufficient to inform both the ES and ecological mitigation and compensation proposals for the planning application for the Proposed Scheme. The planning application for the Proposed Scheme is a full planning application using a preliminary design. As such there will be further detailed design stages for the Proposed Scheme which will be the subject of subsequent approvals through the discharge of planning conditions.

6 Baseline Conditions

6.1.1 This section outlines the ecological baseline for the Proposed Scheme, which has been obtained from various ecological surveys and assessments undertaken between 2019 and 2023.

6.2 Designated Sites

6.2.1 Sites included in the National Sites Network are assessed as being of international importance and include Special Areas of Conservation, Special Protection Areas, candidate Special Areas of Conservation (cSAC), potential Special Protection Areas (pSPA), possible Special Areas of Conservation (pSAC) and Ramsar Sites. Nationally designated sites, including Sites of Special Scientific Interest and National Nature Reserves (NNR) are assessed as being of National importance. Local Nature Reserves (LNR) are valued as being of County importance, as are non-statutory designated sites (County Wildlife Sites).

6.2.2 This reflects the geographical basis of the designations, i.e., site within the National Sites Network support habitats and species that are deemed important at an international biogeographical level, whilst SSSI are designated on the basis of supporting the best examples of particular habitats, species and ecosystems at a National level.

6.2.3 All designated sites identified as part of the desk-based assessment are listed below and their locations are presented Figures B-1a, B1b and B2, in separate document Appendix B.

Internationally Designated Sites

6.2.4 Internationally designated sites that are located within 10km of the Scheme Boundary are described within this section. For further information regarding the designated sites within the National Sites Network, please refer to the WWHAR HRA (WSP, 2023q).

The Wash and North Norfolk Coast SAC

6.2.5 The Wash and North Norfolk Coast Special Area of Conservation (SAC), encompasses a very large area of habitat, which extends to within approximately 6.6km of the Proposed Scheme at its closest point to the north-west. Together, the Wash and North Norfolk Coast form one of the most important marine areas in the UK and European North Sea coast, and include

extensive areas of varying, but predominantly sandy, sediments subject to a range of conditions.

6.2.6 Qualifying habitats: The site is designated under Article 4(4) of the Habitats Directive as it hosts the following habitats listed in Annex I:

- Atlantic salt meadows.
- Coastal lagoons.
- Large shallow inlets and bays.
- Mediterranean saltmarsh scrub.
- Intertidal mudflats and sandflats.
- Reefs.
- Glasswort and other annuals colonising mud and sand.
- Subtidal sandbanks.

6.2.7 Qualifying species: The site is designated under Article 4(4) of the Habitats Directive as it hosts the following species listed in Annex II:

- Harbour Seal Phoca vitulina.
- Otter.

The Wash Ramsar

6.2.8 The Wash Ramsar Site, extends to within approximately 6.6km of the Proposed Scheme at its closest point to the north-west. Important for extensive saltmarshes, intertidal banks of sand and mud, shallow waters and deep channels. It is the most important staging post and over-wintering site for migrant wildfowl and wading birds in Eastern England. It supports a valuable commercial fishery for shellfish and also an important nursery area for flatfish. It holds one of the North Sea's largest breeding populations of Harbour Seal *Phoca vitulina* and in addition to Grey Seal *Halichoerus grypus*. The sublittoral areas support a number of different marine communities.

The Wash SPA

6.2.9 The Wash Special Protection Area (SPA), extends to within approximately 6.6km of the Proposed Scheme at its closest point to the north-west. The Wash is of outstanding importance for a large number of geese, ducks and waders, both in spring and autumn migration periods, as well as through the winter. The SPA is especially notable for supporting a very large proportion (over half) of the total population of Canada/Greenland breeding Red Knot *Calidris canutus islandica*. In summer, the Wash is an important breeding area for terns and as a feeding area for Marsh Harrier *Circus aeruginosus* that breed just outside the SPA.

6.2.10 The Wash SPA supports non-breeding: Bar-tailed Godwit *Limosa lapponica*; Bewick's Swan *Cygnus Columbianus bewickii*; Black-tailed Godwit *Limosa limosa islandica*; Common Scoter *Melanitta nigra*; Eurasian Curlew *Numenius arquata*; Dark-bellied Brent Goose *Branta bernicla bernicla*; Dunlin *Calidris alpina alpina*; Gadwall *Mareca strepera*; Common Goldeneye *Bucephala clangula*; Grey Plover *Pluvialis squatarola*; Red Knot *Calidris canutus,* Eurasian Oystercatcher *Haematopus ostralegus*; Pink-footed Goose *Anser brachyrhynchus*; Northern Pintail *Anas acuta*; Common Redshank *Tringa totanus*; Sanderling *Calidris alba*; Common Shelduck *Tadorna tadorna*; Ruddy Turnstone *Arenaria interpres*; waterbird assemblage and Eurasian Wigeon *Mareca penelope*. It also supports breeding Common Tern *Sterna hirundo* and Little Tern *Sternula albifrons*

Roydon Common and Dersingham Bog SAC

6.2.11 The Roydon Common and Dersingham Bog SAC is a composite site, with its closest part at Roydon Common being situated approximately 5.6km to the north-east of the Proposed Scheme. Roydon Common and Dersingham Bog represent the largest and best examples of M16 *Erica tetralix – Sphagnum compactum* wet heath in East Anglia. This vegetation community is part of a lowland mixed valley mire, a complex series of plant communities grading from wet acid heath through valley mire to calcareous fen. This gradation is of

outstanding interest. The mire is extremely diverse and supports many rare plants, birds and insects.

6.2.12 Dersingham Bog represents Depressions on peat substrates of the *Rhynchosporion* in eastern England. There are examples of this habitat type present in natural bog pools of patterned valley mire, in flushes on the margins of valley mire and locally in disturbed areas associated with trackways and paths in mire and wet heath. Mosaics containing this habitat type are important for bog orchid *Hammarbya paludosa*.

Roydon Common Ramsar

6.2.13 Approximately 5.6km to the north-east of the Proposed Scheme. Most extensive example of valley mire-heathland biotype within East Anglia. It is a mixed valley mire holding vegetation communities which reflect the influence of both base-poor and base-rich water. The vegetation communities have a restricted distribution within Britain. It also supports a number of acidophilic invertebrates outside their normal geographic range and six British Red Data Book invertebrates.

Norfolk Valley Fens SAC

6.2.14 The Norfolk Valley Fens SAC is located approximately 8.9km to the east of the Proposed Scheme.

6.2.15 Norfolk Valley Fens is one of two sites selected in East Anglia, in eastern England, where the main concentration of lowland Alkaline fens (Annex I habitat) occurs. This site comprises a series of valley-head spring-fed fens. Such spring-fed flush fens are very rare in the lowlands.

6.2.16 Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site includes the following.

- Northern Atlantic wet heaths.
- European dry heaths.

- Semi-natural dry grasslands and scrubland facies on calcareous substrates.
- Molinia meadows on calcareous, peaty or clayey-silt-laden soils.
- Calcareous fens.
- Alluvial forests.

6.2.17 Annex II species that are a primary reason for selection of this site include:

- Narrow-mouthed whorl snail *Vertigo angustior*, and
- Desmoulin's whorl snail *Vertigo moulinsiana*.

Nationally Designated Sites

6.2.18 Nationally designated sites for nature conservation that are located within 10km of the Scheme Boundary are described within this section.

River Nar SSSI

6.2.19 The River Nar originates as a spring-fed stream, west of Mileham in Norfolk and flows for 42km before joining the River Great Ouse at Kings Lynn. In the vicinity of the Proposed Scheme it flows in a westerly direction south of Setchey, before bearing north towards Kings's Lynn, passing to the west of West Winch. At its closest point, it extends to within approximately 1.1km of the Proposed Scheme, to the west and near the Hardwick Interchange.. The River Nar combines the characteristics of a southern chalk stream and an East Anglian fen river. Together with the adjacent terrestrial habitats, the Narr is an outstanding river system of its type. The variation in physical features and the influence of the underlying chalk give rise to a rich and diverse flora. The river corridor is also of considerable importance to wildlife.

Roydon Common SSSI & NNR

6.2.20 Roydon Common SSSI is located approximately 5.6km north-east of the Proposed Scheme. It is considered to be one of the best examples in Britain of a lowland mixed valley mire, a complex of plant communities grading from wet acid heath through valley mire to calcareous fen. The mire is extremely

diverse, supporting many rare and uncommon plants. Large areas of nationally important dry heath on acid soils are present alongside considered ornithological and entomological interest.

East Winch Common SSSI

6.2.21 East Winch Common SSSI is located approximately 5.7km to the east of the Proposed Scheme. It is an area of predominantly wet acid heathland on shallow peat of a type that has become rare in west Norfolk. Many wet hollows are present containing diverse fen and mire communities. One rare plant species occurs and also several uncommon species. The site is surrounded by young woodland.

The Wash SSSI & NNR

6.2.22 The Was SSSI, extends to within approximately 6.4km from the Proposed Scheme, at its closest point to the north-west. The intertidal mudflats and saltmarshes represent one of Britain's most important winter-feeding areas for waders and wildfowl outside of the breeding season. Enormous numbers of migrant birds, of international significance, are dependent on the rich supply of invertebrate food. The saltmarsh and shingle communities are of considerable botanical interest and the mature saltmarsh is a valuable bird breeding zone. In addition, the Wash is also very important as a breeding ground for Harbour Seal.

Leziate, Sugar and Derby Fens SSSI

6.2.23 The Leziate, Sugar and Derby Fens SSSI is located approximately 6.4km to the north-east of the Proposed Scheme. These three fens are the remnants of a once extensive valley fen system along the Gaywood River. The site has dried out considerably in recent years due to the drainage of surrounding agricultural land but a wide range of habitats, from dry calcareous grassland to wet boggy heath, is still present. These diverse plant communities reflect variations in the underlying soils. Much of the site is on the greensand belt and here, extensive areas of damp acidic grassland and heath have

developed. The Gaywood River is fed by chalk springs and locally there is species-rich calcareous grassland on chalky soils.

Islington Heronry SSSI

6.2.24 The Islington Heronry SSSI is located approximately 6.7km to the west of the Proposed Scheme. Islington Heronry is a small, isolated stand of mature oaks surrounded by fenland which supports the largest colony of Grey Herons *Ardea cinerea* in Norfolk. There is an average of about 80 occupied nests each year and the adjacent dykes provide ideal feeding conditions for the birds.

6.2.25 Several species of woodland birds, such as Greater Spotted Woodpecker *Dendrocopos major*, are also present in the wood and represent isolated populations separated from nearby woods by many kilometres of farmland.

East Walton and Adcock's Common SSSI

6.2.26 The East Walton and Adocock's Common SSSI is located approximately 8.8km to the east of the Proposed Scheme. The site is of great botanical interest containing some of the finest unimproved grassland remaining in Norfolk. Chalk grassland occurs on the tops of the ridges as a very species-rich sward closely grazed by cattle and rabbits. It supports a rich mix of herbs and grasses including seven locally rare species with as many as 32 species per metre.

6.2.27 The two commons have a very rich invertebrate fauna with 28 Red Data Book and 79 nationally scarce species recorded since 1981. Almost all of the Red Data Book Species and most of the scarce species are associated with the fen or aquatic habitat; a few are associated with the dry grassland or scrub.

Non-Statutory Designated Sites

6.2.28 In total, a further 10 non-statutory sites were identified within a 2km buffer of the Scheme Boundary. Each of these was a designated County Wildlife Site (CWS).

Sheep's Course Wood County Wildlife Site

6.2.29 The Sheep's Course Wood CWS is situated immediately adjacent to the Proposed Scheme in the northeast. The Site is Common Land (CL111) with rights for grazing and consists of a broadleaved woodland on acidic, sandy soils. To the north, oak dominates with a sparse understory. Deadwood is frequent throughout and a large seasonally wet depression occurs near the eastern edge. A dry ditch runs down the western and southern sides of the wood marking the boundary between the site and adjacent plantation woodland in the west and arable field in the south.

West Winch Common CWS

6.2.30 Approximately 200m southwest of the Proposed Scheme. Comprises a large area of well-grazed neutral grassland crossed with frequent hedge-lined dykes. The grassland is drier to the north and possibly semi-improved, but damper and unimproved to the south with frequent damp hollows and occasional standing water.

Brook Watering Meadow CWS

6.2.31 Approximately 500m to the west of the Proposed Scheme. A small, unimproved meadow enclosed by hedgerows and ditches. Predominantly made up of well-drained, neutral grassland over loamy soils, the site is grazed by cattle and cut for hay.

Rush Meadow CWS

6.2.32 Approximately 790m to the west of the Proposed Scheme. Consists of small meadows divided by varied hedgerows containing mature trees. The grassland is neutral with a herb-rich sward in places.

Adj. River Narr CWS

6.2.33 Approximately 1.4km to the west of the Proposed Scheme. Part of a disused railway line close to the River Nar. At either end of the site is neutral unimproved grassland with impeded drainage. At the centre of the site is a small area of fen vegetation dominated by Common Reed *Phragmites australis* and surrounded by dense Hawthorn *Crataegus monogyna* scrub.

Plantation Wood CWS

6.2.34 Approximately 1.6km to the northeast of the Proposed Scheme. An area of semi natural broad-leaved woodland, consisting mainly of pedunculate oak *Quercus robur*. The woodland contains dry ditches, deeper banks and hollows to the northwest, a small pond and a swathe of English bluebells *Hyacinthoides non-scripta*.

South of Gaywood Park CWS

6.2.35 Approximately 1.8km to the northwest of the Proposed Scheme. A small triangular site bounded by two railway lines, one disused. The site is enclosed by residential and industrial development. Habitats include areas of unimproved, neutral dry grassland along the western boundary with lower, wetter areas in the centre.

Saddlebow Reedbeds CWS

6.2.36 Approximately 2km to the west of the Proposed Scheme. A large area of fen with a small area of encroaching scrub. It is surrounded by earth banks colonised by tall herb species. Considered an important local habitat for many bird species.

Old Hall Farm CWS

6.2.37 Approximately 2km to the east of the Proposed Scheme. An area of species-rich unimproved neutral grassland with impeded drainage.

Clenchwarton Road CWS

6.2.38 Approximately 2km north-west of the Proposed Scheme. A small pond with clear water and abundant aquatic including forget-me-not *Myosotis sp.*, duckweed *Lenna sp.* and bur-reed *Sparganium sp.*

6.3 Habitats and Botany

Terrestrial Habitats

Ancient woodland

6.3.1 The desk study identified one area of ancient woodland within 5km of the Proposed Scheme. This woodland is also located within 200m of the Affected Road Network (ARN) and therefore susceptible to air quality changes.

6.3.2 Reffley Wood is located approximately 3.8km northeast of the Proposed Scheme. The woodland is approximately 28ha in size.

UK Habitat Classification

6.3.3 The habitat types present within the Scheme Boundary according to the UK Habitat Classification are presented in Table 6-1. Included is the approximate area of each habitat in hectares (linear habitats are measured in kilometres), the primary habitat codes and the relevant secondary habitat codes. The habitat types and areas correlate with those within the BNG Assessment.

Table 6-1 Summary of Habitats within the Scheme Boundary

UK Habitat Classification	Habitat Code	Area/ Length
Arable and horticulture	c1	1.42
Arrhenatherum neutral grassland	g3c5	1.11
Bramble Scrub	h3d	0.37
Building	u1b5	0.07
Calamagrostis epigejos grassland (Other neutral grassland)	g3c	0.27
Cereal crops	c1c	43.07
Dense scrub	h3	0.08
Developed land sealed surface	u1b	6.01

UK Habitat Classification	Habitat Code	Area/ Length
Eutrophic standing waters - Priority habitat pond	r1a 19	0.16
Hawthorn scrub	h3f	0.85
Mixed scrub	h3h	0.86
Dense scrub (willow)	h3	0.07
Modified grassland	g4	8.08
Mosaic of developed land - Vegetated garden	u1d	0.04
Other coniferous woodland	w2c	0.01
Other lowland mixed deciduous woodland	w1f7	5.54
Other neutral grassland	g3c	0.43
Other swamps	f2f	0.11
Wet woodland	w1d	0.31
Total Area	**Not Applicable**	**68.86**
Hedgerow (priority habitat)	**h2a**	**1.66**

National Vegetation Classification

6.3.4 Thirteen different NVC communities/sub-communities were recorded, including three neutral grassland (MG) communities/sub-communities, three ruderal (OV) communities/sub-communities, five woodland/scrub (W) communities and two swamp (S) communities.

6.3.5 One stand of non-NVC type vegetation was recorded (*Calamagrostis epigejos* grassland) and two areas were unclassified due to being recent plantation woodland/scrub (adjacent to Hardwick Interchange) or comprising an

individual large tree with mixed scrub. This habitat type is classified according to UKHab as Other Neutral Grassland (g3c).

6.3.6 Each survey compartment was then assessed on whether it included HPI habitat or habitats included within Habitat Action Plan (HAP) in the Norfolk Biodiversity Action Plan.

6.3.7 None of the grasslands within the survey areas achieved the species abundance threshold to qualify as lowland meadows or purple moor-grass and rush pastures HPI and none of the grasslands qualified for the lowland meadows HAP within the Norfolk BAP.

6.3.8 The only habitats to qualify as HPI or for a Norfolk HAP were:

- An area of developing W1 *Salix cinerea – Galium palustre* woodland which qualifies as wet woodland HPI/Norfolk HAP;
- An area of developing W10a *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland – typical sub-community and W10d *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland – *Holcus lanatus* sub-community which qualifies as lowland mixed deciduous woodland HPI/Norfolk HAP; and
- A hedgerow which qualifies as hedgerows HPI/Norfolk HAP.

Hedgerows

6.3.9 There are a total of six distinct hedgerows present within the Scheme Boundary.

6.3.10 All hedgerows recorded meet the criteria for inclusion as HPI as they contain more than 80% native species.

6.3.11 Five of these hedgerows would qualify as important hedgerows under the Wildlife and Landscape criteria described in The Hedgerow Regulations. This is largely due to the confirmed presence of red and amber listed bird species listed as Birds of Conservation Concern (BoCC) and species protected under the Wildlife and Countryside Act and Habitats Regulations.

Ancient and Veteran trees

6.3.12 The following is a summary of the information contained within the Arboricultural Impact Assessment for the Proposed Scheme.

6.3.13 No ancient trees were recorded through field surveys.

6.3.14 A total of seven veteran trees were identified through the arboriculture field surveys, of which four are located within the Scheme Boundary. One other veteran tree is located directly adjacent to the Scheme Boundary on the boundary with Sheep's Course Wood.

6.3.15 A further two veteran trees were recorded during the arboriculture field surveys but are located outside of the Scheme Boundary to the southeast of Harwick Interchange.

Invasive Non-native Plant Species

6.3.16 Japanese Knotweed *Reynoutria japonica* was recorded in the north of the Proposed Scheme. A single stand was identified within a hedgerow and ditch that runs parallel to the A47 on the north side. In addition, stands were identified in an area of bramble scrub southeast of the Hardwick Interchange.

Freshwater Aquatic Habitats

6.3.17 An initial aquatic habitat survey was carried out in July 2022. These assessments form the preliminary phase of the freshwater ecology surveys and have been used to characterise watercourses and identify further survey requirements.

