8. Ecology and Nature Conservation

8.1 Introduction

8.1.1 This chapter provides an assessment of the effects upon nature conservation and ecological receptors that are likely to arise from construction and/or operation of the Proposed Scheme.

8.2 Legislative and Planning Policy Context

Nature Conservation Legislation

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

8.2.1 The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref. 8-1) (otherwise known as 'the Habitats Regulations') consolidate and update the Conservation (Natural Habitats, &c.) Regulations 1994. They transpose the requirements of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('the Habitats Directive') into domestic legislation.

8.2.2 The Habitats Regulations identify European Protected Species (EPS) and various habitats of importance within the European Union, with important sites for these habitats/species or both being designated as Special Areas of Conservation (SAC) and important sites for birds being designated as Special Protection Areas (SPAs). Any proposed development that may have a significant effect on a SAC or a SPA should be assessed in relation to the site's 'conservation objectives' (i.e. the reasons for which the site is designated).

8.2.3 The Habitats Regulations simplified the species protection regime to better reflect the Habitats Directive, providing a clear legal basis for surveillance and monitoring of European Protected Species. The Habitats Regulations also amended the Wildlife and Countryside Act 1981 (as amended), updating Schedules 5 and 8 to consider provisions made by the Habitat Regulations 1994 in relation to the protection of EPS. They also offered further clarification to Part 4 of Section 9 considering "reckless" offences on wild animals, which was previously amended by the CRoW Act 2000.

8.2.4 In 2012, the Regulations were further amended to place new duties on public bodies to take measures to preserve, maintain and re-establish habitat for wild birds. They were also amended to ensure certain provisions of the Habitats Directive and the Birds Directive were transposed clearly and Section 15 was amended to make clear that Local Nature Reserves can be designated for re-establishing bird habitat.

The Wildlife and Countryside Act 1981 (as amended)

8.2.5 The Wildlife and Countryside Act 1981 (as amended) (Ref. 8-2) ('the WCA') is the major domestic legal instrument for wildlife protection in the UK and is the primary means by which the following are implemented:

- The Convention on the Conservation of European Wildlife and Natural Habitats ('the Bern Convention') (Ref. 8-3); and
- The Council Directive 79/409/EEC on the Conservation of Wild birds (the 'Bird Directive') (Ref. 8-4).

8.2.6 The main relevant provisions of the Act are the allowance for the protection of the most important habitats and species by designating SSSIs, a level of protection to all nesting wild birds and species and bird species under Schedule 1.

The Natural Environment and Rural Communities Act 2006

8.2.7 Section 41 of The Natural Environment and Rural Communities Act 2006 (Ref. 8-5) ('the NERC Act) requires the listing of habitats and species that are of principal importance for the conservation of biodiversity, including those that have been identified as priorities within the UK Biodiversity Action Plan (UK BAP).

8.2.8 The NERC Act requires that the Section 41 list be used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 'to have due regard' to the conservation of biodiversity when carrying out their normal functions.

The Countryside and Rights of Way Act 2000

8.2.9 Part III of the Countryside and Rights of Way Act 2000 (Ref. 8-6) ('the CRoW Act) deals specifically with wildlife protection and nature conservation. It strengthens the protection afforded to SSSI.

The Protection of Badgers Act 1992

8.2.10 Badgers (*Meles meles)* are protected and so are the setts they live in. Under the Protection of Badgers Act 1992 (Ref. 8-7), in England and Wales it is an offence to:

- Wilfully kill, injure or take a badger (or attempt to do so);
- Cruelly ill-treat a badger;
- Dig for a badger; intentionally or recklessly damage or destroy a badger sett, or obstruct access to it; cause a dog to enter a badger sett; and
- Disturb a badger when it is occupying a sett.

National Planning Policy

National Planning Policy Framework

8.2.11 The National Planning Policy Framework (NPPF) (Ref. 8-8) was revised and republished on 19th February 2019 and details the Government's planning policies for England and how these are expected to be applied.

8.2.12 The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity, contributing to the Government's commitment to halt the overall decline in biodiversity. As stated in Paragraph 170, this includes the establishment of coherent ecological networks. In addition, Paragraph 174 of the NPPF states that plans should "*…identify and pursue opportunities for securing measurable net gains for biodiversity*" and should "*promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species*".

8.2.13 The NPPF specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this it to be delivered in the planning system. Protected and/or otherwise notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

Planning Practice Guidance

8.2.14 This ES will also take into consideration the Planning Practice Guidance (PPG) (Ref. 8-9) which is an online resource that became effective in March 2014. The PPG aims to make planning guidance more accessible and to ensure that the guidance is kept up to date. This includes guidance on policies to protect biodiversity within the *'natural environment'* section, which includes landscape, biodiversity and ecosystems, green infrastructure and brownfield land, soils and agricultural land.

Local Planning Policy

8.2.15 Relevant local planning policies covering Aylesbury are detailed in the following documents:

- Aylesbury Vale District Council Local Plan (AVDLP) (Adopted in 2004) (Ref. 8-10);
- Vale of Aylesbury Local Plan (VALP) Proposed Submission (November 2017) (Ref. 8-11);
- Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) Biodiversity and Planning Guidance Document (2014) (Ref. 8-12); and
- Buckinghamshire and Milton Keynes Biodiversity Partnership: Buckinghamshire and Milton Keynes Biodiversity Action Plan (2015) (Ref. 8-13).

8.2.16 Table 8-1 provides a summary of relevant local planning policies. For the precise wording of each specific policy please refer back to the source document.

Table 8-1 Summary of Local Planning Policy

Document	*Planning Policy*	*Purpose*
Biodiversity and Planning Guidance Document (BBOWT)	Section 3	This document sets out the importance of local and priority habitats, sites and species for Buckinghamshire including Biological Notification Sites (BNS) and Milton Keynes Wildlife Corridors (MKWC).
	Section 4	This document sets out the importance of Biodiversity Opportunity Areas, Green Infrastructure and Biodiversity within built developments.
Buckinghamshire and Milton Keynes Biodiversity Action Plan	N/A	Buckinghamshire and Milton Keynes Natural Environment Partnership has produced a series of Habitat and Species Actions Plans within the Biodiversity Action Plan document; which are designed to address the counties priorities for nature conservation and maximise the involvement of local residents, community groups and businesses in the Buckinghamshire and Milton Keynes BAP.
Aylesbury Vale District Council Local Plan (AVDLP) (Adopted) (2004)	Section 4.169	Aylesbury Vale District Council will have regard to the Buckinghamshire and Milton Keynes Biodiversity Action Plan (2015) to ensure that development does not prejudice biodiversity in Aylesbury Vale. The Council will consult English Nature on any development proposals, which may affect protected species and, if permission is granted, will consider attaching conditions and/or legal agreements under which the developer will be required to take steps to secure the protection of the species.

Document	*Planning Policy*	*Purpose*
Vale of Aylesbury Local Plan Proposed Submission (November 2017)	NE1	Internationally or nationally important Protected Sites (SACs and SSSIs) and species will be protected, therefore the avoidance of likely significant adverse effects should be the first option. Development likely to affect the Chiltern Beechwoods SAC will be subject to assessment under the Habitat Regulations and will not be permitted unless any significant adverse effects can be fully mitigated. Protects and enhances biodiversity, geodiversity and the natural environment. Seeks a net gain in biodiversity on greenfield sites, and no net loss and a net gain where possible on other sites. Ensures mitigation, compensation and enhancement measures are secured and maintained in perpetuity. Protects sites of biodiversity value, and ensures ecological surveys are undertaken by a suitably qualified person. Ensures development proposals do not result in a negative impact on protected or notable species and habitats. Promotes site permeability for wildlife and aims to avoid developments fragmenting wildlife corridors. Information must be provided to the Council for assessment.
	NE3	Ensures development proposals do not have an adverse impact on watercourses and associated corridors.
	NE6	Ensures surveys of wildlife corridors are undertaken with respect to lighting proposals.
	NE7	Does not permit development on local green spaces, unless under very special circumstances.
	NE9	States "*Development should seek to enhance and expand the district's tree and woodland resource, including native black poplars*". Development should not result in the unacceptable loss or, or damage to trees, hedgerows, veteran trees or woodland. Where loss does occur, these should be replaced. A 10m buffer (minimum 5m) around retained and planted native hedgerows should be incorporated, creating a dark corridor with no lighting.

8.3 Assessment Methodology

Introduction

8.3.1 The assessment methodology has been undertaken with regard to the legislative framework in respect of protected sites and species and in the context of relevant planning policy.

8.3.2 The assessment as to the likely significant ecological effects includes an assessment of all ecological features with potential to be directly or indirectly affected by the Proposed Scheme (including secondary and cumulative effects). This includes all habitats within the Site in addition to those outside of the Site boundary that could be affected by the Proposed Scheme.

8.3.3 Based on the nature of the Proposed Scheme, the potential for impacts on the following ecological features have been considered as part of this assessment:

- Statutory and non-statutory sites designated for nature conservation value within 2km (10km for European sites) of the Site;
- Legally protected and/or otherwise notable species currently on-site or within 2km of the Site (5km radius for bat species (EPS)); and
- Habitats or features of ecological value within or adjacent to the Site.

Consultation

EIA Scoping Opinion

8.3.4 An EIA Scoping Opinion request was submitted on 9th January 2017. The response relating ecology and nature conservation is included in Table 8-2.

Table 8-2 Comments raised in the Scoping Opinion (March 2017)

Comments raised	*Response provided in the ES / planning application*
"The proposed road cuts through pasture and arable farmland of unknown value to wildlife. In particular the pasture in the eastern section looks at one time (2003 aerial photographs) to contain wetland areas. The value of this pasture for birds and other species needs to be assessed as part of the Phase 1 survey."	Noted. This has been surveyed as part of the phase 1 habitat survey.
"The road also cuts through an area of diverse grassland and shrub adjacent to the railway which was surveyed by us in 2016 and in the western extremity will remove a section of scrub/woodland of unknown value. There are also a number of hedges along the route which may be removed altogether or in part. As indicated within the Scoping report, there are a number of black poplars which may be affected by the development. Ponds and other waterbodies are present close to the footprint of the proposals."	This has all been surveyed as part of the phase 1 habitat survey.
"Section 2.4 of the scoping report refers to replacement planting where possible. However the NPPF is clear with respect to the need to seek a net gain for biodiversity within the planning system and this is what we would seek to achieve in this instance."	Areas for replacement tree and hedgerow planting have been incorporated into the Proposed Scheme for both wildlife and landscape enhancement and mitigation purposes. Extensive planting has been included with the aim of providing a net gain for biodiversity.
"She [BCC Ecological Advisor] would be particularly concerned to ensure that the value of environmental resources and receptors takes into account, not just the legal status of the habitats and species, but also the function of the habitats in terms of connectivity and green infrastructure within the vicinity of Aylesbury. It is her view that the habitats within and adjacent to the railway corridor as 'high value' for this reason."	This Ecological Impact Assessment (EcIA) takes into account the function of the habitats in terms of connectivity and green infrastructure within the vicinity of Aylesbury. Detail is provided in this ES chapter in the assessment sections.
"Fragmentation of populations of species within the area of the development is particularly worrying in view of the large scale housing developments taking place within the town and the impact of the HS2 development. Mitigation and Compensation should also aim to address this issue. As far as possible the cumulative assessment should aim to consider the scale of developments taking place nearby and fit any compensation measures into a wider scheme."	This EcIA takes account of fragmentation of populations of species. The detail with regard to mitigation and compensation in relation to these issues is presented in this ES chapter in the assessment sections.
"The ecological impacts should also be assessed in combination with any flooding mitigation measures which are likely to be required. The integration of ecology features into any water holding basins should be considered, for instance:"	This EcIA takes into account flooding mitigation and ecological input has been provided into the design. The three incorporated attenuation ponds have been designed with wildlife in mind. Particularly the western most pond adjacent to the retained and enhanced 'green' north/south corridor, which has an irregular shape and with natural shallow sloping banks and includes islands and native aquatic and marginal planting. The planting for this pond includes an open grassland around its perimeter and native hedgerow, trees and scrub beyond this. All these elements have been included to support and encourage biodiversity into the Proposed Scheme.