6.3.18 The following aquatic habitats were found within or in close proximity to the Red Line Boundary; Pierpoint Drain (approximately 180m north of the Proposed Scheme), 10 unnamed ditches and one pond. The majority of the ditch systems assessed in July 2022 were ephemeral, drying out during summer months. Several of these ditches were observed to have established terrestrial plants, and an absence of water favouring groups such as reeds and rushes. As such it is likely these ditches respond directly to precipitation only and are unlikely to support protected and notable aquatic species.

6.3.19 Pierpoint Drain is hydrologically connected to the River Nar SSSI which it joins at 1.1km northwest of the Scheme Boundary. Pierpoint Drain is an ordinary watercourse within the Middleton Stop Drain Water Body catchment area. The drain contains potential barriers to fish movement, including a sluice gate located upstream of the A149 road bridge crossing. The drain has suitable habitat to support a range of aquatic species.

Evaluation

6.3.20 The following habitat types within the Scheme Boundary are considered to be Important Ecological Features within this assessment. This is due to their status as Habitats of Principal Importance under Section 41 of the NERC Act.

- Lowland mixed deciduous woodland.
- Wet Woodland.
- Ponds Priority Habitat.
- Hedgerows Priority Habitat.

6.3.21 Additionally, the mosaic of habitats, including grasslands and scrub habitats, within the areas of the Scheme Boundary located southwest of the Harwick Interchange and West of Sheep's Course Wood are considered to be Important Ecological Features due to their size and complexity. This area is approximately 32ha in size when accounting for the habitat mosaic that extends beyond the Scheme Boundary. The habitat mosaic includes areas of permanent, unmanaged grassland, woodland, scrub and wetland habitats. A large proportion of this habitat also falls within the boundary of the development at Land West of Constitutional Hill.

6.3.22 The area of priority habitat within the Scheme Boundary, alongside the quality and size of the habitat mosaics indicate that the habitats within the Scheme Boundary are collectively important at a County scale. This would also be consistent with the County Wildlife Site selection criteria for Norfolk (NBIS, 2016).

6.3.23 Veteran trees identified within the Scheme Boundary and adjacent are of Local importance.

6.3.24 Ancient woodland within the desk study area has not been surveyed to inform this assessment and their importance is determined on a precautionary basis. Ancient woodlands are of County importance.

6.4 Protected and Notable Species

6.4.1 The following section describes the protected and notable species recorded through the desk study and field surveys. This section is subdivided into the following sections.

- Aquatic features.
- Birds.
- Terrestrial invertebrates.
- Mammals.
- Reptiles.
- Amphibians.

Aquatic Features

Aquatic Macroinvertebrates

6.4.2 A search of the Environment Agency's Ecology and Fish Data Explorer returned results from macroinvertebrate surveys carried out in 2021 on the River Nar, at NGR TF 63588 13456, approximately 1.2km south of the Proposed Scheme Boundary. No protected macroinvertebrate species were noted in the sample. Two species of INNS, the New Zealand Mud Snail *Potamopyrgus antipodarum* and the amphipod *Crangonyx pseudogracilis/floridanus* were identified in the sample.

6.4.3 Following an aquatic macroinvertebrate survey in autumn 2022 and spring 2023 by WSP aquatic ecologists, the biological metrics were calculated for each site, based on the aquatic macroinvertebrate communities present.

These metrics characterise Pierpoint Drain as a habitat that has a heavily sedimented bed with predominant presence of taxa associated with standing to slow flowing water.

6.4.4 The Pierpoint Drain upstream sampling location was indicative of Good WFD status, whilst the community at the downstream sampling location was indicative of High WFD status.

6.4.5 Three aquatic beetles species of note under Community Conservation Index (CCI) scoring, were identified in the samples; the Water Scavenger Beetles *Berosus affinis, Helochares lividus* and the Black Moss Beetle *Hydraena nigrita*. These beetles have a conservation score of 7 and as such are Notable (scarce in Great Britain but not of Red Data Book status).

6.4.6 Pierpoint Drain currently supports a diverse aquatic macroinvertebrate assemblage, with three species classified as Notable (scarce in Great Britain but not of Red Data Book status) under CCI scoring identified. Therefore, the aquatic macroinvertebrate assemblage is considered of County importance.

Fish

6.4.7 A search of the Environment Agency's Ecology and Fish Data Explorer returned data from a single catch survey conducted in March 2017 on the River Nar at NGR TF 67090 13498, approximately 3.7km southeast of the Proposed Scheme Boundary. A total of 67 fish, across nine species, were caught during the survey. Following protected/ notable fish species were caught; Brown/Sea Trout *Salmo trutta,* Bullhead *Cottus gobio,* European Eel Elvers *Anguilla anguilla and* River Lamprey *Lampetra fluviatilis*.

6.4.8 Bullhead is listed under Annex II of The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. They are only protected if they are a qualifying feature of a Special Area of Conservation (SAC). Pierpoint Drain is not designated as such.

Environmental DNA (e-DNA) survey

6.4.9 A fish e-DNA survey was carried out at three strategic locations within the Pierpoint Drain.

6.4.10 At Pierpoint Drain Upstream sampling location, only two fish taxa were detected; Stickleback species *Pungitius sp.* and Three-spined Stickleback *Gasterosteus aculeatus*, neither of which are protected species. At the second sampling point on Pierpoint Drain (Ditch 10 confluence) a total of seven fish taxa e-DNA were detected. These included Common Roach, Gudgeon *Gobio gobio,* Three-spined Stickleback *Gasterosteus aculeatus* and Carp species. A non-native to England Common Carp was recorded however it is not regarded as an INNS. No e-DNA of any legally protected or otherwise notable fish species, nor any invasive non-native fish species, was detected in the sample. At the third sampling point, Pierpoint Drain downstream, a total of eight fish taxa was detected. These included Three-spined Stickleback, Common Rudd, Common Dace *Leuciscus leuciscus*. No e-DNA of any legally protected or otherwise notable fish species, nor any invasive non-native fish species, was detected in the sample.

6.4.11 The results from the e-DNA sampling do not absolutely preclude the presence of legally protected migratory fish species within Pierpoint Drain, as the survey provides both a temporal and spatial snapshot of the possible fish species composition. Basing on the survey data, the presence of previous records and the nature of the habitat, the presence of protected species such as European Eel cannot be excluded.

6.4.12 Fish species assemblage at Pierpoint Drain are considered of County importance.

Macrophytes

6.4.13 A search of Environment Agency's Ecology and Fish Data Explorer returned data from a survey conducted in 2019 from a location on Country Drain at NGR TF 67716 14049, approximately 4.2km east of the Proposed Scheme

Boundary. No protected or invasive non-native macrophyte species were noted in the sample.

6.4.14 During the 2022 macrophyte survey of Pierpoint Drain, the community comprised of Rigid Hornwort *Ceratophyllum demersum*, accounting for 40% of the Survey Area's total macrophyte cover, Broad-leaved Pondweed *Potamogeton natans* accounted for 30% of the total macrophyte coverage, followed by Nuttall's Waterweed (15%) and Shining Pondweed *Potamogeton lucens* (7%). filamentous green algae was present throughout much of the surveyed reach of Pierpoint Drain.

6.4.15 Pierpoint Drain currently supports a macrophyte community of moderate diversity, indicative of good WFD status, with a total of nine taxa recorded within the 100m surveyed reach. The survey did not identify the presence of any legally protected or otherwise notable macrophyte species in Pierpoint Drain. One INNS, Nuttall's Waterweed, was recorded in the survey.

6.4.16 Based on the likely absence of protected and notable species and presence of INNS, the macrophyte assemblage is considered to be of Local importance.

Birds

Desk Study

6.4.17 NBIS returned five Barn Owl records, of which three records were only accurate to 1km and none provide information of roosting or nesting sites. The two records with accurate (six figure) grid references were located near to Moat Farm, approximately 300m west of the Scheme Boundary.

6.4.18 The data search also returned a further 149 bird species with 2km of the Scheme Boundary. This dataset may include records that are beyond this distance if they are within the same grid square as the 2km buffer. None were returned with the Scheme Boundary and species returned within the 250m ZoI were consistent with those recorded during breeding and wintering bird survey for the Proposed Scheme.

Barn Owl

6.4.19 Surveys confirmed the presence of Barn Owls across the survey area and within the surrounding local area, with evidence of the species found within the barns adjacent to the A47 (within the Scheme Boundary) and within the barns at Hardwick Farm (outside of the Scheme Boundary. The complex of barns at Moat Farm were also assessed as potential nest sites.

6.4.20 Suitable Barn Owl foraging habitat was identified within the Proposed Scheme boundary and surrounding survey area, including towards the north of the Proposed Scheme within grassland south of the Harwick Interchange and west of Sheep's Course Wood.

6.4.21 The Stage 2 field surveys identified one occupied breeding site within the barn south of the A47 (within the Scheme Boundary) and seven potential nest sites within trees and buildings. A total of seven potential nest sites were identified within trees and buildings.

6.4.22 The update field survey undertaken in 2023 identified an additional potential nest site to the southeast of Hardwick Interchange. This was a single barn owl nest box attached to a post. The box was being used by Kestrel *Falco tinnunculus* at the time of survey.

6.4.23 Due to the time elapsed between the initial Barn Owl surveys in 2021 and the number of occupied and potential nest sites in proximity to the Proposed Scheme, updated Barn Owl surveys are required to inform detailed design of the Proposed Scheme and mitigation during construction. This is not considered to affect this assessment, given that the survey information gathered to date will be sufficient to inform this assessment.

6.4.24 Barn Owl are considered to be important at a Local scale.

Breeding Birds

6.4.25 A total of 74 species were recorded on or over the survey area during the breeding bird surveys, of these 39 are known to either breed or probably breed on Site.

6.4.26 Of the 74 species recorded, 38 are considered to be of conservation concern through listing on either Red List of BoCC (Stanbury, et al., 2021), Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or as a SPI under Section 41 of the NERC Act. Eighteen of these species are considered to either breed or probably breed on the Site. These species are listed below.

Breeding Birds on the Red List

6.4.27 Species listed on the BoCC Red List included Greenfinch Chloris chloris, House Sparrow Passer domesticus, Linnet Carduelis cannabina, Mistle Thrush Turdus viscivorus, Skylark Alauda arvensis, Starling Sturnus vulgaris, Yellow Wagtail Motacilla flava and Yellowhammer Emberiza citronella

6.4.28 Reed Bunting *Emberiza schoeniclus* were also recorded and are a SPI.

Evaluation

6.4.29 The breeding bird assemblage included no species protected under Schedule 1 of the Wildlife and Countryside Act.

6.4.30 Of the other species nine of those considered to be breeding are recognised as being notable (i.e. SPI or BoCC Red List): Greenfinch, House Sparrow, Linnet, Mistle Thrush, Reed Bunting, Skylark, Starling, Yellow Wagtail and Yellowhammer. None of these species were recorded in populations that represent a notable proportion of the county population in Norfolk (Taylor, 2011).

6.4.31 The suitability of the habitats for breeding birds within the Scheme Boundary and surrounding area has not changed significantly since the surveys were undertaken in 2021. In addition, the distribution of species is unlikely to have changed significantly. Therefore, it is considered that the survey data is sufficient to inform this EcIA and detailed design of the Proposed Scheme.

6.4.32 Breeding birds are considered to be important at a Local scale.

Wintering Birds

6.4.33 A total of 60 species were recorded on or over the wintering bird survey area during the wintering bird surveys in 2022-2021 ('2021 surveys'). A further eight species were recorded during the 2018-2019 surveys ('2019 surveys') that were not recorded in 2021 surveys. These species records are summarised below and their peak counts are presented in Table 13-4 and Table 13-5 and separate document Appendix E.

6.4.34 The 2021 survey dataset included 35 species that are considered notable for the purpose of this assessment. A further 5 notable species were recorded in 2019 that were not recorded in 2021. This includes species that meet the following criteria:

- Listed on Schedule 1 of the Wildlife and Countryside Act (1981 as amended).
- Listed as a SPI.
- Included in BoCC Red List.

Red List Species

6.4.35 Species listed on the BoCC Red List included Grey Wagtail *Motacilla cinerea,* Greenfinch and Woodcock *Scolopax rusticola.* Additionally, Linnet, Song Thrush, Yellowhammer *Emberiza citronella,* Herring Gull *Larus argentatus,* House Sparrow, Skylark, Lapwing *Vanellus vanellus* and Starling are included in the Red List and the NERC Act list of Importance.

6.4.36 Redwing *Turdus iliacus* and Fieldfare *Turdus pilaris* are also Red List species that receive further protection under Schedule 1 of the Wildlife and Countryside Act due to their breeding status in Scotland.

6.4.37 The Red List species Mistle Thrush and White-fronted Goose *Anser albifrons* (flyover only) were also recorded in 2019 but were not in 2021, with latter species also listed on the list of SPI.

Other Species

6.4.38 Marsh Harrier are an Amber List species that receive further protection under Schedule 1 of the Wildlife and Countryside Act and are listed under Annex 1 of the European Bird Directive. Records for this species were for a flyover on one occasion.

6.4.39 The Amber List species Whooper Swan *Cygnus cygnus* was also recorded in 2019 and not in 2021. They also receive further protection under Schedule 1 of the Wildlife and Countryside Act for breeding.

Other Notable Species

6.4.40 Species listed on the BoCC Green List that receive protection under Schedule 1 of the Wildlife and Countryside Act included Peregrine *Falco peregrinus* and Red Kite *Milvus milvus*. Golden Plover *Pluvialis apricaria* are listed under Annex 1 of the European Bird Directive.

Evaluation

6.4.41 The species recorded were broadly typical of woodland, grassland and farmland habitat. No notable aggregations of waterbirds were recorded within the Scheme Boundary or survey area.

6.4.42 The wintering bird assemblage identified no notable waterbird aggregations associated with the sites identified within the Designated Sites section of this assessment. Six species protected under Schedule 1 of the Wildlife and Countryside Act were recorded however it is unlikely that these species are breeding within the survey area due to their restricted habitat requirements and restricted breeding grounds within the UK.

6.4.43 Given that no notable aggregations of wintering birds were identified during surveys and the suitability of habitats has not changed significantly in the interim period since surveys were undertaken, it is considered that the data collected is sufficient to inform this EcIA and to inform detailed design of the Proposed Scheme.

6.4.44 Overall, it is considered that the wintering assemblage is consistent with woodland, grassland and arable areas in West Norfolk and does not support populations of species that are deemed to be important at a County level. The wintering bird assemblage at the Proposed Scheme is therefore considered to be of Local importance.

6.4.45 All wintering bird species are therefore considered to be important at a Local scale.

Terrestrial Invertebrates

6.4.46 NBIS returned multiple records of invertebrate species for groups including, but not limited to; *Coleoptera* (beetles), *Diptera* (true flies), *Hemiptera* (true bugs), *Hymenoptera* (ants, bees, wasps and sawflies), *Lepidoptera* (butterflies and moths), *Odonata* (dragonflies and damselflies) and *Orthoptera* (grasshoppers and crickets). Many of these include species that receive partial protection under the Wildlife and Countryside Act 1981 (as amended) and listed on the NERC Act 2006 as SPI or hold a conservation status of nationally rare, scarce or local.

6.4.47 A complete list of invertebrate desk study records provided by NBIS is included in Appendix C of the Terrestrial Invertebrate Survey Report (WSP, 2023h).

6.4.48 The results of the targeted terrestrial invertebrate surveys provide an indication of the relative species diversity within the targeted groups of invertebrates. Over 500 specimens were collected or record over the course of the surveys, allowing 110 species to be identified.

6.4.49 Of the target groups, *Coleoptera* were most diverse, with 69 species recorded. *Hemiptera* was represented by ten species and *Diptera* by eight species. Other orders, with fewer than eight species included (but was not limited to) *Hymenoptera*, *Lepidoptera, Araneae* (spiders), *Orthoptera* (grasshoppers and crickets), *Dermaptera* (earwigs), *Julida* (snake-millipedes), *Polydesmida* (flat-backed millipedes) and *Isopoda* (woodlice).

6.4.50 Of the species recorded, 89 (c. 81 %) are without any recognised status, being widely distributed and common, and exhibiting little habitat specificity; and 19 species are regarded as locally common or locally scarce. Two species (c. 2 %) are currently regarded as Nationally Scarce, see below. Further information on status definitions and criteria of invertebrate groups can be found in Appendix 1. The full list of invertebrates recorded within the Field Survey Area is displayed in tabular format in Appendix D.

6.4.51 Overall, the Field Survey Area supports an unexceptional invertebrate fauna, which includes mostly common and widespread species, with only a very small proportion of species with conservation status. A range of habitats within the Field Survey Area offered potentially suitable habitat for invertebrate assemblages; however, the relatively low numbers of species recorded, and lack of rare and nationally scarce species indicates that those habitats sampled (which ranged from habitat mosaics of scrub and grassland, to over mature trees) are not of significant importance for invertebrates.

6.4.52 Given the results of the initial invertebrate surveys and that the condition and suitability of habitats has not changed significantly in the interim. No further surveys are considered necessary to inform this is EcIA or the detailed design of the Proposed Scheme.

6.4.53 The invertebrate assemblage is considered likely to be important at a Local scale.

Mammals

Badger

6.4.54 The desk study from NBIS returned four records of Badger within the 2km Study Area within the last ten years. One record is located within the Scheme Boundary that was also identified by field surveys in 2021 and was recorded as an enlarged rabbit burrow. The remaining records are outside of the Scheme Boundary, with one record accurate to the nearest kilometre only. The remaining records are located south of the Scheme Boundary along the A10 and to east of the Proposed Scheme, along the A47.

6.4.55 The field survey identified one active main sett, along with two outlier setts; one disused and one partially active. All of the setts identified were outside of the 250m survey buffer of the Scheme Boundary and no setts were identified within the Survey Area.

6.4.56 As part of the field surveys, additional field signs of badger were recorded. These included latrines, dung pits, and badger footprints. A number of prominent mammal runs were also present however these are likely to have been used by deer which were regularly encountered during survey for the Proposed Scheme.

6.4.57 As no setts were identified within the Scheme Boundary during the 2021 surveys or the update survey in 2023, it is considered that the survey data is sufficient to inform this EcIA. However, due to the time elapsed between the initial surveys, updated surveys up to 250m from the Proposed Scheme alignment will be undertaken to inform detailed design of the Proposed Scheme. Pre-construction surveys are also required to ensure no setts are impacted by construction.

6.4.58 Badgers are common and widespread across the UK and are not identified as a SPI under the NERC Act or a BAP species in Norfolk. The legislation protecting them is in place largely for reasons of preventing animal cruelty rather than because they are considered a priority for conservation.

6.4.59 Badgers are considered to be important at a Local scale.

Bats

6.4.60 A range of bat surveys have been undertaken for the Proposed Scheme at various stages of the project lifecycle. The results of these surveys that are discussed and interpreted within this section.

Overview

Desk Study

6.4.61 NBIS returned multiple bat records including species that are consistent with those recorded during field surveys. The following roosting bat records were

returned within 5km of the Scheme Boundary. These included a number of maternity roosts, typically associated with churches. The closest likely maternity roosts is for Soprano Pipistrelle approximately 260m east of the Proposed Scheme within North Runcton. Full data search information is provided with the technical reports.