Comments raised	*Response provided in the ES / planning application*
"Specific items include: *The addition of potential effects:"*	
"- The effects of changes in air quality on habitats and species in the vicinity (as well as protected sites)."	These effects will be assessed and reported in this ES chapter.
"- Any flood mitigation measures"	See above response with regard to design of the flood mitigation measures.
"- Disturbance through noise, dust, vibration to include the operational phase of the development."	These effects have been assessed and reported in this ES chapter.
"The County Ecologist considers that the list of surveys is comprehensive and appropriate. The additional required surveys however are likely to be required at the outset."	
"Bat risk assessments of all trees/buildings to be removed or potentially affected by the development (including a reasonable buffer to take account of light and other disturbance impacts). Further activity surveys as required.	Bat risk assessments have been undertaken and reported in this ES chapter. Bat risk assessments are to be updated, once updated surveys are completed during the 2020 survey season.
"The HSI [Habitat Suitability Index] and general assessment of ponds within 250m of the development for potential habitat for GCN [Great Crested Newts] and other amphibians along with an assessment of the habitats on site for these species. (A lack of records in the vicinity does not mean populations are absent in this area)."	The HSI surveys undertaken in 2016 did not indicate that GCN were likely and as such GCN surveys were not undertaken. However, since the HSI surveys were undertaken, a survey undertaken by HS2 of the pond at Hall End Farm, indicates presence of GCN. For this reason, HSI surveys will be undertaken for all waterbodies within 500m if the site. At a minimum, eDNA samples will be taken at Hall End Farm and any other waterbodies in April 2020, to determine presence or likely absence of GCN. Further surveys may still be required to establish population size; however, all survey data will be submitted during the determination period.
"Water vole and otter surveys of all waterbodies (they are present along the Aylesbury canals, streams and rivers)."	Water vole and otter surveys were undertaken in 2016, and the results reported in this ES chapter. Surveys are scheduled to be updated in April 2020.
"The bird surveys (in particular the winter bird survey) should include a thorough assessment of the habitat for birds, particularly the pasture fields as suitable open space for birds is under threat in the area."	Bird surveys were initially undertaken in 2017, and the results reported in this ES chapter. Updates to the wintering bird surveys started in December 2019, continuing until March 2020. In addition, updates to the breeding bird surveys are proposed for March to June 2020. Given that barn owl have previously been found utilising the site for foraging and that a barn owl habitat assessment survey indicated that the site conditions were consistent with the original surveys, it was deemed further surveys for barn owl were not necessary.
"The need for invertebrate surveys should be considered as part of the phase 1 survey."	Few suitable habitats for invertebrates are present in the Site. Arable fields with narrow field margins are the predominant habitat type. These habitats are likely to be subject to high concentrations of pesticides. Suitable habitats within the Site, such as grasslands, are either small in size or are species-poor e.g. improved grassland. For this reason, it is not considered that invertebrate surveys are necessary.
"The expansion of the span of the railway crossing to avoid impacts to the semi-improved grassland and woodland area."	The span of the railway crossing has been subject to design development with ecological input to reduce the impact on this more biodiverse habitat area. As a result of this process, a width of 10m has been included within the bridge span to maintain a functional 'green' corridor under the bridge and minimise the

Comments raised	*Response provided in the ES / planning application*
	impacts on the semi-improved grassland as far as practically possible.
"Measures to improve habitat under the bridge to retain connectivity."	As noted above, an additional width of 10m has been included within the bridge span to maintain a functional 'green' corridor under the bridge and minimise the impacts on connectivity as far as practically possible. The grass and scrub habitats under the bridge and both north and south of the bridge within this 'green' corridor will also be managed and maintained for wildlife as part of a site management plan.
"Measures to allow wildlife to cross the road and railway such as culverts, the 'greening up' of the bridge and careful consideration of drainage measures (GCN can fall through grilled drains)."	This was looked into and considered in design; however, the focus remained on maintaining and enhancing the value of the north/south ecological corridor on the western side of the rail line as a key ecological issue. Nonetheless, additional wildlife crossing features will be considered within detailed during, utilising the survey data to determine potential crossing points of badgers and other receptors.
"Planting of black poplar cuttings from local trees in appropriate locations. (DNA tests may be required to check for provenance)."	No black poplars are affected by the Proposed Scheme. However, space has been allowed for tree planting in the proposed landscape design and therefore could be considered during the detailed design stages. A detailed black poplar survey was undertaken of the results reported in this ES chapter.
"The creation of functional compensation habitats within the land to the north or south of the road."	Areas have been identified as part of design and CPO process to create new habitats and native planting areas to be ecologically functional, both north and south of the road.

Post-Scoping Consultation

8.3.5 In a workshop held with BCC on 4th September 2017, the ecology of the Proposed Scheme was discussed in detail including a discussion around the bridge structure and the need for improving habitat north and south of the structure as well as providing a green corridor under the bridge for bats and barn owls. In addition, it was considered that the landscape design also needed to allow for barn owls to travel over the road without colliding with vehicles. These features have been incorporated into the landscape design.

8.3.6 In a meeting with the BCC Ecologist on 5th June 2018, the requirement that the Proposed Scheme will need to undertake a detailed Biodiversity Net Gain Analysis was raised. This has subsequently been undertaken and submitted to BCC as part of the planning application documentation (Doc ref: 60535364_BNG).

Preliminary Ecological Appraisal

8.3.7 A Preliminary Ecological Appraisal (PEA) was undertaken in October 2016. This comprised a desk study and an extended Phase 1 habitat survey. This recorded the habitats within the Site, as well as an appraisal of those habitats to support protected and/or otherwise notable species. Following this, further surveys were undertaken, based upon the recommendations within the PEA. The full PEA can be found in ***ES Volume 2: Appendix 8A***.