Field Surveys

6.4.62 Surveys of structures identified a single roost of Common Pipistrelle within the agricultural barns located to the south of and directly adjacent to the A47 in August 2019. Surveys of this structure were updated in May and September 2021 and no roosting bats were observed. Surveys were also undertaken for the proposed development at Land West of Constitution Hill (planning reference: 13/01615/OM). The surveys were undertaken in June 2021 and no roosts were identified.

6.4.63 Surveys of trees identified multiple roosts, the majority of which were located within Sheep's Course Wood. Outside of this area, the only roost identified was within a mature oak tree (T4) located approximately 80m south of Sheep's Course Wood, connected by a hedgerow. A summer day roost of two Common Pipistrelle was identified behind flaking bark was identified during a dawn re-entry survey in July 2021.

6.4.64 A total of five roosts were identified within Sheep's Course Wood. These roosts all contained individual bats during summer and winter. Summer roost surveys identified a single Pipistrelle Bat within a hazard beam (T28) in May 2021. Winter roost surveys identified the following four roosts.

- T29 – Single Brown Long Eared Bat identified with endoscope.
- T64 – Single Pipistrelle bat identified in rot feature at base of tree.
- T23 – Single Myotis Bat identified in rot hole of oak.
- T24 – Single Natterer's Bat identified in Sycamore rot whole entrance.

Activity Surveys

6.4.65 Static detector surveys and crossing point surveys identified a range of bat species throughout the Proposed Scheme. Further information regarding species is included in the Species Evaluations section, below. The following areas of the Proposed Scheme have been identified as potentially important (relative to the Scheme Boundary) foraging and commuting habitats for bats.

- A47 Underpass.
- Sheep's Course Wood.
- Area West of Sheep's Course Wood CWS.
- North Runcton Common.
- Chequers Lane.
- Overview of Remaining Survey Area

Species Evaluation

6.4.66 It is inherently difficult to distinguish species through sound analysis alone, particularly for species in the Myotis genus. As such, species have been grouped where appropriate for this assessment. Species in the genus Nyctalus have been grouped due to the similarity in the potential impacts from roads on these species and the difficulty in distinguishing the species apart through echolocation alone. The following species and species groups were identified and will be included within this assessment.

- Barbastelle Bat.
- Brown Long-eared Bat *Plecotus auratus*.
- Common Pipistrelle *Pipistrellus pipistrellus*.
- Myotis species (Brandt's Bat *Myotis brandtii*; Daubenton's Bat *Myotis daubentonii*; Natterer's Bat *Myotis nattereri*; and Whiskered Bat *Myotis mystacinus*).

- Nathusius' Pipistrelle *Pipistrellus nathusii*.
- Nyctalus species (Noctule *Nyctalus noctule* and Leisler's *Nyctalus leisleri*).
- Serotine Bat *Eptesicus serotinus*.
- Soprano Pipistrelle *Pipistrellus pygmaeus*.

Barbastelle Bat

6.4.67 No Barbastelle Bat roosts were recorded throughout the surveys for the Proposed Scheme, although early registrations on static detectors indicate that they may roost nearby. Call registrations for Barbastelle Bat were recorded at static detector Point 2 and Point 3 that were located west and east of Sheep's Course Wood, respectively. Low numbers of registrations were recorded in July (1-5 PPN within on hour of sunset) and higher numbers were recorded in October (3-16 PPN within one hour of sunset) high levels of bat activity within one hour of sunset can indicate the potential for maternity colonies of Barbastelle Bats, however given that these peaks in activity were not consistently recorded in the maternity period, it is considered unlikely that a high conservation status roost is located near to the Scheme Boundary.

6.4.68 Barbastelle were recorded at all static detector locations across the Scheme Boundary, with the highest levels of activity recorded at the tree line north of North Runcton Common (Point 9), Sheep's Course Wood (Point 3) and Chequers Lane (Point 8). These areas are therefore considered to be potentially important to the local population. Barbastelle activity was recorded at the detector location to the west of Sheep's Course Wood, although call registrations were low, with an average of 1.47 PPN. All other detector locations recorded low levels of activity, with average PPN less than 0.3.

6.4.69 No Barbastelle Bats were recorded during crossing point surveys in 2022 and surveys for the development at Land West of Constitution Hill Constitution Hill did not record the species during transect surveys.

6.4.70 Barbastelle Bats are considered rare in the UK and are listed as a SPI (under the NERC Act 2006). As species listed on Annex 2 of the Habitats Directive they are also identified in the designation of SACs that now form part of the National Sites Network to support the conservation of this species. Barbastelle Bats are widely distributed in England, with higher densities in south-west and mid-west England, and Norfolk providing populations that are considered significant in the context of the national distribution.

6.4.71 Barbastelle Bats are considered to be important at a Local scale.

Brown Long-eared Bat

6.4.72 Brown Long-eared bats were frequently recorded throughout the Proposed Scheme during static detector surveys and were recorded at Rectory Lane and the A47 underpass during crossing point surveys. The species made up only a small proportion of the bat registration recorded by static bat detectors, however due to their quiet echolocation calls, no conclusions regarding their abundance can be made from this. A single Brown Long-eared bat was identified within a tree roost (T29) in Sheep's Course Wood.

6.4.73 Brown Long-eared Bats are a SPI (under the NERC Act 2006), however they are a relatively common species and their populations are considered to be stable in England (Bat Conservation Trust, 2021). They are widespread in England and a common bat in Norfolk, although they are listed as on the Norfolk Biodiversity Action Plan (BAP). The species is generally considered to be a woodland bat, using trees and a wide variety of building types for roosting.

6.4.74 Brown Long-eared Bats are considered to be important at a Local Scale.

Pipistrelle Species

6.4.75 Pipistrelle species were the most frequently recorded species across the static detector survey area, accounting for over 90% of all bat call registrations recorded.

6.4.76 Common Pipistrelle were the most frequently recorded species throughout the static bat detector, accounting for over 60% of call registrations across the static detector survey area. A total of 47,447 call registration were detector for the species. They were also frequently recorded during crossing point surveys.

6.4.77 A Common Pipistrelle roost was identified within the agricultural barns south of the A47 in 2019, although subsequent surveys in 2021 did not identify this roost. The roost was for an individual bat. A summer day roost of two Common Pipistrelles was identified behind flaking bark of T4 located approximately 80m south of Sheep's Course Wood.

6.4.78 Soprano Pipistrelle were the second most frequently recorded bat species by static detectors, accounting for almost 30% of all call registrations detected. They were also frequently recorded during the crossing point and bat activity transect surveys.

6.4.79 Nathusius' Pipistrelle were occasionally recorded by static detectors where low levels of activity were identified throughout the Proposed Scheme. Nathusius' Pipistrelle accounted for less than 0.002% of all call registrations.

6.4.80 Pipistrelle roosts were identified within trees T64 and T28 using endoscopes, however the species could not be determined as distinguishing features were not visible. These were both individual bats recorded in summer and winter.

6.4.81 Common Pipistrelle populations are considered to be increasing in England and are widely distributed throughout Norfolk.

6.4.82 Soprano Pipistrelle are a SPI (under the NERC Act 2006), however they are a relatively common species and their populations are considered to be stable in England (Bat Conservation Trust, 2021). They are widespread in England and a common bat in Norfolk, although they are listed under the Norfolk BAP which is likely due to under recording.

6.4.83 Nathusius' Pipistrelle is rarer than other pipistrelle species in the UK, though records have increased in recent years. Nathusius' Pipistrelle is rare but

widespread throughout Great Britain and more common in Northern Ireland. Nathusius' Pipistrelle were only occasionally encountered during surveys, it is likely that there is a small population in the vicinity of the Proposed Scheme.

6.4.84 Common Pipistrelle, Soprano Pipistrelle Nathusius' Pipistrelle are considered to be important at a Local Scale.

Myotis Species

6.4.85 For the purpose of this assessment, all bat species in the Myotis genus have been grouped together. This is partly due to the difficulty in separating the species from analysis of echolocation calls alone, but also because the effects of roads on these species is generally similar for all species in the genus, particularly for those species that are known to be present in Norfolk.

6.4.86 The Norfolk and Norwich Bat Group lists four Myotis species that are known to be present in the county. Species that are considered within this assessment include:

- Daubenton's Bat;
- Natterer's Bat;
- Whiskered Bat; and
- Brandt's Bat.

6.4.87 Given the rarity of Whiskered and Brandts Bat, it is considered likely that most call registrations were Daubenton's Bat or Natterer's Bat.

6.4.88 At total of 942 Myotis bat call registrations were recorded throughout the Proposed Scheme during static detector monitoring. They were recorded at all static detector locations, with the highest levels of activity recorded at Chequers Lane (Point 8), where a total of 304 call registrations were detected. Higher levels of activity, compared with the rest of the survey locations were the north of the A47 underpass (Point 5), the line of trees north of North Runcton Common (Point 9) and a wet ditch in the south of the Proposed Scheme (Point 10) where the peaks in activity were recorded in September.

6.4.89 Two hibernation roosts of *Myotis* bats were recorded within Sheep's Course Wood during the ground level tree assessments in February 2021. No other roosts were recorded during the other winter inspection surveys complete in the winter 2022. The roosts were identified in trees T23 (a single *Myotis* bat) and T24 (a single Natterer's Bat).

6.4.90 Daubenton's Bat are considered to be common and widespread throughout Britain and Ireland (Russ, 2012) with their population in England considered to be stable (Bat Conservation Trust, 2021). Daubenton's Bats are widely distributed in Norfolk and are particularly found near areas with freshwater.

6.4.91 Natterer's Bat are considered to be widespread across Britain (Russ, 2012) and populations in England are considered to be increasing (Bat Conservation Trust, 2021). They are widely distributed in Norfolk.

6.4.92 Whiskered Bat and Brandt's Bat have a combined population trend within the National Bat Monitoring Programme due to the difficulty separating them with confidence in the field. The two species are uncommon but widespread in England. Populations of Whiskered and Brandt's bat combined are considered to have been stable in England. Information on the status and distribution of these species in Norfolk is limited.

6.4.93 Myotis species are considered to be important at a Local scale.

Serotine and Nyctalus Species

6.4.94 No roosts of Serotine Bat or *Nyctalus* species were identified during the bat roost surveys for the Proposed Scheme.

6.4.95 Noctule were regularly detected throughout the Proposed Scheme during crossing point surveys and bat static surveys. Noctule were regularly observed flying at height (typically >20m) during crossing point surveys which is very typical of big bat species. Leisler's bat were only confirmed at Point 1, however Nyctalus species (where call registrations were unable to be distinguished) were recorded throughout the survey area. The highest levels

of Noctule and Nyctalus species were recorded within the mosaic of habitats to the west of Sheep's Course Wood.

6.4.96 Noctule and Leisler's bats are widespread in Cambridgeshire and although they are found throughout England, they are likely to be relatively sparsely populated throughout their range due to the large home ranges they occupy. Leisler's are uncommon but widely distributed. Noctules are widely distributed and fairly common in Norfolk where suitable habitat is present. Serotines are thinly distributed in Norfolk - at the northern limit of their UK range.

6.4.97 Noctule are a SPI (under the NERC Act 2006), however Noctule and Serotine populations in England are considered stable and data on Leisler's is deficient so it is difficult to establish whether the population sizes are increasing, decreasing or remaining stable, although their habitat remains stable (Bat Conservation Trust, 2021).

6.4.98 Noctule are relatively common and widespread in Norfolk, and Serotine and Leisler's were rarely confirmed and only occasionally encountered, which is typical of their distribution in the county.

6.4.99 Serotine populations in England are considered stable and data on Leisler's is deficient so it is difficult to establish whether the population sizes are increasing, decreasing or remaining stable, although their habitat remains stable (Bat Conservation Trust, 2021).

6.4.100 Noctule, Leisler's and Serotonin are considered to be important at a Local Scale.

Otter

6.4.101 NBIS returned eight records of otter within the 2km Desk Study Area. Two records were at least 1.4km west of the Proposed Scheme associated with the River Nar and two further records were associated with the River Nar approximately 2km south of the Proposed Scheme. Two records were approximately 700m north west of the Proposed Scheme near to the Hardwick Industrial Estate. A single record of a dead Otter from 1971 was

present in Middleton, approximately 2km from the Proposed Scheme. This record was for a 100m grid reference and so the precise location cannot be confirmed.

6.4.102 The 2021 surveys identified no signs of Otter and the site has very limited habitat with suitability for holts. Otters are therefore considered to be likely absent from the Proposed Scheme and surrounding area and are no longer considered within this assessment.

Water Vole

6.4.103 The Desk Study returned eight records for Water Vole within the 2km Study Area. No records were present within the Scheme Boundary or within any watercourses that are likely to be affected by the Proposed Scheme.

6.4.104 Surveys confirmed the presence of Water Vole within a network of ditches approximately 150m to the east of the Scheme Boundary within the southern extent of the Scheme Boundary (ditches D13, D14 and D15 within the Water Vole Survey Report). Latrine counts from the surveys along with a habitat suitability assessment were used to estimate the population density. The survey results indicated the presence of a low-density population in the south of the Proposed Scheme. It should be noted that no water vole field signs were recorded in D13 in 2021 which is directly impacted by the Proposed Scheme. However, the update site survey undertaken in June 2023 determined that the suitability of the habitat has improved since the 2021 survey season, with more areas of open water. The field surveys in 2021 were constrained by dense vegetation within this waterbody. A such, updated Water Vole surveys will be required to inform detailed design and mitigation during construction.

6.4.105 No evidence of water voles was recorded within any other watercourses affected by the Proposed Scheme.

6.4.106 Given the low population density present, Water vole are considered to be important at a Local scale.

Reptiles

6.4.107 The desk study returned no sites designated for reptiles; this search included statutory and non-statutory designated sites. Species records from the last ten years have been analysed and grass snakes have previously been recorded within the desk study area, however, these records are outside of the Scheme Boundary and within habitat that is geographically isolated.

6.4.108 Common lizard, grass snake, and slow worm were recorded throughout the Scheme Boundary during surveys in 2019 and 2021. The populations of each species have been assessed against the survey assessment criteria set out within Froglife Advice Sheet 10 (Froglife, 1999) for determining population size class estimates. The survey assessment criteria are aimed at safeguarding important reptile sites.

6.4.109 It should be noted that these are high level estimates based on survey results to indicate potentially important sites and there is no scientific method for assessing actual populations sized without mark and recapture. It should also be noted that a higher density of reptile refugia were used during surveys to ensure confidence in negative results, however the assessment criteria have not been adapted for this assessment, as they still provide an objective evaluation of the importance of the reptile populations.

6.4.110 The 2021 surveys were conducted across 17 discrete survey areas whereby low populations of each species were recorded in each survey area.

6.4.111 When assessing the total population of each species across the entire Scheme Boundary, low populations of grass snake and slow worm were recorded with peak counts of four and one respectively. The peak count of common lizard was six which would indicate a good population.

6.4.112 The site would classify as a key reptile site under the assessment criteria as it supports three reptile species, although it is noted that only one area of the 17 discrete areas surveyed within the Scheme Boundary supported all three species. This area was the arable field margin that runs parallel to the northern boundary of the A47.

6.4.113 Three reptiles species are present within the Scheme Boundary, however these populations are not considered to be large enough to be considered as key sites within the county.

6.4.114 All reptiles species are considered to be important at a Local scale.

Amphibians

Great Crested Newt

6.4.115 A total of 26 ponds were identified within 500m of the Scheme Boundary. Two ponds west of the A10 were excluded from further survey due their distance (>250m from the Scheme Boundary) and the A10 presenting a physical barrier to dispersal.

6.4.116 Of the remaining 24 ponds that were surveyed for the Proposed Scheme and the adjacent Hardwick Green EIA, great crested newts were confirmed present within 11 ponds. The summary of survey results are presented in separate document Appendix D, Table D-1.

6.4.117 The Great Crested Newt Mitigation Guidelines (English Nature, 2001) suggest that peak counts can be summed across ponds to obtain a population estimate when ponds are within 250m of each other, and where there are no significant barriers to movement.

6.4.118 Ponds 2, 3, 4, 5 and 10 would meet these criteria and for reference will be referred to as Metapopulation A.

6.4.119 Ponds 11 and 14 would also meet these criteria and will be referred to as Metapopulation B. No other ponds are considered likely to form metapopulations, either due to geographical barriers or due to the distance between other populated ponds

6.4.120 It is not possible to determine a population estimate for either Metapopulation A or B using the methodology described within the Great Crested Newt Mitigation Guidelines (English Nature, 2001). This is due to the population surveys being completed across different survey nights, meaning that a peak count in one night cannot be assessed. In addition, Pond 5 was

not subject to population size class surveys as it was dry during the 2021 survey period.

6.4.121 The peak count for each pond, where available, and professional judgement has therefore been used as a guide for assessing the likely population size for each metapopulation.

6.4.122 Metapopulation A is considered to be at least a medium population size class based upon the peak counts across Ponds 2, 3, 4, and 10 which had peak counts of 24, three, three and 22 respectively. Given that Pond 5 was dry during the 2021 season it is likely that newts from these ponds would have utilised neighbouring ponds within the metapopulation area. As such is considered unlikely that the metapopulation would exceed the peak count of 100 adults that would determine a large population size class.

6.4.123 Metapopulation B is considered likely to be a small population size class given that the peak counts for Ponds 11 and 14 were three and two respectively.

6.4.124 Great Crested Newts are a SPI under the NERC Act and are also listed on the Norfolk Species Action Plan, although they are described as locally common or frequent across most of Norfolk, excluding the Broads (Norfolk Biodiveristy Partnership, 2023). The survey data for the Proposed Scheme has not identified any large populations of the species that are likely to be considered as key sites for the species within the county.

6.4.125 Great Crested Newts are considered to be important at a Local scale

7 Embedded Mitigation

7.1.1 This section outlines the ecological mitigation measures that have been incorporated into the design of the Proposed Scheme. These measures are illustrated in the landscape proposals and general arrangement plans for the Proposed Scheme. In addition, measures that are considered to be industry standard practice and will be implemented by the principal contactor during

construction are included here. These measures will also be included in an Outline Construction Environmental Management Plan (OCEMP).

7.1.2 For the purpose of this assessment, mitigation refers to measures that are planned to avoid, mitigate (reduce) and/or compensate (replace), where possible, for likely impacts and affects arising from construction and operation of the Proposed Scheme.

7.2 Design Mitigation

7.2.1 The following mitigation measures have been embedded into the design of the Proposed Scheme. These measures are described from the north of the Scheme Boundary to the south.

7.2.2 The design of the Proposed Scheme has been refined where possible to minimise the loss of important habitats such as woodland, hedgerows and trees. Construction compounds are located within lower value habitats such as neutral grassland and arable cropland, as these areas will be easiest to reinstate and have a lower ecological impact.

7.2.3 The Scheme Boundary has been extended to include land for the provision of compensatory habitat. These areas include habitats that will be used to mitigate landscape and visual impacts as well as ecological mitigation. The landscaping within these areas is designed to maximise biodiversity benefits and will include native plant species and will primarily include lowland mixed deciduous woodland.

7.2.4 Indicative landscaping and habitat creation and enhancement proposals for the Proposed Scheme are provided in the current landscape proposals. Proposals for habitat compensation within these plans have been conceived with regard to the impacts on HPI, primarily lowland mixed deciduous woodland and hedgerows.

7.2.5 Woodland habitats have been included within the landscape proposals that have been strategically placed to complement existing woodland outside of the Scheme Boundary. Additional mitigation measures will include the

production of a Landscape and Ecological Management Plan (LEMP) and a detailed landscape strategy to be developed at detailed design stage. The focus of these additional measures will be to develop planting strategies that will incorporate ecologically complex woodland and will include areas of woodland containing depressions, wet areas, ponds and wet woodland if possible. Areas of scrub, glades and rides will be incorporated into the planting strategy that will increase the condition of the woodland and provide more diverse woodland habitat for a range of species.

7.2.6 Habitat features such as hedgerows, lines of trees and woodland will be interrupted by the Proposed Scheme where it intersects these habitats within the landscape. These habitats are typically used by bats to navigate the landscape and construction of the Proposed Scheme will permanently sever these habitats. In order to maintain connectivity for bats through the landscape, the landscaping proposals include planting of woodland, trees and hedgerows at all habitat features in order to minimise disruption of flight paths for bats. Within the landscaping proposals, larger, more mature standard trees will be specified to minimise adverse impacts through habitat severance. Planting of mature standards will ensure that these reinstated habitat features are able to establish faster and reach similar maturity to habitats that are lost through construction. This mature habitat planting will be included to the north of Chequers Lane in order to maintain flight paths across the road and maintain flight height. This will also ensure connectivity is maintained through the residential developments further west of the Proposed Scheme.

7.2.7 The landscaping strategy has been designed to replace existing bat foraging and commuting habitat to be lost to the Proposed Scheme (i.e., hedgerows, tree lines and grassland), and to provide habitat enhancement.

7.2.8 The newly created habitat will provide potentially greater access and foraging habitats around and within the Proposed Scheme for bats in the long term, particularly when compared to the existing arable land. The landscape strategy will also provide some mitigation / buffering for increased levels of lighting from vehicle lighting and street lighting once mature.

Drainage Design

7.2.9 The location of drainage and attenuation ponds has been revised during the development of the Proposed Scheme to reduce the loss of HPI. The location of these changes has been discussed individually within this section.

7.2.10 The proposed drainage strategy will utilise SuDS components to manage the surface run-off entering the watercourses, ensuring that water quality treatment and pollution control requirements are met. Prior to discharging into watercourses, surface water run-off will be conveyed within a network of swales before discharging into attenuation ponds/basins. These ponds, which will support emergent and submerged vegetation along their shoreline and in shallow zones, provide both attenuation and enhance treatment processes.

7.2.11 Therefore, this embedded mitigation design will control the levels of suspended sediment and pollutants entering the watercourse, reducing impacts and effects on aquatic macroinvertebrates and fish.

Area Southeast of Hardwick Interchange

7.2.12 The location of the attenuation pond southeast of the Hardwick Interchange been amended to its current position further west to potentially reduce woodland habitat loss and potentially avoid impacting upon ponds containing great crested newts. The retention of other habitat would also mitigate the effect of habitat loss upon protected and notable species, including birds, bats and reptiles.

7.2.13 Compensatory planting has been incorporated into the landscape proposals. The plans incorporate woodland planting and it is envisaged that woodland rides, glades, ponds and other features will be incorporated at detailed design stage to create areas with ecological complexity.

A47 Embankments and Verges

7.2.14 Replacement woodland and hedgerow planting has been incorporated into the landscape proposals that will run parallel to the widened road on the southern and northern embankments of the A47. This will allow replacement

of the existing habitats as it is assumed that these areas will need to be cleared to facilitate construction of the proposed Scheme.

A47 Underpass

7.2.15 The A47 underpass is located to the east of Hardwick Interchange extending underneath the A47.

7.2.16 Static bat detector data from the A47 underpass recorded the highest number of bat call registrations throughout the survey area. The majority of activity was attributed to Common and Soprano Pipistrelle. Myotis species and Brown Long-eared Bat were also recorded in relatively high numbers compared with the rest of the static detector locations. Barbastelle Bats were recorded at this location; however, the numbers were very low. Crossing point surveys at this location also recorded continuous foraging through the underpass and using surrounding woodland rides and habitat. Species recorded during crossing point surveys were Common and Soprano Pipistrelle, and Brown Long-eared Bat. Barbastelle were not recorded during the crossing point surveys. Bats were very rarely recorded at road height and at risk of vehicle collision, with the majority using the tunnel to pass under the A47.

7.2.17 The existing underpass is round structure, constructed of corrugated metal and concrete. Photographs of the tunnel entrances are presented in Annex 8.12. It is approximately 4.1m high, 6m wide and 35m long. The tunnel entrance on the northern extent is bounded by ditches, arable cropland and hedgerows, scrub and woodland which runs parallel to the A47 along its norther boundary. To the south, the tunnel entrance is bounded by the mosaic of habitats that are located southeast of the Harwick Interchange, which include wet woodland, lowland mixed deciduous woodland, wetlands and grassland. Woodland runs parallel along the southern boundary of the A47. The southern tunnel entrance is tapered, following the shape of the road embankment.

7.2.18 The Proposed Scheme will require the construction of a new slip road onto the A10 and Hardwick Interchange at this location that will require the

lengthening of the underpass which will be extended by 26m to a total length of 61m (76m to the toe of the new embankment) once constructed.

7.2.19 To ensure that bats are able to continue to the use the A47 underpass once constructed, mitigation has been embedded into the design and engineering options for the new structure. This has ensured that the dimensions (height and width) and shape of the underpass will be largely unchanged through the proposals. The use of underpasses by bats is typically influenced by the underpass type, height and the amount of forest (woodland) and hedgerows in the surrounding landscape and this has been the focus of mitigation design.

7.2.20 The aim of the mitigation is to retain and extend the existing underpass structure and, where possible, to maintain the height and width. The underpass will also be constructed using the same round corrugated metal structure, retaining the same tapered entrance on the southern extent. This design option has been selected over more traditional underpass designs that were also considered. Continuation of the existing structure design will enable the dimensions of the underpass to be maintained so far as possible.

7.2.21 The topography of the land at the location of the new underpass and slip road means that the profile of the tunnel will need to be tapered (reduced in height) towards the southern extent. This is to prevent drainage issues where the southern extent of the underpass would otherwise be lower than the proposed ground levels. The new section of the underpass will therefore taper in height from the existing section at 4.1m to between 3.6m and 3.7m at the southern entrance. A reduction of up to 0.5m (12%). The southern entrance to the new tunnel will be flared to existing tunnel height (4.1m) to encourage bats to continue using the structure and the width will remain unchanged through the length of the underpass.

7.2.22 Planting is incorporated into the landscape proposals surrounding the tunnel and running parallel to the A47 on the north and south embankments to replace that which is lost to the Proposed Scheme through the widening of the A47 and creation of the new slip road.

7.2.23 Research on the use of underpasses as bat mitigation under roads and railways indicates that the level of use is influenced by the height of the underpass and the behavioural characteristics of individual bat species. Guidelines on bat mitigation for linear transport infrastructure have been developed using research of existing underpass structures. The two main guidelines used to inform mitigation design for the Proposed Scheme include:

- Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure. (Berthinussen & Altringham, 2015); and
- Conference of European Directors of Roads (CEDR): Bat mitigation measures on roads - a guideline (CEDR, 2016).

7.2.24 The CEDR guidelines provide the most comprehensive assessment of the species-specific requirements for underpass structures when used for bat mitigation. Table 7-1 provides a summary of the recommended underpass dimensions for different species depending on their behavioural characteristics. Species are grouped by these characteristics into groups A to E. Species relevant to the Proposed Scheme have been included.

7.2.25 These guidelines suggest there may be a reduction in use by certain species within groups C and D given that the height of the tunnel will be reduced to 3.6m but unlikely to significantly change the level of use given the evidence of existing use of the tunnel which is already below the recommended height. All bat species will show a large natural behavioural flexibility, which is evident at the existing underpass, whereby the existing height is below the recommended minimum height within the CEDR guidelines, yet the level of use is evidently higher at the underpass than at road level.

7.2.26 Additional mitigation measures are considered in Section 9: Additional Mitigation Measures to maintain the function of the underpass for bats. These measures include landscaping or screens installed either side of and over the top of the tunnel entrance to guide bats into the tunnel and not over the road.

Table 7-1 Recommended underpass dimensions

Species groups	Behaviour characteristics	Bat species applicable to the proposed scheme	Recommended dimensions (height (H) and width (W)
Group A	Extremely manoeuvrable bats, which often fly within foliage, or close to vegetation, surfaces and structures at variable flight heights. When commuting, they often follow linear and longitudinal landscape elements. Low-flying (typically < 2 m) when commuting over open gaps.	Brown Long-eared Bat	H >2 m, W >2 m
Group B	Very manoeuvrable bats that most often fly near vegetation, walls, etc. at variable heights but occasionally hunt within the foliage. When commuting, they often follow linear and longitudinal landscape elements. Flying at low to medium height when commuting over open gaps (typically < 5 m).	Daubenton's Bat, Brandts Bat, Whiskered Bat, Natterer's Bat	H >2 m, W >2 m over waterways H >4 m, W >4 m over land

Species groups	Behaviour characteristics	Bat species applicable to the proposed scheme	Recommended dimensions (height (H) and width (W)
Group C	Bats with medium manoeuvrability. They often hunt and commute along vegetation or structures at variable heights, but rarely close to or within the vegetation. May also hunt in open areas. Commuting over open stretches generally takes place at low to medium heights (typically 2 – 10 m) with no clear tendency to lower flight.	Common Pipistrelle, Soprano Pipistrelle, Nathusius' Pipistrelle	H >4.5 m, W >5 m
Group D	Bats with medium manoeuvrability with a straighter flight pattern than bats in category C. They hunt and commute both in the away from vegetation and structures in a variety of flight heights. May occasionally fly but never hunt within vegetation. Commuting over open stretches tend to occur at medium heights (2 – 10 m) with no clear tendency to lower flight.	Barbastelle Bat, Serotine Bat	H >4.5 m, W >5 m. Effectiveness is very questionable

Species groups	Behaviour characteristics	Bat species applicable to the proposed scheme	Recommended dimensions (height (H) and width (W)
Group E	Less manoeuvrable bats that most often fly high and in the open airspace away from vegetation and other structures. These bats generally commute over open stretches at medium heights or higher (10 m and often higher). It must be stressed that even these species may fly quite low over open areas under certain conditions, e.g. when hunting insects over warm (road) surfaces, or when they emerge from a roost site.	Common Noctule, Leisler's Bat	Not a recommendable mitigation method for these species

Agricultural Barns South of the A47

7.2.27 The alignment of the Proposed Scheme has been designed to ensure that the agricultural barns south of the A47 will be retained within the Proposed Scheme.

Area North of the Proposed New A10/A47 Roundabout Junction

7.2.28 Woodland planting has been incorporated into the landscape proposals to the north of the new A10/A47 roundabout junction. This planting is primarily to contribute to habitat compensation for lowland mixed deciduous woodland that will be lost to the Proposed Scheme. The majority of this woodland loss will occur directly south of this location, where the Proposed Scheme passes through the area of Lowland Mixed Deciduous west of Sheep's Course Wood.

7.2.29 In addition to the compensatory woodland planting, the attenuation ponds have been relocated from the area south of the A47 to the arable cropland north of the A47. These measures have been incorporated into the design to reduce the loss of lowland mixed deciduous woodland and reduce the impact upon protected and notable species that utilise these habitats.

Area West of Sheep's Course Wood

7.2.30 The Scheme Boundary has been significantly reduced in the mosaic of habitat that is located to the west of Sheep's Course Wood. These measures have been integrated into the design to reduce woodland and grassland loss and retained a larger buffer of retained habitat to the Sheep's Course Wood CWS. This retained buffer will also reduce the effects upon protected and notable species that utilise these habitats.

Area between Sheep's Course Wood and Rectory Lane

7.2.31 The Scheme Boundary has been extended to the east of the new road alignment to accommodate woodland habitat compensation along the eastern boundary of the Proposed Scheme. This woodland compensation extends between Sheep's Course Wood and Rectory Lane. This will contribute to compensation for lowland mixed deciduous woodland and species that utilise this habitat, reduce lighting impacts on neighbouring habitat and allow

connectivity for protected and notable species, including bats from Sheep's Course Wood. A potential wildlife underpass is illustrated in the general arrangement plans at this location to allow safe passage for animals beneath the road. This will consist of a single 600mm pipe with the intension for use by small mammals (such as badger) as well as other species.

7.2.32 A single pond located within this area will be enhanced through the Proposed Scheme through habitat management to remove bramble scrub and through dredging to remove siltation. In addition, the change in habitat within this area from arable land to semi natural habitat (woodland and grassland) will provide an opportunity to increase the condition of this habitat for biodiversity.

Rectory Lane Overbridge

7.2.33 Woodland planting has been incorporated into the landscape proposals for the embankment of the proposed new Rectory Lane overbridge to reduce light pollution and maintain bat connectivity through the Proposed Scheme along Rectory Lane.

Rectory Lane to North Runcton Common and Chequers Lane

7.2.34 The Scheme Boundary has been extended to the east between Rectory Lane and North Runcton Common. This additional land will be used for compensatory woodland planting that will also provide a connective corridor between Sheep's Course Wood and North Runcton Common, reduce lighting impacts from the road and the proposed new roundabout northeast of the North Runcton Common which is a potentially important area for bats within the vicinity of the Proposed Scheme. The woodland creation will also continue between the HAR and the Scheme Boundary to create a woodland buffer at the western boundary of North Runcton Common.

7.2.35 Woodland planting has been incorporated into the landscape proposals to the north and south of the proposed new footway crossing at Chequers Lane. The woodland planting will maintain connectivity for bats through the landscape and reduce lighting impacts from lighting at the crossing.

Area South of Chequers Lane

7.2.36 Woodland planting has been incorporated into the landscape proposals along the east of the new road as it extends between Chequers Lane and the attenuation ponds in the southern extent. Woodland planting is also incorporated around these ponds to reduce lighting impacts. To the east of the attenuation ponds, a wet ditch has been proposed within the landscape proposals that will serve as a receptor site for Water Vole if this is required for mitigation at a later stage in the design process.

7.3 Construction Mitigation

7.3.1 The following construction mitigation measures have been considered as industry standard practice that will be incorporated into a CEMP.

Airbourne Pollution from Dust Emissions

Dust Suppression Measures

7.3.2 Dust and air quality management measures will be implemented to limit pollution arising from the transportation and storage of materials, including the following, as appropriate:

- Covering materials, deliveries or loads entering and leaving the construction site for the purposes of preventing materials and dust spillage.
- Vehicles transporting materials within or outside the construction site will not be overloaded.
- Stockpiles and mounds will be kept away from sensitive habitats, watercourses and surface drains where reasonably practicable, and sited to take into account the predominant wind direction relative to sensitive receptors.
- Stockpiles and mounds will be maintained to avoid material slippage.
- Materials stockpiles likely to generate dust will be enclosed or securely sheeted, kept watered or stabilised as appropriate.

- Fine dry material will be stored inside buildings or enclosures with measures in place to ensure no escape of material and no overfilling during delivery.
- Mixing of large quantities of concrete or bentonite slurries will be undertaken in enclosed or shielded areas, using appropriate techniques and mitigation.
- The number of handling operations for materials will be kept to the minimum reasonably practicable.
- Materials handling areas will be maintained to constrain dust emissions through the use of measures such as watering facilities to reduce or prevent escape of dust from the site boundaries.

Haul Routes

7.3.3 Haul routes will be provided through the works for use by construction vehicles to access the works. The construction and maintenance of haul routes, will include the following measures, as appropriate:

- The surfacing of haul roads should be inspected regularly and maintained appropriately.
- Re-use of haul route surfacing materials where the locations of haul routes change during construction.
- Provision of areas of hard-standing at site access and egress points to be used by any waiting vehicles.
- Methods to clean and suppress dust on haul routes (including watering) and in designated vehicle waiting areas. The frequency of cleaning will be suitable for the purposes of suppressing dust emissions from the site boundaries.
- Enforcement of speed limits.

Excavation and Earthworks Activities

7.3.4 Dust pollution from excavations and earthworks activities will be limited through the use of the following measures, as appropriate:

- Topsoil will be stripped as close as reasonably practicable to the period of excavation or other earthworks activities to avoid risks associated with runoff or dust generation.
- Drop heights from excavators to vehicles involved in the transport of excavated material will be kept to the reasonably practicable minimum.
- Materials will be compacted after deposition, with the exception of topsoil and subsoil on land to be restored for agriculture, landscaping and wildlife habitats.
- Soil spreading, seeding, planting or sealing of completed earthworks will be undertaken as soon as reasonably practicable following completion of the earthworks.

Habitat Loss

Protection of Trees

7.3.5 The principal contractor will employ an arboriculture consultant to oversee works relating to the protection of at-risk trees, as noted within the Arboriculture Impact Assessment.

7.3.6 Retained trees will be protected in line with the recommendations in BS 5837: Trees in relation to design, demolition and construction.

7.3.7 The following measures will be implemented, as appropriate:

- Provision of appropriate protective fencing to reduce the risks associated with vehicles passing over root systems or beneath canopies.
- Measures to prevent compaction of soils, including undisturbed woodland soils.

- Maintenance of vegetation buffer strips.
- Selective removal of lower branches to reduce the risk of damage by construction plant and vehicles.
- Standard guidance for working within root protection zones, including procedures to follow if significant roots are uncovered during work.
- Provision of contractor guidance for working close to retained aged and veteran trees and areas of retained woodland and watching briefs as appropriate.
- Monitoring of the effectiveness of the tree protection measures throughout the construction period by an appropriately qualified arboricultural consultant.

7.3.8 The supply, storage, handling, planting and maintenance of new planting will be undertaken in accordance with appropriate British Standards, including BS 8545; 2014 - Trees: from nursery to independence in the landscape – Recommendations; BS 5837 Trees in relation to design, demolition and construction – Recommendations, BS 3998 Tree Work - Recommendations; and BS 4428 Code of practice for general landscape operations (excluding hard surfaces) and other appropriate guidance including the UK Forestry Standard and the UK Woodland Assurance Standard.

Water-borne Pollution

Pollution Prevention Measures

7.3.9 The principal contractor will develop and implement appropriate measure to control the risk of pollution due to construction works, materials and extreme weather events. This will include a pollution incident control plan, as part of the contractor's environmental management system, which recognises the risk of pollution from construction activities and presents proactive management practices to ensure that any pollution incident that may occur, such as a diesel spillage, is minimised, controlled, reported to relevant parties

and remediated. The plan will define the criteria for implementing the relevant measures.

7.3.10 The following measures will be adopted by the principal contractor to manage the risk of pollution incidents.

- Statement of appropriate information to be provided in the event of any incident such as a spillage or release of a potentially hazardous material.
- Notification of appropriate emergency services, authorities and personnel on the construction site.
- Notification of relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required.
- Provision of maps showing the locations, together with address and contact details, of local emergency services facilities (e.g. police stations, fire authorities, medical facilities and other relevant authorities).
- Ensure that site drainage plans and flood risk management plans are available on site and are kept up-to-date.
- Ensure that pollution shut-off valves are used in compounds with formal drainage.
- Ensure staff competence and awareness in implementing plans and using pollution response kit.
- Provision of contact details for the relevant authorities, such as the Environment Agency, and the persons responsible on the construction site and within the contractors' organisation for pollution incident response.