Desk Study

8.3.8 A desk study was carried out to identify nature conservation designations and protected and/or otherwise notable habitats and species potentially relevant to the Proposed Scheme.

8.3.9 The desk study identified any international nature conservation designations within 10 km of the Site boundary; other (national) statutory nature conservations designations within 5 km of the Site boundary; and local non-statutory nature conservation designations, protected and/or otherwise notable habitats and species and invasive non-native species within 2 km of the Site boundary. Bat records were identified within 5 km of the Site boundary, due to their high mobility.

8.3.10 The Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref. 8-14) was consulted on 19th April 2018 to identify statutory designated sites. Data from the Buckinghamshire and Milton Keynes Environmental Records Centre (BMERC) (Ref. 8-15) were consulted on 10th April 2018 to identify non-statutory designated sites and records of protected and/or notable species. An update to the desk study will be undertaken in April 2020; the Preliminary Ecological Appraisal will be undertaken in accordance with any changes in the dataset, during the determination period.

Extended Phase 1 Habitat Survey

8.3.11 A Phase 1 Habitat survey was undertaken in accordance with the standard survey method (Joint Nature Conservation Committee, 2010, Ref. 8-16). It involves categorising different habitat types and habitat features within a survey area. The information gained from the survey can be used to determine the likely ecological value of a site and to direct any more specific survey work which may need to be carried out prior to the submission of a planning application. The standard Phase 1 Habitat survey method can be 'extended' to record target notes on protected, notable and invasive species.

8.3.12 The survey was undertaken by a suitably qualified AECOM ecologist who recorded and mapped habitat types within the survey area, along with any associated ecological receptors on 13th October 2016. Additional surveys were undertaken for the Site, following the initial extended Phase 1 habitat survey. This included:

- Update to the extended Phase 1 habitat survey following the provision of access to additional areas of the Site (28th March 2017);
- Targeted botanical survey (12th June 2017);
- Extended Phase 1 habitat survey of the land west of the Site (5th February 2018); and,
- Update of extended Phase 1 habitat survey (9th December 2019).

8.3.13 With the exception of barn owl and Phase 2 botanical surveys, updates to all surveys undertaken two of more years prior to the submission of the planning application were started in winter 2019 and will continue until summer 2020. Once the surveys are complete, the findings will be submitted within an ES addendum during the planning determination period. Updates concern the following surveys:

- Great crested newts: HSI and eDNA surveys of all waterbodies within 500m;
- Bat Roost Potential (BRP) of all trees and buildings on site;
- Bat activity surveys;
- Breeding bird surveys;
- Wintering bird surveys;
- Otter and water vole survey;
- Reptile surveys; and,

- Badger walkover survey.

8.3.14 Furthermore, depending on the outcome of the great crested newt (*Triturus cristatus*), further surveys may be required to determine population size; it is anticipated that this will be required for the pond at Hall End Farm considering that a survey undertaken by HS2 confirmed presence. Bat emergence surveys may also be required depending on the outcome of the BRP survey.

8.3.15 Where relevant ecological receptors were present, target notes were recorded. These included details of typical and notable plant species; however, the Phase 1 habitat survey is not intended to be a detailed inventory of the plant species present.

8.3.16 During the extended Phase 1 habitat survey, an appraisal was made of the potential suitability of habitats recorded to support protected and/or otherwise notable species of plants or animals. Field signs, habitats features, and any sightings or auditory evidence were recorded; however no detailed surveys were carried out for any particular species, with the exception of great crested newt. A Habitat Suitability Index (HSI) survey of waterbodies within 500m of the Site was undertaken, to identify their suitability to support great crested newt. The extended Phase 1 habitat survey also included taking notes of visible instances of invasive non-native plant and animal species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and the EU IAS Regulation 2014 (Ref. 8-17), including Japanese knotweed (*Fallopia japonica*). Locations of any such invasive non-native plant or animal species were recorded if found.

Great Crested Newt Habitat Suitability Index (HSI)

8.3.17 Prior to undertaking the 2016 Phase 1 Habitat Survey, aerial photography and 1:2,500 Ordnance Survey mapping were examined to attempt to identify all ponds within 500m of the Site. This process could not guarantee to definitively identify all ponds present but is the best that can be achieved within the limits of available data.

8.3.18 Specific searches were made for ponds within and immediately adjacent to the Site when undertaking the extended Phase 1 Habitat Survey on 13th October 2016.

8.3.19 If access allowed, any waterbodies identified within the desk study and field survey were inspected and appraised for their suitability for great crested newt. This included an estimation of a Habitat Suitability Index (HSI) for all ponds based on the standard method (Oldham *et al*. 2000, Ref. 8-18). While HSI is not intended for use as a means to determine which ponds do and do not require further survey for great crested newt, it does provide qualitative data on the potential likelihood of great crested newts being present. These data may subsequently be used to decide if a full survey is required to inform a planning application.

8.3.20 HSI is a method of quantifying the suitability of a water body to support great crested newts. Any water bodies recorded within the Site were subject to an assessment using the HSI on 13th October 2016 by an ecologist who holds a Natural England Class 1 licence for survey of great crested newt.

8.3.21 The calculation of the HSI for a water body requires that the following ten key variables are recorded and assigned a numerical value; these ten variables are:

- Location within Britain;
- Pond area;
- Pond drying (based on local knowledge and field evidence);
- Water quality;
- Percentage perimeter shaded;

- Presence or absence of waterfowl;
- Presence or absence of fish;
- Number of ponds within 1km;
- Suitability of terrestrial habitat; and
- Percentage of macrophyte cover.

8.3.22 The results of the HSI assessment are scored in accordance with the criteria specified in Table 8-3 below.

Table 8-3 Habitat Suitability Index score and interpretation

HSI Score	*Pond suitability for great crested newts*
< 0.5	Poor
0.5	Below average
0.6	Average
0.7	Good
>0.8	Excellent

8.3.23 The October 2016 extended Phase 1 habitat survey identified the need for further surveys, the methodologies for which are outlined below.

Botanical Surveys

8.3.24 Following the recommendations of the PEA (***ES Volume 2: Appendix 8A***), the following assessments were undertaken between June and August 2017:

- Hedgerow Survey and Assessment; and
- Black Poplar Survey.

8.3.25 Only one parcel of grassland and scrub within the whole Proposed Scheme area had the potential for any botanical interest. As such, a botanical survey was undertaken here (see Figure 2 within ***ES Volume 2: Appendix 8B***). A walkover survey, undertaken on 9th December 2020 confirmed that the number and condition of the hedgerows, black poplar and grasslands were consistent with the original findings. For this reason, no update surveys were required.

8.3.26 The methods utilised for each of these is outlined below.

Hedgerow Survey and Assessment

8.3.27 Online databases including Multi Agency Information for the Countryside (MAGIC; www.magic.gov.uk) and National Library of Scotland (maps.nls.uk, Ref. 8-19) were consulted to identify and locate any historical field boundaries within the Site boundary.

8.3.28 In addition, a hedgerow assessment was undertaken in July 2017 by an experienced AECOM Ecologist. The methods and results of the Hedgerow Assessment can be found in the Phase 2 Botanical Survey Report in ***ES Volume 2: Appendix 8B***.

8.3.29 For the purposes of this assessment, each hedgerow was sampled in 30m sections in accordance with the guidance outlined within Schedule 1 Part II of the Hedgerow Regulations (1997) (Ref. 8-20). The criterion for identifying important hedgerows is

presented in ***ES Volume 2: Appendix 8B***. Hedgerows survey sections were set out as follows:

- Where the length of the hedgerow exceeded 30m, but did not exceed 100 metres, the number of woody species present was counted in the central stretch of 30m;
- Where the length of the hedgerow exceeded 100m, but did not exceed 200m, the number of woody species present was counted in the central stretch of 30 metres within each half of the hedgerow and the aggregate was divided by two; and
- Where the length of the hedgerow exceeded 200m, the number of woody species present in the central stretch of 30m was counted within each third of the hedgerow and the aggregate was divided by three.

Black poplar survey

8.3.30 A black poplar assessment was undertaken on 12th June 2017 by an experienced AECOM ecologist. The Site, including adjacent boundaries, was surveyed and any black poplars were recorded and mapped. The methods and results of the black poplar can be found in the Phase 2 Botanical Survey Report in ***ES Volume 2: Appendix 8B***.

Botanical survey

8.3.31 A botanical survey was undertaken on a triangular parcel of grassland land to the north of the Site, adjacent to the west of the London – Aylesbury railway line. This was the only substantial and continuous block of a potentially more diverse habitat on the Site and was also one identified by the BCC Ecologist as an area of greater interest in the scoping opinion. The visit included a comprehensive survey of the botanical species within the specified area and an assessment of the Site for the presence or potential for protected or priority plant species. All species were recorded, and notes made of abundance and distribution using a 'DAFOR' scale, a modification on the National Vegetation Classification (NVC, Rodwell, 2006, Ref. 8-21). The methods and results of the Botanical Survey can be found in the Phase 2 Botanical Survey Report in ***ES Volume 2: Appendix 8B***.

Protected Species

8.3.32 A number of protected species surveys were undertaken at the Site between 2016 and 2018. Updates to these surveys, starting in December 2019 and continuing until September 2020, are required given the time since the baseline data was last collected. The methodologies for these are outlined below.

8.3.33 Surveys were undertaken for the following species:

- Great crested newts
- Badger;
- Bats;
- Birds;
- Reptiles; and
- Water vole and otter.

Great crested newts

8.3.34 No additional surveys for great crested newt were undertaken between 2016 and 2019, as no suitable waterbodies were identified during the initial extended Phase 1 habitat surveys. However, since these surveys were undertaken, new evidence has come to light; a survey undertaken of Hall End Farm by HS2, which is located approximately 230m from the Site,

indicates presence of great crested newts. Considering this, the fact that the original survey data has expired, and the heavy rainfall experienced during winter 2019-2020, all potential waterbodies within 500m of the Site, including Hall End Farm will be assessed using HSI during spring 2020, to determine each waterbodies' potential to support great crested newts.

8.3.35 Based on the outcomes of the HSI surveys and a review of the potential for the Proposed Development to result in impacts on any potential great crested newt populations present, waterbodies subject to the HSI assessment will be selected for great crested newt eDNA survey to confirm presence/ absence.

8.3.36 eDNA refers to DNA that can be extracted from environmental samples such as water, soil or faeces, without first isolating any target organism. All living organisms leave traces of their DNA within the environment and this enables the detection of great crested newt through collection and testing of water samples from waterbodies.

8.3.37 Collection of water samples for eDNA analysis will be undertaken in accordance with methodology recommended by Technical Advice Note WC1067 prepared by Biggs *et al.* (2014). In line with the guidance, water samples will be collected from several locations within each waterbody. From the combined samples a subsample will then be taken and preserved using ethanol prior to analysis in a laboratory.

8.3.38 For eDNA samples taken within the optimum survey window (1th April to 30th June), negative results from eDNA surveys are accepted as evidence of likely absence of great crested newt from the waterbody in question, and further survey is not then required. As all samples will be taken in April, during the optimum survey window, a negative result can be relied upon for confirming likely absence of great crested newt. Positive results indicate that great crested newt DNA is present within a waterbody, and therefore further surveys are required to estimate population size.

8.3.39 The methods and results of the HSI survey undertaken in 2016 can be found in the PEA Report in ***ES Volume 2: Appendix 8A***. Updated and further surveys will be complete within spring 2020; new data will be submitted during the determination period.

Badger

8.3.40 The presence/absence survey undertaken in April 2017 followed the methodology described by Harris *et al* (1989) (Ref. 8-22). The survey comprised a search of the entire survey area paying particular attention to feature edges, such as woodland, scrub and field margins where setts and other signs of badger activity are more commonly found. All areas of suitable habitat were inspected for field signs of badger presence including:

- Setts;
- Footprints;
- Paths/runs;
- Latrines and dung pits;
- Hairs;
- Foraging signs including 'snuffle holes'; and
- Bedding material.