- Provision of contacts for a competent spill response company that can be contacted at short notice for an immediate response (where appropriate).

7.3.11 In the preparation of local pollution incident response measures, the principal contractor will consult with relevant organisations, including statutory bodies and other relevant parties, such as the Health and Safety Executive (HSE) (Construction), the Fire Authority, the Ambulance Service, the Environment Agency, Natural England (the Government's advisory body on the natural environment), utilities companies and the respective local authorities (emergency planning and pollution control functions).

7.3.12 The principal contractor will have in place effective arrangements to investigate and provide reports on any potential or actual significant pollution incidents, including, as appropriate:

- A description of the pollution incident, including its location and Ordnance Survey (OS) grid reference, the type and quantity of contaminant and the likely receptor(s).
- Contributory causes.
- Adverse effects.
- Measures implemented to mitigate adverse effects.
- Any recommendations to reduce the risk of similar incidents occurring.

8 Preliminary Assessment of Likely Impacts and Effects

8.1.1 This section details the assessment of likely significant effects on important Ecological Features arising as a consequence of the construction and operation of the Proposed Scheme. It takes account of the embedded mitigation measures described in section 7 above. Additional mitigation measures and the residual effect of the development once these additional

measures are implemented are described in the Sections 9: Additional Mitigation Measures and 10: Significant Effects.

8.2 Designated Sites

Internationally Designated Sites

8.2.1 The HRA Report (WSP, 2023q) has been compiled to provide information on the identification and assessment of effects on internationally designated sites (the National Sites Network). These matters are assessed in the HRA report. A summary of the assessment is provided below.

8.2.2 The following internationally designated sites were identified within the EZoI of the Proposed Scheme for habitat fragmentation and loss of functionally linked land through site clearance during construction and through noise and visual disturbance during operation:

- The Wash and North Norfolk Coast Special Area of Conservation (SAC);
- The Wash Special Protection Area (SPA); and
- The Wash Ramsar Site.

8.2.3 The following sites are not designated for mobile species for which the Proposed Scheme could act as functionally linked land and they do not fall within 200m of the affected road network (ARN) where they could be impacted by changes in air quality.

- Roydon Common and Dersingham Bog SAC.
- Roydon Common Ramsar.
- Norfolk Valley Fens SAC.

8.2.4 ‘Stage 1 – Screening’ for the HRA was undertaken and identified that none of the internationally designated sites would suffer potential Likely Significant Effects (LSE) from the identified potential impact of habitat loss, fragmentation

and/or loss of functionally linked land, either in isolation or in combination with other plans or projects.

8.2.5 Given that no LSEs were identified and/or screened out, the Proposed Scheme was not subject to 'Stage 2 - Appropriate Assessment'.

8.2.6 There are therefore no anticipated impacts upon internationally designated sites during construction or operation of the Proposed Scheme.

Nationally Designated Sites

8.2.7 There are no predicted impacts upon any nationally designated sites, including River Nar SSSI, Roydon Common SSSI, East Winch Common SSSI, The Wash SSSI and NNR, Leziate, Sugar and Derby Fens SSSI, Islington Heronry SSSI, and East Walton and Adcock's Common SSSI as a result of construction or operation of the Proposed Scheme as there are no impact pathways to the designated sites.

Non-Statutory Designated Sites

8.2.8 Of the ten non-statutory sites identified through the desk study none are located within the Scheme Boundary.

Construction

Dust Pollution

8.2.9 Sheep's Course Wood CWS is located directly adjacent to the Scheme Boundary and one of the proposed temporary works areas for construction traffic. As such there is potential for impacts from dust emissions though trackout during construction that may not be fully mitigated by the embedded construction mitigation measures.

8.2.10 The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then

spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

8.2.11 As general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500m from large sites (IAQM, 2014).

8.2.12 Dust emissions will be temporary impact during construction and the effects are unlikely to lead to significant effects upon the woodland habitats within the CWS in the long term. However, habitat degradation may occur during construction in the absence of additional mitigation.

8.2.13 Dust emissions are considered to have a temporary, short-term, low impact that represents significant adverse effects at a Local scale.

8.2.14 The remaining CWSs discussed within the Baseline Section are a sufficient distance from the Scheme Boundary that no construction impacts are predicted.

Operation

Air Pollution

8.2.15 Chapter 6: Air quality determines that Rush Meadow CWS, West Winch Common CWS, Sheep's Course Wood CWS, Saddlebrook Reedbeds CWS and Brook Watering Meadow CWS fall within 200m of the ARN. Of these sites, only Sheep's Course Wood will be significantly impacted by air quality impacts. Due to its proximity to the Scheme Boundary, additional impacts during construction are predicted. Negligible impacts are predicted upon the remaining sites.

8.2.16 The remaining sites scoped into this assessment that are will not be impacted by air quality changes and no further impacts are predicted upon these sites.

8.2.17 No impacts are predicted upon Adj. River Narr CWS, Plantation Wood CWS, South of Gaywood Park CWS, Old Hall Farm CWS and Clenchwarton Road CWS.

8.2.18 Sheep's Course Wood CWS is located within 200m of the ARN and will be subject to air quality changes through increased traffic volumes during operation. The details of this assessment are presented in Chapter 6: Air Quality. The modelling for the air quality assessment has identified increases above 1% of the critical levels of nitrogen deposition at the opening year (2027) and the design year (2042). In addition, increases in ammonia (NH3) above 1% of the critical level have been identified at the opening year.

8.2.19 Sheep's Course Wood is an area of closed canopy Oak woodland with a sparse, low diversity understory. The woodland is also located in proximity to the existing A47 and therefore exposed to existing air pollution. Based on the magnitude and extent of the air quality changes and that these changes are unlikely to lead to considerable changes in the vegetative structure or diversity of the woodland, increases in nitrogen deposition and ammonia are considered to be a permanent low impact that represents a significant adverse effect at a Local scale.

8.3 Habitats and Botany

Terrestrial Habitats

Construction

Site and Vegetation Clearance

8.3.1 Construction of the Proposed Scheme and associated construction site and vegetation clearance work is expected to lead to permanent removal of a proportion of habitats within the Scheme Boundary. This includes both common and widespread habitats and HPI.

8.3.2 The predicted habitat loss within the Scheme Boundary is listed in Table 8-1, below. Included is the area of each habitat in hectares (linear habitats are measured in kilometres). It should be noted that these areas are approximate areas of loss and based on a reasonable worst-case scenario for the construction of the Proposed Scheme. In addition, area measurements are rounded to the nearest two decimal points.

Table 8-1 Predicted Habitat Change

Habitat Classification	Baseline	Retained	Enhanced	Created	Change
Cereal crops (including arable and horticulture)	44.49	0.08	0	6.11	-38.3
Modified grassland	8.08	0.66	0	24.19	16.77
Hawthorn scrub	0.85	0.05	0	0	-0.8
Mixed scrub	0.86	0.07	0	0.43	-0.36
Eutrophic standing waters - Pond priority habitat	0.16	0	0.04	0	-0.12
Developed land; sealed surface	6.01	2.27	0	10.8	7.06
Building	0.07	0.05	0	0	-0.02
Wet woodland	0.31	0	0	1.41	1.1
Other lowland mixed deciduous woodland	5.54	1.99	0	20.49	16.94
Other coniferous woodland	0.01	0.01	0	0	0
Mosaic of developed land - vegetated garden	0.04	0	0	0	-0.04
Dense scrub (willow)	0.08	0	0	0	-0.08
Other neutral grassland	0.43	0	0	0	-0.43
Other swamps	0.11	0	0	0	-0.11
Dense scrub	0.08	0	0	0	-0.08
Arrhenatherum neutral grassland	1.11	0.28	0	0	-0.83
Bramble Scrub	0.37	0	0	0	-0.37

Habitat Classification	Baseline	Retained	Enhanced	Created	Change
Calamagrostis epigejos grassland (Other neutral grassland)	0.27	0	0	0	-0.27
Grand Total	**68.86**	**5.46**	**0.04**	**63.43**	**Not Applicable**
Hedgerows (priority habitat)	1.66	0	0	3.45	1.79

8.3.3 Taking account of the embedded mitigation measures, the change in habitat composition through the Proposed Scheme will result in a net increase in area of lowland mixed deciduous woodland with approximately 17 hectares of additional habitat created and 2 hectares retained. The Proposed Scheme will result in a net increase in the length of hedgerow (priority habitat) with approximately 1.79km of additional hedgerow habitat post development. The area of wet woodland will also increase by approximate 1.1 hectares. Although these habitats will increase in overall area and length, it is recognised that these habitats will not directly replace those being lost to the Proposed Scheme, particularly in terms of the maturity and age of those habitats and their ecological functions in the wider context of the landscape. In addition, these increases in habitat area would not achieve a no-net-loss or net gain in biodiversity using the Natural England Biodiversity Metric. It is therefore considered that the Proposed Scheme will result in an overall deterioration of habitat that will constitute an overall habitat loss due to the reduction in habitat quality.

8.3.4 There will be a net loss of approximately 0.12 hectares of priority habitat ponds through the Proposed Scheme. In addition, from the habitat change presented in Table 5-1 it is evident that the overall diversity of habitat types within the Scheme Boundary will reduced. Nine habitat types present within the Scheme Boundary will be lost, which will contribute to the loss of important habitat mosaics.

8.3.5 Habitat loss is a permanent impact for those habitats lost to the Proposed Scheme and a long-term impact for those that will take time to establish. The magnitude of this impact is high, given that this will incur a large alteration to the baseline conditions. Habitat loss represents an adverse effect that is significant at a County scale.

Operation

8.3.6 No further impacts upon habitats are predicted during the operation of the Proposed Scheme.

Ancient Woodland

Construction

8.3.7 There are no anticipated impacts upon ancient woodland during construction of the Proposed Scheme, as there are no areas within the Proposed Scheme boundary.

Operation

Air pollution

8.3.8 Air quality modelling has identified negligible impacts from increased air pollution upon Reffley Wood as a result of air quality changes. There are negligible adverse effects upon ancient woodland during operation of the Proposed Scheme.

Veteran Trees

Construction

Site and Vegetation Clearance

8.3.9 All four veteran trees within the Proposed Scheme boundary or adjacent will be retained through the implementation of embedded mitigation measures to protect retained trees. There are no anticipated impacts upon veteran trees during construction of the Proposed Scheme.

Operation

Air pollution

8.3.10 Air quality modelling has identified negligible impacts upon veteran trees as a result of air quality changes. As such, negligible adverse effects upon veteran trees through air pollution will occur during operation of the Proposed Scheme.

Invasive Non-Native Species

Construction

Spread of INNS

8.3.11 Unmitigated construction activities along the northern boundary of the A47 and the areas southeast of Hardwick Interchange would likely result in the spread of Japanese Knotweed onto third party land. It should also be noted that Japanese Knotweed may also be classified as a controlled waste.

Operation

8.3.12 There are no anticipated impacts from the operation of the Proposed Scheme with regards to INNS.

8.4 Protected and Notable Species

Aquatic Macroinvertebrates, Fish and Macrophytes

8.4.1 Taking account of the embedded mitigation measures for construction and operation of the Proposed Scheme, there are predicted impacts upon aquatic macroinvertebrates, macrophytes and fish from the Proposed Scheme.

Birds

Barn Owl

Construction

Site and Vegetation Clearance

8.4.2 The construction of the Proposed Scheme and associated site and vegetation clearance work is expected to lead to the direct loss of habitats suitable for use by Barn Owl for nesting and foraging purposes.

8.4.3 Three trees that provide potential nest sites are located directly adjacent to the Scheme Boundary and two are located in close proximity to the boundary. A single nest box is also located to the southeast of Hardwick Interchange that will need to be removed to facilitate construction.

8.4.4 The two agricultural barns south of the A47 contained evidence of historic nesting, and both contained nest boxes. The largest of the two barns (B1) contained an observed breeding site during the 2021 surveys. Both are therefore assessed as potential nest sites for the purpose of this assessment.

8.4.5 The complex of barns at Hardwick Farm contained multiple roosting and resting sites, including active and potential roost sites, potential nest sites and temporary rest sites for Barn Owl.

8.4.6 None of these buildings or trees will be lost to the Proposed Scheme. No buildings that will be demolished for the Proposed Scheme were suitable for Barn Owl. A single nest box will be removed to facilitate construction, although this Barn Owl nest box was not occupied by the species.

8.4.7 The loss of Barn Owl foraging habitat represents a negligible adverse effect given the limited habitat within the Scheme Boundary and the availability of further habitat within the wider area.

Disturbance: Lighting, Noise, Vibration and Visual

8.4.8 Barn Owl could potentially be subject to lighting, noise, visual and vibration disturbance during construction, and this may lead to changes in behaviour. Increased levels of human activity and the presence of large machinery such as excavators and piling rigs has the potential to lead to increased visual disturbance during construction. It is however likely that birds that are temporarily disturbed would be displaced to other suitable habitat in the surrounding landscape. Consequently, any displacement of bird species is not expected to materially affect their condition or ability to persist in the environment.

8.4.9 If Barn Owl are confirmed breeding in trees and buildings that are directly adjacent to works areas, further mitigation may be required (outlined in Section 9) with regards to their protected status under Schedule 1 of the Wildlife and Countryside Act and the potential for disturbance during the breeding season.

8.4.10 The disturbance of barn owl and removal of barn owl foraging habitat during the construction period represents a temporary, short-term medium impact that would result in a significant negative effect at the Local scale in the absence of additional mitigation.

Operation

Road Traffic Collision: Injury and Mortality

8.4.11 Barn Owl are particularly susceptible to mortality associated with vehicle collision. Where the Proposed Scheme severs suitable foraging habitat and territories, potentially separating foraging areas from nest or roost locations, an increased risk of death or injury from vehicle collisions is likely, particularly where there was no main road previously (along the HAR).

8.4.12 Foraging habitat is limited within the Scheme Boundary and the grassland habitats that will be created alongside the Proposed Scheme are not considered likely to attract Barn Owl foraging along the route and therefore increase vehicle collision risk.

8.4.13 In addition, embedded mitigation includes woodland and hedgerow planting adjacent to the road that will encourage birds to fly higher and reduce the risk of collisions with vehicles. It is anticipated that disturbance during operation would be a permanent low impact that will represent a negligible adverse effect on Barn Owl.

Disturbance: Lighting, Noise and Visual

8.4.14 Noise, lighting and visual disturbance during operation can have an adverse impact on Barn Owl. Barn Owl using the habitat closest to the A47 and Hardwick Interchange are already adapted to the noise and visual disturbance of live traffic already present in the area. It is anticipated that disturbance during operation would not give rise to significant adverse effects on Barn Owl.

Breeding and Wintering Birds

Construction

Site and Vegetation Clearance

8.4.15 Site and vegetation clearance during construction works would result in the removal of a proportion of the suitable habitats within the Proposed Scheme boundary. The approximate extent of habitats lost (permanently and temporarily) to the Proposed Scheme is provided in Table 8-1. It is expected that some habitats would be subject to a substantial level of disturbance during construction. A number of these habitats including trees, arable land, woodland, grassland, scrub and hedgerows are suitable for a range of breeding and wintering birds.

8.4.16 Some habitat loss within the Proposed Scheme would be permanent, which is associated with the built footprint of new roads and non-motorised user route. Other habitat loss would be temporary in nature, particularly areas of arable land used for construction compounds. Removal and disturbance of habitats would reduce the availability of habitat used by a range of bird species including some species of conservation concern.

8.4.17 Habitats within the Scheme Boundary provide nesting opportunities for a range of species. All wild birds are protected by the Wildlife and Countryside Act, and vegetation clearance and site clearance activities have the potential to kill or injure wild birds and cause damage or destruction of active nests if these activities are undertaken during the bird breeding season.

8.4.18 The unmitigated, temporary, short term medium impacts upon birds from construction of the Proposed Scheme would lead to adverse effects that would be significant up to a Local scale.

Disturbance: Lighting, Noise and Visual

8.4.19 Breeding and wintering birds could potentially be subject to lighting, noise, visual and vibration disturbance during construction, and this may lead to changes in behaviour. Increased levels of human activity and the presence of

large machinery such as excavators will also contribute to this disturbance. It is however likely that birds that are temporarily disturbed would be displaced to other suitable habitat in the surrounding landscape. Consequently, any displacement of bird species is not expected to materially affect their condition or ability to persist in the environment.

8.4.20 Disturbance during construction is a temporary, short term low impact that represents a negligible effect on breeding and wintering birds.

Operation

8.4.21 Operation of the Proposed Scheme will not result in impacts that will lead to any significant effects.

Terrestrial Invertebrates

Construction

Site and Vegetation Clearance

8.4.22 Construction of the Proposed Scheme and associated site and vegetation clearance work is expected to lead to the removal of a large proportion of habitats within the Scheme Boundary. This would result in the direct loss of habitats suitable for use by important terrestrial invertebrates. Some loss of suitable habitat would be permanent, associated with the built footprint of new infrastructure and lasting for at least the duration of the operational period. This loss could affect the functionality of the remaining areas of suitable habitat type to support this species and will reduce the availability of suitable habitat within the local landscape.

8.4.23 The loss of suitable habitat would decrease the availability of foodplants for terrestrial invertebrate populations. This could lead to the decline in important populations of terrestrial invertebrates from within this area.

8.4.24 The loss of terrestrial invertebrate habitat during the construction period is a temporary, medium term, medium impact that represents a significant adverse effect at a Local scale.

Operation

Disturbance: Lighting

8.4.25 Disturbance through lighting during the operational period could lead to potential effects on terrestrial invertebrates.

8.4.26 Embedded mitigation measures comprising woodland planting to reduce lighting impacts will reduce light spill onto retained and created habitats within the Scheme Boundary and adjacent. However, the section of the A47 that will be dualled between Sheep's Course Wood and the Harwick interchange will be lit with street lighting up to 10m high pillar lights. It is considered unlikely that the woodland creation either side of the A47 would mitigate this lighting impact upon adjacent habitat.

8.4.27 There are additional areas of woodland creation to the east of the Proposed Scheme that will be unlit. As such, the effects of disturbance during the operational period does not represent a significant adverse effect.

Mammals

Badgers

Construction

Site and Vegetation Clearance

8.4.28 Badgers are considered for assessment due to their legal protection. No Badger setts are located within the Scheme Boundary or within 30m. However, due to the time elapsed between the Badger surveys there is potential for new setts to have been created in the interim, although none were identified during the update site survey in 2023. The following assessment is therefore precautionary and assumes a reasonable worst case that new setts may be uncovered prior to construction. It is considered highly unlikely that new badger main setts would be excavated in the interim period to construction.

8.4.29 Potential impacts upon Badger setts could arise from construction activities, including vegetation, site clearance, plant movement and excavation which

could lead to damage and destruction of setts within the Scheme Boundary. Impacts upon setts also have the potential to kill or injure Badgers.

8.4.30 These temporary, short term, medium impacts represent a permanent adverse effect that is significant at a Local scale.