8.3.41 With reference to the standard survey methodology (Harris *et al*., 1989) any setts found were assessed for level of use by the number of entrance holes and thus classified into four types: 'main', 'annexe', 'subsidiary' and 'outlier'. The methods and results of the 2017 Badger Survey can be found in the PEA Report in ***ES Volume 2: Appendix 8A***. This survey

is scheduled to be updated in spring 2020. Updated findings will be submitted during the determination period.

Bats

8.3.42 Bat surveys undertaken include an assessment of buildings and trees to support roosting bats, bat emergence surveys and bat activity surveys, including static detector surveys. These surveys are scheduled to be updated between April and September 2020. Updated findings will be submitted during the determination period and as an addendum, once all surveys are complete.

8.3.43 The methodologies are outlined below.

Assessment of suitability to support roosting bats – trees

8.3.44 A detailed inspection of all suitable trees within the Site boundary was undertaken by two AECOM ecologists, one of whom holds a Natural England WML-18 (Level 2) bat survey class licence, on 13th June 2017. The survey was conducted in line with the Bat Conservation Trust (BCT) best practice bat survey guidelines (Collins, 2016) (hereafter 'BCT Guidelines') (Ref. 8-23) and BS 8596 Surveying for bats in trees and woodlands (British Standards, 2015) (Ref. 8-24).

8.3.45 Close focusing binoculars and a high powered torch (*Cluson* Clulite) were used to conduct an external assessment from the ground. All potential access/egress points and features with suitability to support roosting bats (e.g. cracks, crevices) were identified and recorded along with any evidence which may have indicated the location of roosts, such as:

- Stains around entrance holes (resulting from the deposition of oil secretions in bat fur);
- Scratch marks around entrance holes (resulting from bat claw holds);
- Bat droppings;
- Feeding remains; and
- Odours or noise characteristic of bats.

8.3.46 On the basis of the survey, the overall suitability of each feature supporting roosting bats was then classified using a scale of negligible, low, moderate, high or confirmed. This assessment was based on both the intrinsic suitability of the feature to support roosting bats and other evidence giving an indication of the likelihood of use by bats (e.g. presence of droppings, lack of cobwebs or exposure to elements).

Assessment of suitability to support roosting bats – buildings

8.3.47 An inspection of all accessible buildings within and adjacent to the Site boundary was undertaken on 13th June 2017. This survey was conducted in line with the BCT Guidelines (Ref. 8-23). Only one building (a shed) was recorded on the Site. Buildings beyond the west of the Site were not subject to survey, as they are more than 10m from the Proposed Scheme and will therefore not be subject to disturbance.

8.3.48 For the building on the Site, close focussing binoculars were used to conduct an external assessment of buildings to the west of the Site. All potential access/egress points and potential roost features (PRFs) which may support roosting bats (e.g. cracks, crevices, roof voids) were identified and recorded along with any evidence which may indicate the location of roosts, such as:

- Stains around entrance holes (resulting from the deposition of oil secretions in bat fur);
- Scratch marks around entrance holes (resulting from bat claw holds);

- Bat droppings;
- Feeding remains; and
- Odours or noise characteristic of bats.

8.3.49 On the basis of the survey, the overall suitability of each feature supporting roosting bats was then classified using a scale of negligible, low, moderate, high or confirmed. This assessment was based on both the intrinsic suitability of the feature to support roosting bats and other evidence giving an indication of the likelihood of use by bats (e.g. presence of droppings, lack of cobwebs, or exposure to elements).

8.3.50 No internal inspections of the buildings were undertaken, as the building that will be removed during the construction of the Proposed Scheme was assessed as having a negligible suitability to support roosting bats. All other buildings are more than 10m from the Proposed Scheme and will not be disturbed by the Proposed Scheme, therefore these buildings did not need to be surveyed. The methods and results of the Bat Roost Potential Assessment can be found in the Bat Roost Potential Assessment Report in ***ES Volume 2: Appendix 8C***.

Emergence and re-entry surveys – trees

8.3.51 Two suitably experienced ecologists undertook dusk emergence and dawn re-entry surveys of a single black poplar tree adjacent to the railway line, assessed as having a moderate suitability to support roosting bats.

8.3.52 One additional black poplar tree was assessed as having a moderate suitability to support roosting bats, however due to the distance from the Proposed Scheme, no further survey was required.

8.3.53 Nine additional trees were assessed as having low suitability to support roosting bats. In accordance with the BCT Guidelines (Ref. 8-23), no further survey was undertaken for trees identified as having a low suitability to support roosting bats.

8.3.54 The aim of the surveys was to identify bats leaving and/or returning to any roost that may be present. In accordance with the BCT Guidelines (Ref. 8-23), two surveys were undertaken. The dusk emergence survey covered the period from 15 minutes before sunset to one and a half hours after sunset. The dawn re-entry survey commenced one and a half hours before sunrise and ended at sunrise.

8.3.55 During these time periods, two experienced ecologists observed potential access/egress points on the tree. Surveyors carried echolocation detectors (*Petterson* D-240x) to help determine which species were present.

8.3.56 The time, location, number, species (where possible) and direction of flight were recorded for each bat pass (either echolocation heard, or activity seen) encountered during the survey. The echolocation calls detected were recorded to a *Roland Edirol* digital recorder to allow the use of *Batsound* analysis software (v4.2) to verify bat calls where required.

8.3.57 All surveys were undertaken during favourable weather conditions, as summarised in Table 8-4. The methods and results of the Bat Emergence Survey can be found in the Bat Survey Report in ***ES Volume 2: Appendix 8D***.

Table 8-4 Bat emergence survey weather conditions

Survey date	*Time*	*Temperature (OC) at start of survey*	*Weather conditions*
24/08/17	04:30 – 06:00	12	Calm, dry
05/09/17	19:27 – 21:12	18	Humid, calm, warm. Light rain from 20:20 to 21:00

Activity surveys

8.3.58 The number of survey visits, transects and automated static detectors used was determined through consideration of the size of the Site and its relative quality, in line with the BCT Guidelines (Ref. 8-23). This led to a conclusion that the Site was of moderate quality habitat and therefore a single activity survey visit per month between May and September would be appropriate.