Noise and Vibration

8.4.31 Disturbance impacts through noise and vibration may also arise from plant movements and construction activities. Generally, disturbance impacts from construction are most likely to occur to setts within 30m of the construction boundary. As such, further setts beyond the Scheme Boundary may be impacted by construction that have not been identified within this assessment.

8.4.32 The unmitigated impacts during the construction of the Proposed Scheme would be temporary and could occur throughout the duration of construction. These temporary, short term, low impacts would represent a significant adverse effect upon Badgers at a Local scale.

Operation

Road Traffic Collision and Habitat Interruption and Fragmentation

8.4.33 Road traffic collisions could occur during the operation of the Proposed Scheme which will be a particular risk where the Proposed Scheme intersects regularly used pathways, foraging areas and Badger territories. Areas of the Proposed Scheme that require mitigation would need to be determined at detailed design stage and following updated badger surveys within the landscape. Potential locations for badger/wildlife underpasses have been integrated into the general arrangement plans and the precise location of these will be determined at detailed design stage. This unmitigated permanent low impact would have a permanent adverse effect at a Local scale.

Bats

Construction

Site and Vegetation Clearance

8.4.34 No confirmed roosts are anticipated to be affected by the Proposed Scheme.. In addition, the presence/likely absence surveys of trees and buildings was undertaken in 2021 and although this data is considered sufficient to inform this impact assessment, these surveys would need to be repeated to inform detailed design and may also need to be repeated prior to construction to inform the requirement for protected species licensing and further mitigation and compensation.

8.4.35 Site and vegetation clearance will require the removal of trees with suitability for roosting bats which could affect the local roost resource. Although no roosts that have been identified will be impacted during site and vegetation clearance.

8.4.36 The construction of the Proposed Scheme including site and vegetation clearance would result in the removal of habitat within the Scheme Boundary that is used for foraging. The approximate extent of habitats to be lost as a result of construction of Scheme is detailed in Table 8-1. Of the habitats lost, ditches, wetlands, broadleaved woodland, scattered trees, lines of trees, hedgerows, scrub and grassland represent the majority of highly suitable habitat for commuting and foraging bats. Areas of hard standing (e.g., roads) and arable fields are generally considered to provide negligible and low suitability foraging and commuting habitats respectively.

8.4.37 Removal of areas of high suitability habitats such as those to the west of Sheep's Course Wood and east of Hardwick Interchange would reduce the availability of foraging habitats within the Scheme Boundary. This habitat removal may also cause interruption of commuting routes used by bats to commute between their roosting sites and other habitats in the wider landscape.

8.4.38 Extensive woodland creation is proposed throughout the Proposed Scheme and primarily to the east of the new road. It is considered that this compensation would provide commuting and foraging habitat, whilst maintain connectivity between Sheep's Course Wood and North Runcton Common which have both been highlighted as potentially important areas for bats within the ZoI of the Proposed Scheme.

8.4.39 Although woodland compensation within the embedded mitigation will have a reduction in the effect of habitat loss during construction of the Proposed Scheme, it is recognised that this woodland will take time to establish and reach the same habitat quality that which is lost the Proposed Scheme.

8.4.40 Habitat loss is a temporary, long term medium impact that represents a significant adverse effect at a Local scale.

Disturbance: Lighting

8.4.41 Lighting from the construction phase could deter bats from using areas of habitat that have previously been unlit. This could comprise suitable commuting and foraging habitat for bats as well as potential roost sites in buildings, woodland and trees within and outside of the Scheme Boundary.

8.4.42 Unmitigated disturbance through lighting impacts during construction of the Proposed Scheme could lead to temporary, reversible impacts resulting in adverse effects on foraging and commuting bats. There is also potential for permanent impacts upon tree and building roosting bats that lead to adverse effects.

8.4.43 Lighting disturbance is a permanent medium impact that represents a significant adverse effect at a Local scale.

Operation

8.4.44 No additional habitat loss beyond the habitats cleared during construction would take place during the operational phase.

Road Traffic Collision and Road Mortality

8.4.45 Bats are susceptible to mortality associated with collisions with road vehicles. Where the Proposed Scheme interrupts a bat flight path this may increase the mortality risk. Where bat commuting routes such as hedgerows and tree lines are interrupted by the Proposed Scheme, this may result in increased bat mortality at locations where bats have been observed crossing the landscape using these features. The HAR Section of the Proposed Scheme will also introduce traffic into areas where there are no roads at present.

8.4.46 The Proposed Scheme will be open to all traffic and therefore a collision risk will increase for all bat species that typically foraging and commute below 5m above ground. However, the speed of the HAR section of the Proposed Scheme is 40mph which is likely to reduce this risk and the dualled section of the A47 will be permanently lit with lighting up to 10m high which is likely to deter many species from using this carriageway.

8.4.47 Noctule, Leisler's and Serotine are species that are known to fly high and to forage in open spaces that is likely to make them less susceptible to the barrier effects of roads and to collision mortality. Most other bat species fly at low speeds, close to the ground between 0-4m, particularly when crossing open spaces (Berthinussen & Altringham, 2015). Surveys at the Proposed Scheme have identified Chequers Lane as a potentially well used commuting and foraging route. Embedded mitigation within this area includes woodland planting either side of the new road, including larger standard trees to ensure that canopy height can be achieved in a shorter period of time and reduce the time taken to achieve a desired canopy height. It is recognised that a 5m canopy height will take a number of years to achieve.

8.4.48 The A47 underpass has been designed to minimise impacts on bats by maintaining the existing tunnel height where possible. The slight reduction in underpass height on the southern side will have a negligible effect on Myotis species and Brown Long-eared Bats given that they have been found to regularly use underpasses with lower heights. Common and Soprano Pipistrelle Bats utilised the underpass most during surveys and up to three

individuals were regularly recorded foraging through it continuously. Current guidance suggests that there may be a reduction in use of the underpass for these species due to the decrease in height, although the reduction in use cannot be quantified.

8.4.49 Road traffic collision is a medium-term (until new tree and woodland habitat creation has reached a mature state), medium impact that represents a significant effect a Local scale.

Disturbance: Lighting

8.4.50 Artificial lighting associated with operation of the Proposed Scheme could deter certain bat species from using habitats that are newly illuminated including areas used by commuting bats. Areas requiring lighting includes the section of the A47 that will be dualled between Sheep's Course Wood and the Harwick interchange, with up to 10m high street lighting.

8.4.51 This impact is considered unlikely to occur where street lighting is already present. Currently the only street lit areas are near the Harwick Interchange and the A10 at the southern extent of the Proposed Scheme.

8.4.52 Studies have shown that Noctule, Leisler's, Serotine and Pipistrelle bats can congregate around certain types of streetlights, feeding on the insects attracted to the light, but this behaviour is not true for all bat species (BCT and ILP, 2023). It should also be noted that this behaviour could increase predation risk and collision risk due to higher levels of activity near to the roads. The slower flying broad winged species such as Brown Long-eared Bats, Myotis species and Barbastelle Bats generally avoid all area with streetlights (BCT and ILP, 2023).

8.4.53 Lighting disturbance is considered to be a permanent low impact that represents a significant adverse effect at a Local scale.

Water Vole

Construction

Site and Vegetation Clearance

8.4.54 Although no Water Vole burrows of fields signs were confirmed within the Scheme Boundary, due to increases in the habitat quality of ditches in the north and south of the Proposed Scheme, there is potential for impacts upon any water voles that may have colonised these areas in the interim. This is more likely in the ditch in southern extent of the Proposed Scheme, as this ditch is connected to a network of ditches that contained Water Vole during 2021 surveys.

8.4.55 Construction of the Proposed Scheme could result in the loss of terrestrial and aquatic habitats which are suitable for use by water vole for breeding, commuting, foraging and sheltering. The losses of these habitats are likely to reduce the availability of breeding, commuting, foraging and sheltering habitats for water vole, and could affect Water Vole distribution and abundance.

8.4.56 The construction of the Proposed Scheme has the potential to sever Water Vole habitat into areas either side of the new road. This could create a barrier to Water Vole passage through the introduction of culverts and other road drainage infrastructure. This would reduce the ability of Water Voles to move between areas of suitable habitat and could prevent water vole movement along existing commuting routes.

8.4.57 Any water voles present within or in proximity to areas of construction would also be at risk of injury or being killed or injured during construction activities.

8.4.58 The loss and severance of water vole habitat during the construction period represents a permanent medium impact that is not reversible in the absence of additional mitigation and could result in a significant adverse effect at the Local scale.

Operation

8.4.59 No additional habitat loss beyond the habitats cleared during construction, fragmentation, or disruption would take place during the operational phase.

Reptiles

Construction

Site and Vegetation Clearance

8.4.60 Construction of the Proposed Scheme and associated site and vegetation clearance work is expected to lead to the removal of a large proportion of reptile habitats. This would result in the direct loss of habitats suitable for use by reptiles for basking, commuting, foraging and hibernating purposes. Some loss of habitat suitable for reptiles would be permanent, associated with the built footprint of new infrastructure. This loss could affect the functionality of the remaining areas of suitable habitat to support reptiles and will reduce the availability of suitable habitat within the local landscape.

8.4.61 The construction of the Proposed Scheme will sever reptile habitat into areas either side of the new road and could create a barrier to reptile movement. These impacts are likely to reduce the ability of reptiles to move between suitable habitats.

8.4.62 Any reptiles present within or in proximity to areas of construction would also be at risk of injury or being killed during site and vegetation clearance operations.

8.4.63 The injury and mortality of reptiles during the construction period represents a permanent, direct, long-term medium impact that would result in a significant negative effect at the Local scale in the absence of additional mitigation.

8.4.64 The loss and severance of reptile habitat during the construction period represents a permanent medium impact that would result in a significant adverse effect at a Local scale.

Operation

8.4.65 There are no anticipated impacts and no significant affects from the operation of the Proposed Scheme.

Great Crested Newt

Construction

Site and Vegetation Clearance

8.4.66 Construction of the Proposed Scheme and associated site and vegetation clearance work is expected to lead to the removal of a large proportion of terrestrial habitat (woodland scrub and grassland) for Great Crested Newts. Alongside damage and destruction of their resting places, these activities also risk disturbing, killing and injuring Great Crested Newts.

8.4.67 Four confirmed breeding water bodies will be lost to the Proposed Scheme. All four are located to the southeast of the Harwick Interchange at the location of the new A47 slip roads and attenuation pond (ponds 2, 3 ,4 and 5 within the Great Crested Newt Survey Report (WSP, 2023o)).

8.4.68 Some loss of habitat suitable for Great Crested Newts would be permanent, associated with the built footprint of new infrastructure and lasting for at least the duration of the operational period. This loss could affect the functionality of the remaining areas of suitable habitat type to support the species and will reduce the availability of suitable habitat within the local landscape. The Proposed Scheme will sever terrestrial habitat into areas either side of the new road and could create a barrier to movement between breeding and foraging habitats.

8.4.69 The injury and mortality of Great Crested Newts during the construction period represents a permanent, long-term impact that would result in a significant negative effect at the Local scale in the absence of additional mitigation.

8.4.70 The loss and severance of reptile habitat during the construction period represents a permanent medium impact that that would result in a significant adverse effect at the Local scale.

Operation

Road Mortality

8.4.71 The risk of injury or mortality by vehicle movements and draining is considered likely where the Proposed Scheme severs retained terrestrial habitats either side of the new road. This risk will be increase where terrestrial habitat is severed within 250m of confirmed breeding habitat.

8.4.72 The effects of road mortality in the absence of additional mitigation during the operational period represents a permanent medium impact that would result in a significant adverse effect at the Local scale.

9 Additional Mitigation Measures

9.1.1 This section sets out the additional mitigation measures that can be mitigated for which are likely to be required to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment during construction and operation of the Proposed Scheme. Measures applicable to each of the Important Ecological Features are described below.

9.1.2 These additional mitigation measures would be secured in principle through the planning permission with appropriate planning conditions and approved at detailed design stage.

9.2 Designated Sites

Non-Statutory Designated Sites

Construction

Dust Pollution

9.2.1 Embedded mitigation for dust impacts during construction is described in Section7. Due to the proximity of Sheep's Course Wood to construction haul roads and site access, it is considered that additional mitigation measure above industry standard practice (within an OCEMP) will be required.

9.2.2 A Dust Management Plan will be produced and incorporated into a CEMP to ensure measures to mitigate dust impacts during construction are adequately assessed and mitigated.

Habitats and Botany

Habitats

Construction

Site and Vegetation Clearance

9.2.3 Surface water attenuation features are required throughout the Proposed Scheme and where possible, these should be designed to frequently hold water, rather than drain away. These drainage features should be designed to create wet ponds that will be of benefit to general biodiversity and will increase habitat complexity. The focus of this mitigation will be to incorporate habitats that would qualify as Habitats of Principal Importance and contribute towards loss of these habitats through the Proposed Scheme.

9.2.4 Planting schemes for these new ponds will be developed at detailed design stage, however the use of native plant species of local prevalence will be favoured.

9.2.5 The measures to protect retained habitats throughout construction of the Proposed Scheme will be detailed in the CEMP. The CEMP will include plans showing the location for all fences/barriers to be erected for the purpose of protecting retained habitats. Reference to the relevant procedures, including any special measures, to be implemented in the event of a pollution incident that could affect retained habitats and other Important Ecological Features. The principal contractor will reduce any habitat loss within the land required for the Proposed Scheme by keeping the working area to the minimum required for construction.

Invasive Non-Native Species

Construction

Construction: Spread of INNS

9.2.6 Appropriate measures for the treatment and control of Japanese Knotweed will be implemented during vegetation clearance and site clearance. A specialist invasive plant contractor will need to be appointed to develop a mitigation plan and remove Japanese Knotweed from the construction areas.

9.2.7 Appropriate construction, handling, treatment and disposal procedures will be implemented in relation to these, and any other species listed in Schedule 9, Part I or Part II of Section 62 the Wildlife and Countryside Act 1981, as amended, or the Weeds Act 1959 to prevent the spread of such species.

9.2.8 Route-wide measures will be implemented to promote biosecurity and minimise the risk that invasive non-native species and diseases are spread as a consequence of the project. Pre-construction surveys and monitoring through stage of construction will be undertaken to ensure the location of INNS within the Scheme Boundary is informed but up to date survey information.

9.2.9 A programme of works will be implemented that will reflect the fact that it can take a number of years to eradicate invasive species such as Japanese Knotweed.

9.2.10 Removal of invasive species will take account of ecological best practice guidance and appropriate measures will be taken to identify and protect other features of environmental importance during eradication or removal.

Protected and Notable Species

Birds

Barn Owl

Site and Vegetation Clearance

9.2.11 Additional mitigation pertaining to Barn Owl will be detailed in an Ecological Mitigation Strategy. This document will include measures to mitigate impacts to occupied breeding sites and potential nesting sites during construction. Surveys will also be completed at detailed design stage to inform the mitigation strategy and CEMP. Pre-works checks for nesting barn owl on the occupied breeding sites and potential nest sites directly adjacent to the Proposed Scheme will be undertaken to inform mitigation proposals.

9.2.12 Mitigation will involve the closure of any nest sites outside of the typical breeding period (September to February inclusive) and replacement boxes installed away from the construction area and new road. As this will take place outside of the breeding season (September to February inclusive), it is not envisaged that a licence will be required.

Breeding and Wintering Birds

Construction

Site and Vegetation Clearance

9.2.13 If carried out during the breeding season, vegetation and site clearance could cause the destruction or damage of active nests and any eggs or live young present. The following measures will therefore be implemented:

- Any vegetation or trees that do not require clearance to facilitate the Proposed Scheme (including veteran trees) will be retained and protected during construction with appropriate construction fencing.
- Vegetation and site clearance will take place between September and February inclusive, i.e., outside the main bird breeding season, wherever practicable. Should it be necessary to remove habitats

suitable for breeding birds during the nesting season, these will be subject to a pre-clearance check by an Ecological Clerk of Works with ornithology expertise .

- In the event any active nests are found, clearance works will be halted within a minimum distance of 5 m from the nest. This buffer distance will be varied on the advice of the ecologist, dependent on the nature of affected habitats and the species of bird involved. Clearance works will not recommence until any young have fledged and left the nest, with a re-inspection by an ecologist to confirm the absence of active nests.

9.2.14 The proposals for reinstatement and compensatory habitat as set out in the landscape proposals will provide replacement habitat for breeding and wintering birds. The following compensation planting will be provided in detailed design proposals:

- New woodland planting throughout the Proposed Scheme.
- New and enhanced hedgerows within the Scheme Boundary.
- Provision of scrub, glades, ponds and new wet woodland within the Scheme Boundary.

9.2.15 The (management of new landscaped areas within the Proposed Scheme will be detailed within a LEMP. Considerations for managing these habitats optimally for breeding and wintering birds will be incorporated into the management plan, as well as measures to avoid impacts upon these species through management operation.

Terrestrial Invertebrates

Construction

Site and Vegetation Clearance

9.2.16 Key areas for terrestrial invertebrates will be lost to the Proposed Scheme. The following measures will be implemented to mitigate impacts on terrestrial

invertebrates and will focus on habitat compensation. These measures will be documented in full within a Landscape and Ecological Management Plan.

- Habitat creation throughout the Proposed Scheme includes suitable habitats for a range of terrestrial invertebrate species. The use of nutrient poor substrates for road verges and areas of open grassland will be used to encourage a wider diversity of plant species and habitat for terrestrial invertebrates.
- Dead wood features such as log piles will be created from trees that will be lost to the Proposed Scheme. Although this will be of limited benefit to species that are associated with standing deadwood, they will provide habitat for a range of other species. It is proposed that all arisings from tree felling are retained within the Scheme Boundary to be repurposed as habitat features. Woodchip can also be used in areas of new woodland creation.

9.2.17 Provision of deadwood derived from trees lost to the Proposed Scheme will provide some compensation for the loss of deadwood resource. Tree and scrub planting within new woodland adjacent to the Proposed Scheme will also provide some compensation in the long term for these habitat resources, as well as other invertebrates species. The use of flowering scrub species will be incorporated into the planting scheme.

9.2.18 The mitigation measures for terrestrial invertebrates will be secured through the provision of a Landscape and Ecological Management Plan.

Mammals

Badger

9.2.19 A pre-construction Badger survey will be carried out a in advance of site clearance to confirm that there are no setts within and up to 30m from the Scheme Boundary. This will allow identification of any additional mitigation required to inform construction mitigation. In addition, updated badger surveys will be undertaken at detailed design stage to inform the requirement for additional mitigation that will mitigate impacts during operation of the

Proposed Scheme, such as badger fencing and underpasses. These measures will then be incorporated into the detailed design if necessary.

Construction

Site and Vegetation Clearance and, Noise and Vibration

9.2.20 Badger setts within the Scheme Boundary or within adjacent land up to 30m from the Scheme Boundary may be impacted during construction. Where possible, exclusion zones will be adhered to during construction to ensure that impacts are avoided. Depending on the type of impact, the exclusion zones will typically be between 10 and 30m of any active sett entrance. Any works within 30m of any active sett entrance will be assessed by an experienced and competent ecologist to determine whether the exclusion zone may be reduced, and whether additional mitigation and/or licensing from Natural England will be required.