8.3.59 Due to the size of the Site, each activity survey involved two transects, with two surveyors walking each pre-defined transect route, which included a series of 'listening points' located at potentially important features with regards to bats. At each 'listening point', surveyors recorded bat activity for at least three minutes using bat echolocation detectors. Any additional activity encountered whilst walking between points was also noted. The survey route was designed to include potential flight paths or foraging areas within the Site, and also mature trees, which may offer suitable roost sites. The starting point and direction of the

transect was varied during each survey visit in order to ensure all areas of the transect were walked close to dusk.

8.3.60 Surveyors carried echolocation detectors (*Petterson* D240x) to help determine which species were present. Bat activity was plotted in the field on a Trimble Juno 3D mobile mapper using ArcPad software. The dusk surveys commenced a quarter of an hour before sunset and continued to at least two hours after sunset. The dawn survey was carried out from two hours before sunrise until sunrise. In line with the BCT Guidelines (Ref. 8-23) at least one dawn survey was conducted during the same night period as a dusk survey.

8.3.61 The time, location, number, species (where possible) and direction of flight were recorded for each bat pass (discrete burst of echolocation heard, or bat activity observed) encountered during the survey. One surveyor recorded the echolocation calls detected to a *Roland Edirol* digital recorder to allow use of Batsound analysis software (v4.2) to verify bat calls where required.

8.3.62 Survey visits were scheduled to avoid nights with cold, wet or windy conditions. All surveys were undertaken during favourable weather conditions which are summarised in Table 8-5 below. The methods and results of the Bat Activity Survey can be found in the Bat Survey Report in ***ES Volume 2: Appendix 8D***.

Table 8-5 Activity survey weather conditions

Survey date	*Time*	*Temperature (°C) at start of survey*	*Weather conditions*
10/04/2017	19:38 – 21:53	11	Cool, calm, dry
31/05/2017	20:56 – 23:11	19	Calm, mild, dry
26/06/2017	21:15 – 23:30	18	Mild, light breeze
26/07/2017	20:45 – 23:03	19	Overcast, windy, rain before survey
27/07/2017	03:15 – 05:15	13	Cool, windy, dry
15/08/2017	20:11 – 22:26	18	Mild, light breeze, dry
06/09/2017	04:23 – 06:23	11	Cool, calm, overcast, rain previous evening

Automated bat detector surveys

8.3.63 Eight SM2bat+ static automated echolocation detectors (SM2bat+ detector) were placed within the Site monthly from April to September 2017 inclusive. The locations of the SM2bat+ detectors were as follows and can be seen illustrated on Figure 1 within the Bat Survey Report in ***ES Volume 2: Appendix 8D***:

- Location A in a hedgerow to the west of the B4443;
- Location B to the east of houses along the B4443, within a hedgerow along a ditch;
- Location C in a hedgerow that intersects two arable fields;
- Location D in a hedgerow intersecting an arable field and an area of long grassland and tall ruderal vegetation;
- Location E along the western edge of the London – Aylesbury railway line;
- Location F along the eastern edge of the London – Aylesbury railway line;
- Location G in a hedgerow to the west of Wendover Road; and

- Location H in a hedgerow to the east of Wendover Road.

8.3.64 In accordance with the BCT Guidelines (Ref. 8-23), the SM2bat+ detectors were left *in situ* for a minimum of five nights in April, May, June, July, August and September 2017. Data were recorded onto an SD card in zero crossing format for subsequent echolocation call analysis using Analook software. The methods and results of the Bat Automated Detector Survey can be found in the Bat Survey Report in ***ES Volume 2: Appendix 8D***.

Birds

Wintering bird survey

8.3.65 A total of four wintering bird survey visits were undertaken by an experienced ornithologist between 15th February and 17th March 2017. The survey was subsequently updated between December 2019 and March 2020, where a total of five visits were undertaken. All surveys undertaken during this period followed the British Trust for Ornithology's (BTO) Pilot Winter Farmland Bird Survey methodology (Ref. 8-25).

8.3.66 Surveys were undertaken in suitable weather conditions (see Table 8-6) of good visibility and avoiding heavy rain and/or strong winds, fog or heavy snow, when bird behaviour may be atypical, or when surveying may be impractical.

8.3.67 A survey transect was devised that allowed observation of all major areas of habitat within and adjacent to the proposed areas of development activity. All birds present were identified by sight and/or call and recorded using standard BTO species codes. The methods and results of the Winter Bird Survey can be found in the Wintering Bird Survey Report in ***ES Volume 2: Appendix 8E***.

Table 8-6 Wintering bird survey conditions

Date	*Time*	*Temperature (°C)*	*Weather*
15/02/17	09.30-13.30	8	Dry with intermittent sun.
27/02/17	10.35-14.00	9	Dry and overcast.
08/03/17	10.15-14.15	12	Largely dry (several brief showers), overcast.
17/03/17	10.15-13.45	7	Dry and overcast with a moderate breeze.
09/12/2019	12.30-15.45	9	Dry, sunny and fairly windy.
14/01/2020	13.00-.14.30	9-13	Intermittent showers, overcast and fairly windy.
28/01/2020	09.30-13.00	5-7	Dry and sunny with a moderate breeze.
19/02/2020	11.00-15.30	7	Light rain until 13.30, overcast with a moderate breeze.
09/03/2020	10.00-14.15	10-12	Damp and overcast with brief sun. Fairly windy.

Breeding bird survey

8.3.68 A total of six breeding bird survey visits were undertaken by an experienced AECOM ornithologist between 5th April and 28th July 2017. These surveys followed a predetermined transect to take into account all habitats on the Site and adjacent, utilising an adapted BTO Common Birds Census (CBC) survey method (Ref. 8-26) to make field counts of species present and record breeding activity.