9.2.21 Where impacts upon Badgers and their setts cannot be avoided, a Natural England Badger Mitigation licence may be required. This will enable Badgers to be excluded from active setts to enable construction works to proceed legally. Any setts that require exclusion of Badger will be monitored for up to 21 days to determine whether the sett is in current use. If a sett is determined to be in current use, a licence to close the sett will need to be applied for through Natural England. Natural England will generally only grant licences to close active Badger setts between July and November.

9.2.22 In addition, detailed measures will be included in the CEMP to prevent injury to Badgers during construction, which will include: all compounds and working areas will be checked for Badgers prior to construction; lighting to be directed away from setts and limited light spill in surrounding habitats, all excavations should be covered overnight or of an angled access/egress point installed to allow a means of escape.

Operation

Road Traffic Collision and Habitat Interruption and Fragmentation

9.2.23 Badger proof wildlife fencing will be installed where necessary within the Proposed Scheme to reduce the risk of vehicle collision during operation. Badger proof fencing will be installed following updated Badger surveys to determine if and where this will be required.

9.2.24 Underpasses will be installed under the new road if well-used badger pathways are identified (as none are currently) to allow Badger to pass safely under the Proposed Scheme and reduce the risk of traffic collisions. The location of these underpasses will be determined at detailed design stage and the design will adhere to relevant best practice. Badger proof fencing and underpasses will be designed in line with Design Manual for Roads and Bridges (DMRB) guidance (DMRB, 2001).

Bats

Construction

Site and Vegetation Clearance

9.2.25 No confirmed roosts are anticipated to be lost to the Proposed Scheme, however trees with roost suitability will likely be removed to facilitate construction or remediated (e.g., pruning or pollarding) for health and safety reasons.

9.2.26 To inform detailed design and production of the CEMP, updated ground level tree assessments and inspection surveys will be undertaken. These will comprise of a preliminary assessment from ground level of all trees that have the potential to be impacted by the proposed development. This survey will identify all trees with suitability for roosting bats or those that require further aerial or ground level inspection using licenced techniques. The aim of these surveys is to inform the requirement for further presence or likely absence surveys for bat roosts. This information will be used to inform the detailed design, CEMP and the requirement for protected species licences and mitigation proposals to remove trees.

9.2.27 At the construction stage, felling of trees with suitability for roosting bats will be preceded by a suitable survey or inspection to ensure no roosts/bats are present, in line with BCT guidelines (BCT, 2023). An updated ground level tree assessment will also be carried out to ensure any additional roost features are identified. Where trees cannot be inspected or surveyed sufficiently before felling, soft felling and dismantling techniques will be employed during the suitable time of year to ensure roost features can be safely brought to the ground and any bats are able to leave roost features overnight. If roosts are identified during pre-felling inspections and surveys, a mitigation licence from Natural England may be required in order to proceed with tree felling or remediation activities.

9.2.28 Replacement roost features will be incorporated, if required, in the form of bat boxes and veteranisation (creation of roost features in existing trees) of retained trees where appropriate. These replacement roost features will compensate for any loss of roost resource and will also act as rescue bat boxes if required under Natural England mitigation licence. The location, number and type of replacement roost feature will be detailed within the Landscape and Ecological Management Plan. This management plan will also detail further measures to manage and monitor habitats provided for species mitigation.

Visual (Lighting) Disturbance

9.2.29 Lighting during construction may affect bat roosts as well as foraging and commuting routes resulting in temporary fragmentation and potential impacts upon roosts. This will be most prevalent where compounds are located and may require lighting beyond typical working hours for security. It is considered that the majority of the works will take place during standard working hours and therefore will limit the disturbance to bats foraging / commuting bats from general construction activities. Lighting and the position of site compounds will be detailed within the CEMP which will determine the appropriate set up of compounds in order to limit light spill onto important bat habitat. Compounds requiring lighting at night will be positioned away from important habitat

features for bats, including woodland, trees and boundary habitats such as hedgerows and lines of trees that may be used by bats. No lighting will be installed around trees with suitability for roosting bats.

9.2.30 Lighting during the construction phase would be designed to satisfy the requirements of the Institute of Lighting Professional's Guidance Note 01/21 'The Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2021), which would limit potential disturbance effects. Construction would also be carried out primarily during daylight hours (during periods where bats are largely inactive).

9.2.31 Any such lighting required will be restricted to, and directed towards, the working areas to prevent any light spill and disturbance /displacement of roosting, foraging and commuting bats in adjacent habitat. Habitats of importance for commuting and foraging bats are considered to be ditches and other water bodies, broadleaved woodland, scattered trees, lines of trees, hedgerows, orchard, scrub and grassland. Night working outside may be permitted following development of the lighting strategy and under supervision of the ECoW. The CEMP and lighting strategy will be conditioned/provided as part of detailed design and will ensure that a 10m dark corridor will be maintained along all potentially important habitats.

9.2.32 The maintenance and monitoring of the required dark corridors during construction will allow bats to continue to forage and commute. Appropriate additional or remedial measures will be employed if necessary following results of monitoring. This is required to maintain the Favourable Conservation Status of the local bat population.

Operation

Road Traffic Collision

9.2.33 The landscape mitigation features (described in Section 7) to mitigate impacts of habitat loss and fragmentation on bats have been designed to incorporate measures to reduce collision risk during operation of the Proposed Scheme. These include retained tall vegetation near to linear habitat features and

planting of woodland and mature trees near to potentially important commuting and foraging routes to maintain flight heights and green corridors.

Visual (Lighting) Disturbance

9.2.34 In addition to the landscaping measures detailed above which will reduce lighting impacts in the long term, a Lighting Strategy will be developed at detailed design to reduced lighting impacts upon neighbouring bat habitat where possible. However, it is anticipated that lighting along the dualled section of the A47 will be required and mitigation options will be limited. This is reflected within Section 10: Significant Effects.

Water Vole

Construction

Site and Vegetation Clearance

9.2.35 General precautionary mitigation will be detailed within the CEMP to avoid impacts upon Water Voles during construction. No works will be carried out within 5m of water bodies where Water Vole are present until suitable update surveys and mitigation have been undertaken where required.

9.2.36 An updated water vole survey will be undertaken to inform detailed design. These surveys will map the extent of any water vole burrows and field signs to ensure that field survey data remains relevant to inform detailed design. This survey will be undertaken during the active season.

9.2.37 If Water Vole burrows and field signs are located in proximity construction areas, an assessment will be a made to determine whether impacts upon burrows can be avoided. If this is not possible, a Natural England Mitigation Licence may be required to displace or translocated Water Voles to avoid impacts during construction.

9.2.38 Prior to construction, any Water Voles present will be displaced or translocated from affected ditches into retained, unaffected and connected habitat. Within the detailed design stage there will be opportunities to include wet ditches within the design proposals that will serve as a receptor site if

required. These areas will be created in advance of translocation or displacement to ensure they are in a suitable condition to be colonised.

9.2.39 In addition to these mitigation measures, the design and requirement for culverts under the new road and infrastructure will be determined and where necessary, embedded into the detailed design. This will include an assessment of whether temporary culverts are required during construction along waterbodies where Water Vole are present.

Reptiles

Construction

Site and Vegetation Clearance

9.2.40 Reptiles have been recorded throughout the Proposed Scheme. Prior to construction activities in areas containing reptiles, mitigation will be necessary to avoid killing or injuring. These measures will include translocation of reptiles from larger, more complex areas of habitat and sensitive habitat clearance, hand searches and destructive searches from smaller areas of habitat containing lower numbers of reptiles. For example, narrow field margins.

9.2.41 These mitigation measures will require a detailed reptile mitigation strategy that will be included within an Ecological Mitigation Strategy for the Proposed Scheme. This will be developed at detailed design stage and mitigation measures will be incorporated into the construction programme to ensure that sufficient time is allocated for translocation and sensitive habitat removal in advance of construction. This will account for seasonal constraints associated with reptile mitigation, which generally can only be carried out between April and October (weather dependant) with summer months becoming suboptimal due to higher temperatures and difficulties finding and capturing reptiles.

9.2.42 The translocation of reptiles will require an offsite receptor area for reptiles to be moved on to. This area will need to be of a sufficient size and habitat suitability for reptiles to be relocated to and will require surveys to ensure that

the site does not hold an existing population. Enhancement measure may also be necessary including changes to managements and the creation of foraging, basking and shelter habitats. Translocation of reptiles onto neighbouring suitable habitat close to the Proposed Scheme is unlikely to be a suitable option given that most of this habitat will be developed for the adjacent housing developments. Land within the Scheme Boundary is unlikely to be suitable for reptiles given that it will be largely used for construction, including extensive landscaping.

9.2.43 An offsite receptor site will therefore need to be secured, with necessary long-term management and maintenance agreed to ensure that the populations of reptiles will persist post development. This area will need to be subjected to appropriate surveys to ensure that it will be suitable for translocation.

9.2.44 Translocation of reptiles will likely require a minimum trapping effort of 90 days during appropriate weather conditions. This accounts for the complex habitats and size of the areas requiring translocations to be carried out. This can be paired with habitat clearance activities where appropriate to reduce shelter habitat and increase the capture rates.

9.2.45 For smaller areas of habitat containing low number of reptiles such as field margins, sensitive habitat clearance and a short trapping period followed by a destructive search are likely to be appropriate. These measures will be detailed within the reptile mitigation strategy.

Great Crested Newts

Construction

9.2.46 Great Crested Newts are present in the areas of the Proposed Scheme southeast of the Harwick Interchange and west of Sheep's Course Wood. The habitat mosaics within these areas provide highly suitable habitat for breeding in the form of ponds as well as terrestrial habitat in the form of woodland, grassland and scrub. As the Proposed Scheme will impact these areas a licence from Natural England will be required to proceed with development.

9.2.47 There are two licensing options available to the project; District Level Licensing (DLL) and a Great Crested Newt Mitigation Licence. For the purpose of this assessment, it has been assumed that DLL will be the favoured route, given that the woodland compensation and pond creation within the Proposed Scheme is unlikely to be created sufficiently in advance of construction for use as a receptor site under a Mitigation Licence. However, this remains an option that can be explored at detailed design stage and as the programme develops. However, these habitats may be colonised by Great Crested Newts in the future and provide compensation for loss of the loss of suitable habitat within the locality of the Proposed Scheme.

9.2.48 An impact assessment and conservation payment certificate (an IACPC) will be applied for from Natural England. Natural England will:

- Measure the impact of the proposed development on great crested newts;
- Assess the cost of compensating for the impact through new or improved ponds for great crested newts;
- Issue an IACPC if the development is suitable for district level licensing;
- Countersign the IACPC once the developer has signed and returned it.

Operation

9.2.49 Mitigation for operation impacts will be determined through the impacts assessment process with Natural England. It may be necessary to extend the impact area beyond the Scheme Boundary where Great Crested Newts outside of the boundary may be impacted further by the development during the operational phase. If it is not possible to extend this impact zone within the licence, further mitigation may need to be incorporated into the detailed design to ensure that impacts are appropriately mitigated. This is likely to include underpasses and permanent exclusion fencing in key areas to reduce the likelihood of road mortality.

10 Significant Effects

10.1.1 This section details the assessment of significant effects taking account of the embedded mitigation detailed in Section 7 and the additional mitigation measures detailed in Section 9.

10.2 Designated Sites

Non-Statutory Designated Sites

Sheep's Course Wood

Construction

Dust Pollution

10.2.1 Following implementation of construction mitigation measures, it is considered that the effect of construction impacts can be sufficiently mitigated to have a negligible effect on habitats within Sheep's Course Wood.

Operation

Air pollution

10.2.2 The effect of air pollution during operation of the Proposed Scheme will represent a significant effect at a Local scale.

10.3 Habitats and Botanical

Terrestrial Habitats

Site and Vegetation Clearance

10.3.1 On the basis of embedded and additional mitigation measures, habitat loss will represent a significant effect at a Local scale. It is considered that the embedded and additional measures to mitigate habitat loss would likely reduce the magnitude of the impact from high to medium given then extent of new habitat creation within the Propose Scheme.

10.3.2 This assessment may change depending on whether offsite measures to achieve Biodiversity Net Gain can be secured for the lifespan of the Proposed Scheme, in which case a long-term positive effect may be achievable.

Ancient Woodland

Operation

Air pollution

10.3.3 Air pollution will occur during operation of the Proposed Scheme. This impact will represent a negligible effect upon ancient woodland.

Veteran Trees

Construction

Site and Vegetation Clearance

10.3.4 Embedded mitigation measures to protect veteran trees and other retained trees during construction of the Proposed Scheme will ensure that no impacts occur to veteran trees.

Operation

Air pollution

10.3.5 Negligible effects upon veteran trees through air pollution will occur during operation of the Proposed Scheme.

Invasive Non-Native Species

Construction

Spread of INNS

10.3.6 Following implementation of mitigation measures during construction it is considered that the spread of Japanese Knotweed can be avoided.

10.4 Protected and Notable Species

Aquatic Ecology

Construction

Chemical and Sediment Pollution via Hydrological Pathways

10.4.1 Following implementation of the embedded construction mitigation measures, impacts on fish, aquatic macroinvertebrates and macrophytes can be avoided. There are negligible effects upon these aquatic features during construction the Proposed Scheme.

Operation

Chemical Pollution via Hydrological Pathways

10.4.2 Following implementation of the embedded design mitigation measures, impacts on fish, aquatic macroinvertebrates and macrophytes can be avoided. There are negligible effects upon these aquatic features during operation the Proposed Scheme.

Birds

Barn Owl

Construction

Site and Vegetation Clearance, Disturbance: Lighting, Noise, Vibration and Visual

10.4.3 Following implementation of the additional mitigation measures there are no significant effects on Barn Owl through lighting noise and visual disturbance during construction.

Operation

Road Traffic Collision: Injury and Mortality, Disturbance: Lighting, Noise and Visual

10.4.4 Following implementation of the embedded mitigation measures there are negligible effects on Barn Owl through lighting, noise and visual disturbance.

Breeding and Wintering Birds

Construction

Site and Vegetation Clearance

10.4.5 It is anticipated that impacts from construction on nesting birds can be avoided through the additional mitigation measures.

10.4.6 Given the clearance of habitats during construction, there will be a loss in suitable nesting and foraging habitat for breeding birds including foraging along with roosting and foraging habitat for wintering birds. Impacts from habitat loss are therefore predicted to remain with effects predicted to be significant adverse at a Local scale in the short term until compensation measures have been implemented through landscape proposals. Once these habitats have been created and become established, it is anticipated that the effect of habitat loss through site and vegetation clearance during construction will not lead to significant effects on breeding and wintering birds.

10.4.7 There will be a net loss of arable cropland habitat through the Proposed Scheme which may lead to loss of breeding and foraging habitat for farmland species. However, this impact is considered to lead to negligible effects upon any species.

Disturbance: Lighting, Noise and Visual

10.4.8 Disturbance during construction is considered to represent negligible effects on breeding or wintering birds.

Terrestrial Invertebrates

Construction

Site and Vegetation Clearance

10.4.9 Following implementation of mitigation and compensation measures, impacts on terrestrial invertebrates will represent a temporary significant effect at a Local scale in the medium term prior to compensation measures reaching their target habitat type and maturity. In the long term, once compensatory habitats have established, negligible effects are predicted.

Mammals

Badger

Construction

Site and Vegetation Clearance, Noise and Vibration

10.4.10 Following implementation of the additional mitigation measures effects, on Badgers during construction can be avoided or suitably mitigated throughout construction of the Proposed Scheme.

Operation

Road Traffic Collision and Habitat Interruption and Fragmentation

10.4.11 Following implementation of the additional mitigation measures, effects on Badgers during operation of the proposed Scheme can be avoided or suitably mitigated throughout construction.

Bats

Construction

Site and Vegetation Clearance Site, Disturbance: Lighting

10.4.12 Through implementation of the embedded and additional mitigation measures, impacts from habitat loss can be adequately compensated for and lighting impacts during construction can be reduced and avoided. In the long term, once compensatory habitats have established the impact of habitat loss and lighting are negligible.

Operation

Road Traffic Collision and Road Mortality

10.4.13 Through implementation of the embedded and additional mitigation measures, the effect of road traffic mortality is a medium term (until vegetation has established), medium impact that represents a significant adverse effect at a Local scale.

Disturbance: Lighting and Noise

10.4.14 The unmitigated effect of street lighting required along the dualled section of the A47 and approach to the new roundabout junction will lead to disturbance impacts on retained habitat adjacent (Sheep's Course Wood) and compensatory commuting and foraging habitat adjacent to the new road alignment. In addition, noise from the new road is likely to reduce the levels of bat foraging and commuting activity within the vicinity of the road, including retained habitat. Lighting and noise are considered to be permanent low impacts that represent a significant effect upon all bats species at a Local scale.

Water Vole

Construction

Site and Vegetation Clearance

10.4.15 Following implementation of additional mitigation measures, such as translocation, impacts on Water Vole during construction of the Proposed Scheme are negligible.

Reptiles

Construction

Site and Vegetation Clearance

10.4.16 Following implementation of additional mitigation measures for reptiles, such as translocation, there are negligible effects upon reptiles during construction and operation of the Proposed Scheme.

Great Crested Newt

Construction

Site and Vegetation Clearance

10.4.17 Following implementation of additional mitigation measures, such as translocation or use of the DLL scheme there are negligible effects upon Great Crested Newts during construction of the Proposed Scheme.

Operation

Road Mortality

10.4.18 Following implementation of additional mitigation measures or use of the DLL scheme there are negligible effects upon Great Crested Newts during operation of the Proposed Scheme.

11 Cumulative Effects

11.1.1 The Proposed Development is situated in an area with several other plans and projects which have either come forward or are expected to come forward in the near future. There is therefore potential for significant and non-significant effects arising from the Proposed Scheme alone to act in combination with those from other plans and projects. This may result in cumulative effects to Important Ecological Features which could have an increased significance compared to the assessment of the Proposed Development alone.

11.1.2 Chapter 17: Cumulative Effects has scoped in nine commercial and residential development projects for the assessment of cumulative impacts which are described below. In addition to these developments, the wider West Winch Growth Area has been included within Chapter 16. The West Winch Growth Area Framework Masterplan (Borough of King's Lynn and West Norfolk, 2023) has been used for reference, which provides an outline of the current proposed development location and layout.

11.1.3 The air quality modelling for the Proposed Scheme detailed in Chapter 6: Air Quality includes the cumulative effect of the Proposed Scheme including the West Winch Growth Area. The Air Quality assessment (Chapter 6) concludes that during the operational phase, all committed developments that are likely to cause substantial increases in traffic have been included in the traffic data, and so have been included in the air quality assessment. As such, the cumulative effect of this impact from smaller distant commercial and

residential developments discussed below are unlikely to give rise to cumulative effects and not discussed further within this section.

11.2 Commercial and Residential Development

11.2.1 There are nine residential and commercial developments listed below which have either been granted planning permission, are under construction or are awaiting decision. These developments have been considered as potentially having a cumulative effect with the Proposed Scheme and other projects. Details of the developments and a summary of available ecological information for their planning applications is provided in Table 11-1.

11.2.2 The majority of these development schemes are small to medium sized developments that are generally isolated from the Proposed Scheme and the Important Ecological Features that are included in this assessment. It is considered that for the majority of the developments, there are no plausible impact pathways that could combine to result in significant effects or an increase to the scale of significant effects.

Table 11-1 Committed Commercial and Residential Developments

Planning Reference Number	Description	Approximate distance	Comments	Cumulative impacts and effects likely
23/00269/F	Proposed product display area and factory retail outlet	2km northwest	Sufficient distance from the Proposed Scheme and application is within an area of existing residential and commercial development.	None.
20/01957/FM	Construction of 78 affordable dwellings and associated access, infrastructure and landscaping	3km north	Development within existing residential area on an area of unmanaged modified grassland. EcIA completed and all impacts are reported to have been appropriately mitigated and adverse effects reported to be minor adverse upon bats and breeding birds through habitat loss. Under construction.	Cumulative effects are considered unlikely given the small scale of this development, distance from the Proposed Scheme and scale of impacts.

Planning Reference Number	Description	Approximate distance	Comments	Cumulative impacts and effects likely
17/01151/OM	Outline Major Application: Sustainable mixed-use urban extension comprising up to 450 dwellings and associated infrastructure.	3.9km north	Development on an area of mixed pastoral and arable farmland. EcIA for the development describes impacts ranging from adverse (non-significant) to positive (significant effect).	Due to the adverse effects arising from the development being non-significant or positive, there are no cumulative effects predicted.
23/00195/F	Retrospective: Warehouse extension associated with the existing building to the Southern side of the site	Adjacent to the south boundary	Small scale development unlikely to contribute to cumulative effects	None.

Planning Reference Number	Description	Approximate distance	Comments	Cumulative impacts and effects likely
21/01873/FM	Construction of 226 new homes and associated green space, landscaping and ancillary infrastructure	1.4km north	Development within an area of amenity grassland within existing residential area. An ecology assessment has been produced for the development which concludes negligible effects upon all Important Ecological Features.	None
14/01690/OM	Construction of up to 81 dwellings with access road	3.3km north	Development within existing residential area adjacent to the Gaywood River. Basic ecology assessments completed for protected species and mitigation proposed.	None.

Planning Reference Number	Description	Approximate distance	Comments	Cumulative impacts and effects likely
14/01114/OM	Outline Application: mixed use development comprising business / industrial / storage and distribution floorspace.	800m north	Development within an area of semi natural grassland adjacent to existing mixed-use development. A comprehensive ecological appraisal has been carried out which concludes minor adverse effects upon Otter, Water Vole and Grass Snake. The populations of Water Vole and Grass Snake are likely to be distinct to those within the Proposed Scheme.	None.

Planning Reference Number	Description	Approximate distance	Comments	Cumulative impacts and effects likely
16/02231/OM	Residential development of the land to provide up to 600 dwellings and associated infrastructure.	Approximately 4.3km north	Development within an area of open grassland adjacent to ancient woodland. The ES for the development concludes negligible effects upon all ecological features apart from terrestrial invertebrate which will incur minor beneficial effects.	None.
17/01106/OM	Residential development for up to 125 dwellings together with associated works.	Not Applicable	Limited ecological data is available for the development. A letter report submitted with the application infers that the development is unsuitable for reptiles, and that Badger and Water Vole are likely absent.	None.

West Winch Growth Area

11.2.3 It is envisaged that the West Winch Growth Area will deliver up to 4,000 homes, with 2500 being delivered by 2036. The Growth Area will be brought forward by individual developer planning applications and at present, two applications were identified through the Borough Council of King's Lynn and West Norfolk planning portal. These projects and their available ecological impact assessments are summarised below. A large proportion of the developments within the Growth Area have not submitted planning applications and therefore cannot be assessed in detail.

11.2.4 The majority of the Growth Area is located within arable and pastoral farmland to the east of West Winch. The Proposed Scheme will curtail the eastern extent of the Growth Area. One development (Land West of Constitution Hill Constitution Hill) will be constructed within the habitat mosaic east of Sheep's Course Wood, which has been identified as an area of habitat that is of County importance and is designated as a CWS.

Land At West Winch Kings Lynn Norfolk (18/02289/OM)

11.2.5 This development comprises an outline application for up to 500 homes with a neighbourhood centre, associated landscaping, parking and supporting infrastructure. The application site is largely arable cropland to the east of West Winch.

11.2.6 An ES has been submitted with the application which concludes that significant effects are predicted in the absence of mitigation on bats, barn owl and nesting birds on site, West Winch Common CWS, River Nar SSSI and several internationally designated sites. With mitigation, no significant residual adverse effects are predicted for this development.

Land West of Constitution Hill Constitution Hill North Runcton Norfolk PE33 0QP (3/01615/OM)

11.2.7 The development comprises an outline application for change of use from agricultural/undeveloped land to a new development of housing and associated facilities, comprising a mix of up to 1,110 residential units, primary

school, local centre public open space, landscaping and highway access on the A47 and A10.

11.2.8 The residual effects of the development have been summarised in Table 11-2. The description of significant effects is taken directly from the impact assessment for the development. There are no definitions provided for negligible, minor or moderate effects. Therefore, the geographical scale of each impact described below is used to inform this assessment.

Table 11-2 3/01615/OM Residual Effects Following Mitigation

Ecological Feature	Significant Effect
Sheep's Course Wood CWS	Negligible negative effect at the County level
Grassland	Moderate negative effect at the County level
Deciduous woodland	Minor negative effect at the Local level
Scrub and trees	Minor negative effect at the Local level
Hedgerows	No significant effect
Ponds	Minor positive effect at the Local level
Great Crested Newt	Minor negative effect at the District level
Breeding birds	Moderate negative effect at the District level
Wintering birds	Minor negative effect at the Local level
Invertebrates	Moderate negative effect at the County level
Badger	Minor negative effect at the Local level
Roosting bats	Negligible negative effect at the Site level
Foraging and commuting bats	Negligible negative effect at the District level
Water Vole	Negligible to Minor negative effect at the Site level

Remaining Allocation

11.2.9 No other applications within the Growth Area have been submitted and as such cannot be assessed quantitively due to the lack of sufficient information to assess cumulative effects with the Proposed Scheme. However, the

majority of the Growth Area development will be constructed within areas of arable and pastoral farmland to the west of the Proposed Scheme and therefore professional judgement will be used, where possible, to undertake a qualitative assessment of cumulative effects based on this information.

Cumulative Effects Assessment

11.2.10 In consideration of relevant plans and projects in relation to the developments noted above, it is concluded that cumulative effects will arise upon selected Important Ecological Features that are also affected by the Proposed Scheme.

Sheep's Course Wood CWS

11.2.11 The Proposed Scheme will cause significant effects at a Local scale due to air pollution arising from increased traffic levels. This assessment contained within Chapter 6 of this ES was made based upon traffic modelling that incorporated the additional 4000 homes within the Growth Area. This assessment therefore includes as assessment of cumulative impacts and effects from those developments in Section 8 and Section 10.

Terrestrial Habitats

11.2.12 The majority of the Growth Area appears to be within areas of arable cropland and pastoral farmland which is not an important ecological feature in its own right as defined within this assessment.

11.2.13 The Proposed Scheme and the development at Land West of Constitution Hill will result in habitat loss from both developments. This habitat loss will occur to the west of Sheep's Course Wood, within the mosaic of habitat that is assessed as important at a County scale. The grassland within this area that is located within the development area at Land West of Constitution Hill was also assessed as important at a County scale, with impacts predicted at a County scale. Effects upon other habitats within this development are predicted at a Local scale

11.2.14 The combined effect of both developments upon habitats are not considered to exceed the County and Local scale impact reported for the development at Land West of Constitution Hill.

Ancient Woodland

11.2.15 Air quality modelling for the Proposed Scheme allowed for the increase in housing from the Growth Area. It is considered that there will be no significant effects in combination with other plans and projects included within this assessment.

Veteran Trees

11.2.16 Air pollution modelling has considered the increase in air pollution as a result of the Growth Area. No further impacts or effects are anticipated to occur to veteran trees within or adjacent to the Proposed Scheme as a result of other plans or projects within this assessment.

Aquatic Ecology

11.2.17 No impacts are anticipated from other plans or projects within this assessment to the Pierpoint Drain or other aquatic features that are connected to the Proposed Scheme.

Birds

Barn Owl

11.2.18 The Proposed Scheme will not result in significant effects upon Barn Owl and the two development applications within the Growth Area do not report significant effects upon these species. The cumulative effect of residual impacts on this species are unlikely to result in significant effects.

Breeding and Wintering Birds

11.2.19 Cumulative impacts and effects upon other bird species cannot be quantified for all projects within the Growth Area due to a lack of available survey information.

11.2.20 Minor negative effects are reported for breeding birds at a District level and wintering birds at Local level through the development at Land West of

Constitution Hill. The development at Land at West Winch, Kings Lynn Norfolk concludes no significant effects on breeding and wintering birds.

11.2.21 The Proposed Scheme will result in impacts that are not significant and it is anticipated that the cumulative effects of the neighbouring housing developments discussed above would not lead to an increase in the scale of effects upon breeding and wintering birds.

Terrestrial Invertebrates

11.2.22 Surveys have been completed for the Proposed Scheme and the development Land West of Constitution Hill. No other survey data is available however it is considered unlikely that the rest of the Growth Area supports significant populations of important species given that the developments will likely be constructed within arable cropland that is of negligible suitability for invertebrates.

11.2.23 The development at Land West of Constitution Hill reports an adverse effect at a County scale due to habitat. The Proposed Scheme is not considered to result in an increase to the scale of this County scale adverse effect.

Mammals

Badger

11.2.24 No significant effects will occur from the Proposed Scheme or either of the two development applications that have been submitted. No information is available to assess cumulative effects upon Badgers across the remaining Growth Area.

11.2.25 The assessment for land West of Constitution Hill concludes significant minor negative effects at Local scale. The Proposed Scheme is not considered to result in an increase to the scale of this adverse effect.

Bats

11.2.26 Cumulative effects are likely to occur as a result of the developments within the Growth Area due to the urbanisation of the landscape that will

cause habitat loss and an increase in lighting above the baseline environment. It is considered unlikely that the importance of any species across the Growth Area would exceed the Local importance attributed by all development's assessments. This is due to the majority of high suitability habitat being located within the Proposed Scheme and the development at Land West of Constitution Hill, for which both schemes identified activity by low numbers of bats, resulting in an assessment of Local importance. The remaining Growth Area development is confined to large open habitats (arable cropland and pastoral grassland) that are likely of low to moderate suitability for roosting bats.

11.2.27 The cumulative effect on all bat species is considered to remain at a Local scale in the light of available ecological information.

Water Vole

11.2.28 The distribution and abundance of Water Vole across the Growth Area cannot be quantified due to the lack of survey information available for the remaining developments that have not been submitted for planning. Therefore, cumulative effects upon Water Vole cannot be accurately assessed for the whole Growth Area.

11.2.29 The applications that have submitted include mitigation proposals to reduce adverse effects and the residual effects are not considered to represent significant effects. The combined residual impacts upon Water Vole are considered to represent cumulative effects that are not significant.

Reptiles and Great Crested Newt

11.2.30 No cumulative effects are anticipated upon Great Crested Newts or reptiles as all development assessed within this cumulative assessment have included measures to mitigate significant effects upon reptiles. The Proposed Scheme is not considered to result in significant effects in combination with these individually non-significant effects.

12 Monitoring

12.1.1 A post-construction monitoring programme should be carried out annually during the first five years after construction, commencing in year 1. This will focus on the establishment of the ecological mitigation measures, including offsite translocation sites, help inform future management and, if necessary, allow for the implementation of remedial measures.

12.1.2 Ecological monitoring surveys are required to assess the efficacy of the mitigation for significant effects stated in Section 10 and confirm the findings of this impact assessment. The monitoring would be secured by planning condition and through the implementation of a LEMP.

12.1.3 An aftercare plan will be included as part of the LEMP. The Strategy would provide an auditable record of the mitigation commitments identified and the requirements for regular maintenance. It is anticipated that the following monitoring activities will be required to ensure implemented mitigation is successful.

12.2 Habitats

12.2.1 Surveys of landscape and habitat creation and mitigation areas will be completed following completions of the construction phase. This would assess the success of habitat mitigation measures and ensure that any remedial management and planting is identified and completed.

12.2.2 Should any ecological mitigation measures be identified as failing (to be defined within the LEMP) by the monitoring exercises, the Ecology Management Plan will be reviewed and remedial works to ensure that the objectives are achieved may be necessary.

Bats

12.2.3 Site surveys of reinstated, created and enhanced habitats on and off-site to assess suitability for foraging and commuting bats will be undertaken. Monitoring of any bat boxes or roost features installed for additional mitigation should also be undertaken if required for licensing purposes.

Badger

12.2.4 Monitoring of underpasses and fencing provided as additional mitigation will be carried out to ensure that fencing and underpasses remain effective. This monitoring will use a combination of site visits to check fencing and underpasses for signs of use and condition, as well as camera traps where required to monitor for longer periods of time.

Reptiles

12.2.5 Monitoring of translocated populations and habitat assessments will be carried out to ensure that reptile populations remain stable post translocation and to ensure that management interventions are carried out where required.

13 Summary

13.1.1 A summary of the impact assessment upon Important Ecological Features during construction and operation of the Proposed Scheme is summarised in Table 13-1 and Table 13-2 below. The EIA significance within each table refers to the matrix approach described within the methodology in Table 5-2.

13.1.2 Mitigation is required to ensure that significant effects upon Important Ecological Features and impacts upon legally protected species are adequately avoided, mitigated and compensated for. Additional mitigation measures should be secured through planning conditions where required. Further survey and assessment will also be required to inform detailed design of the Proposed Scheme and to ensure that mitigation during construction is informed by up-to-date ecological information. For the purpose of this assessment, a reasonable worst case has been assumed where uncertainty arises and mitigation either embedded into the design of the Scheme or proposed as additional mitigation, the need for which will be determined through further survey where required.

13.1.3 Cumulative effects are predicted for a number of ecological features when assessed against the developments within the West Winch Growth Area.

13.1.4 Monitoring of habitats and mitigation measures (both embedded and additional) for significant effects of the Proposed Scheme will be necessary to ensure that mitigation is effective

Table 13-1 Summary of Ecological Effects During Construction

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Statutory designated sites of international importance	International	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Statutory designated sites of national importance	National	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Non-statutory designated sites - Sheep's Course Wood CWS	County Wildlife Site	Dust pollution	Local	Dust management plan	Negligible	Negligible

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Habitats	County	Site and habitat clearance	Local	Refinement of the Proposed Scheme Boundary and construction area Additional habitat creation included at detailed design stage Production of landscape and ecological management plan	Local	Minor adverse
Veteran Trees	Local	Site and habitat clearance	Local	Tree protection measures	Negligible	Negligible
Ancient Woodland	County	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
INNS	Not Applicable	Spread of INNS	Not Applicable	Removal or burial of Japanese Knotweed and measures implemented to avoid spread outlined within a CEMP	Not Applicable	Not Applicable
Aquatic macroinvertebrates	County	Chemical and sediment pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable
Fish	County	Chemical and sediment pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Macrophytes	Local	Chemical and sediment pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable
Barn Owl	Local	Site and Vegetation Clearance Disturbance through lighting, noise, vibration and visual	Local Local	Update surveys to inform detailed design and pre-construction surveys for active nest sites. Provision of compensatory nest boxes and removal/exclusion of barn owl (if required) Provision of a CEMP	Negligible Negligible	Negligible Negligible

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Breeding birds	Local	Site and Vegetation Clearance Disturbance: Lighting, Noise and Visual	Local Not significant	Vegetation clearance outside of the nesting period or following mitigation measures under supervision of ECoW Further habitat creation at detailed design Production of a LEMP	Negligible Negligible	Negligible Negligible
Wintering birds	Local	Site and Vegetation Clearance Disturbance: Lighting, Noise and Visual	Local Negligible	Further habitat creation at detailed design Production of a LEMP	Negligible Negligible	Negligible Negligible

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Terrestrial Invertebrates	Local	Site and Vegetation Clearance	Local	Habitat creation measures	Negligible	Negligible
Badgers	Local	Site and Vegetation Clearance Noise and vibration	Local Local	Update surveys to inform requirement for sett closure/avoidance Sett closure under licence (if required) Provision of a CEMP detailing mitigation measures	Negligible	Negligible

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Bats – All species	Local	Site and Vegetation Clearance Disturbance: Lighting	Local Local	Update surveys as required Provision of a CEMP detailing mitigation measures Soft felling/inspection of trees with suitability for roosting bats Replacement roost features Landscaping/habitat compensation Lighting mitigation to be detailed in CEMP	Negligible	Negligible

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Water Vole	Local	Site and Vegetation Clearance	Local	Avoidance measures detailed within CEMP Licensed translocation/displacement if required. Update surveys to inform detailed design and mitigation measures	Negligible	Negligible
Otter	Likely absent	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impacts	Significance of Effect	Additional Mitigation	Significance of Residual Effect	EIA Significance
Reptiles	Local	Site and Vegetation Clearance	Local	Production of a reptile mitigation strategy detailing measures to translocate reptiles to an offsite receptor area. Reptile receptor site to be identified, surveyed and secured	Negligible	Negligible
Great Crested Newt	Local	Site and Vegetation Clearance	Local	DLL	Negligible	Negligible

Table 13-2 Summary of Ecological Effects During Operation

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Statutory designated sites of international importance	International	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Statutory designated sites of national importance	National	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Non-statutory designated sites - Sheep's Course Wood CWS	County	Air Pollution	Local	No additional mitigation proposed	Local	Minor adverse
Habitats	County	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Veteran Trees	Local	Air pollution	Negligible	Not Applicable	Negligible	Negligible
Ancient Woodland	County	Air Pollution	Negligible	Not Applicable	Negligible	Negligible
INNS	Not Applicable	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Aquatic macroinvertebrates	County	Chemical pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable
Fish	County	Chemical pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Macrophytes	Local	Chemical pollution through hydrological pathways	Impacts avoided	Not Applicable	Not Applicable	Not Applicable
Barn Owl	Local	Road traffic collision/ injury and mortality Disturbance through lighting, noise and visual	Negligible Negligible	None	Negligible Negligible	Negligible Negligible
Breeding birds	Local	No impacts likely to result in significant effects	Negligible	None	Negligible	Negligible

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Wintering birds	Local	No impacts likely to result in significant effects	Negligible	None	Negligible	Negligible
Terrestrial Invertebrates	Local	disturbance: lighting	Negligible	None	Negligible	Negligible

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Badgers	Local	Road traffic collision and habitat interruption and fragmentation	Negligible	Additional surveys will be undertaken to inform detailed design and the requirement for wildlife underpasses and fencing to reduce road collision risk.	Negligible	Negligible

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Bats – All species	Local	Road traffic collision and road mortality Disturbance through lighting	Local Local	Landscape mitigation features to reduce collision risk. Lighting strategy to reduce lighting impacts upon bat roosting, foraging and commuting routes.	Local Local	Minor adverse effect Minor adverse effect
Water Vole	Local	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Otter	Likely absent	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Ecological Feature	Importance	Potential Impact	Significance of Effect	Additional Mitigation	Residual Effect	EIA Significance
Reptiles	Local	None	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Great Crested Newt	Local	Road Mortality	Local	Optional mitigation to include: Extension of DLL impact area, or Detailed design measures including permanent exclusion fencing and wildlife/amphibian underpasses	Negligible	Negligible

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