8.3.69 Surveys were undertaken to include times of day when birds are most active (i.e. early morning, but at least an hour after dawn) in suitable weather conditions and good visibility (see Table 8-7). Surveys avoided heavy rain and/or strong winds, fog or heavy snow, when bird behaviour may be atypical, or when surveying may be impractical.

8.3.70 A survey transect was devised that allowed observation of all areas of the Site and the connecting habitats within and adjacent to the proposed areas of development activity. Visits lasted three to four hours. All birds present were identified by sight and/or song and recorded using standard BTO species codes and BTO notation codes for their activities. The methods and results of the Breeding Bird Survey can be found in the Breeding Bird Survey Report in ***ES Volume 2: Appendix 8F***. Updates for the breeding bird surveys are scheduled to be undertaken between March and June 2020. New data will be incorporated into an addendum during the determination period.

Table 8-7. Breeding bird survey dates, times and conditions

Date	*Time*	*Temperature (°C)*	*Weather*
05/04/17	07.30-11.30	6-9	Sunny and cold to start, followed by sun and scattered cloud later.
27/04/17	08.00-12.00	11	Sunny and cool earlier, followed by thick cloud.
10/05/17	07.30-11.30	2-10	Cloudy and cold to start with slight breeze, followed by sunny and warm conditions later.
25/05/17	08.00-11.30	16	Sun and cloud, but warm.
15/06/17	07.30-11.30	17	Sunny and warm
28/07/17	07.30-10.30	13	Cool and cloudy with slight breeze to start, followed by bright sun and then returning to cloud.

Barn owl survey

8.3.71 During the winter season a landscape scale barn owl habitat assessment survey was undertaken on 14th and 29th March 2017, which suggested that there was potential for barn owl to be present within the local area and with suitable foraging habitat within the Proposed Scheme, the potential for barn owl to be present here too.

8.3.72 Subsequently, a total of four barn owl activity survey visits were undertaken by experienced ornithologists between May and July 2017, in order to determine the value of the Site for barn owl, looking specifically at foraging areas.

8.3.73 The survey method followed the standard approach as set out for surveying barn owl (Gilbert, *et al*, 1998, Ref. 8-27). All four visits focused around dusk when barn owls were likely to be most active, thereby maximising the chance of observing the majority of barn owl activity and any territorial behaviour. Surveys commenced 30 minutes before dusk until 1.5 hours after sunset during favourable weather conditions (see Table 8-8).

8.3.74 A survey route that combined both vantage points and walked transects was devised that allowed observation of all major areas of suitable habitat within and adjacent to the Site. All barn owl present were identified by sight and recorded following the standard CBC notation and using BTO species code (BO). On 9th December 2018, an updated barn owl habitat assessment was undertaken, which confirmed that the condition of habitats on site were consistent with the original barn owl habitat survey findings. For this reason, it is assumed that barn owl are still using the site for foraging purposes.

8.3.75 The methods and results of the Barn Owl Survey can be found in the Barn Owl Survey Report in ES Volume 2: Appendix 8G.

Table 8-8 Barn owl survey dates and weather conditions

Date	Time	Temperature (°C)	Weather	Comment
25/05/17	20:05 – 22:05	14	Calm, light wind, cool	
13/06/17	20:20 – 22:20	15	Calm, light wind, dry	
10/07/17	20:20 – 22:20	17	Cloudy, warm, still	Half the site only
13/07/17	20:20 – 22:20	17	Cloudy, warm, still	Half the site only
27/07/17	20:00 – 22:00	15	Cool, breezy, scattered cloud	
09/12/2019	12.30-15.45	9	Dry, sunny, fairly windy	Habitat assessment only

Reptiles

8.3.76 Reptile surveys were undertaken in accordance with best practice guidance set out in the Herpetological Workers' Manual (Gent & Gibson 1998, Ref. 8-28). This involved placing artificial refugia, which were laid flush to the ground in suitable habitat, to entice reptiles to bask and/or shelter under. The artificial refugia used comprised of roofing tin and bitumen roofing-felt approximately 0.5m x 0.75m in size.

8.3.77 A total of 80 artificial refugia were placed in three main locations within the Site attractive to reptiles (e.g. sunny areas adjacent to scrub and south facing) on the 29th March 2017 and left in-situ to 'bed in' until 12 days had passed. A total of seven visits were undertaken between 10th April 2017 and 26th May 2017. All artificial refugia were checked within a constant temperature range of between 10°C and 20°C and under suitable weather conditions (Froglife, 1999, Ref. 8-29).

8.3.78 An indication of reptile population size was made from all the survey data obtained. Reptile population size is classed according to guidance set out in the 'Reptile survey – Froglife Advice Sheet 10 (Froglife, 1999, Ref. 8-29). These are classed as exceptional, good or low population assemblages (Table 8-9) and based on a density of 10 refugia per hectare. The methods and results of the Reptile Survey can be found in the PEA Report in ***ES Volume 2: Appendix 8A***. Updates to the reptile survey are scheduled to be undertaken between April and May 2020. New data will be incorporated into an addendum during the determination period.

Table 8-9 Categories for establishing reptile population

Species	Exceptional Population	Good Population	Low Population
Slow-worm	>20	5-20	<5
Viviparous lizard	>20	5-20	<5
Adder	>10	5-10	<5
Grass snake	>10	5-10	<5

Riparian mammals

8.3.79 A survey was undertaken on 7th September 2017 to identify the use of the Site by water vole (*Arvicola amphibious*) and otter (*Lutra lutra*). The survey focused on the only water course on site, which is the Bedgrove Brook in the far east of the Site.

8.3.80 The water vole survey was undertaken in accordance with the Water Vole Conservation Handbook (Ref. 8-30). This consisted of identifying the extent and distribution of water vole activity through searches of the banks of the network of rivers and streams, areas of standing water and swamp habitat for field signs indicating recent activity (e.g. feeding stations, latrines, footprints) as well as signs of past and potentially present activity (e.g. burrows).

8.3.81 In addition, and in accordance with the Water Vole Conservation Handbook environmental assessment surveys for large scale schemes, the scope of surveys was extended to between 50-500m upstream and downstream of each existing crossing point, were possible.

8.3.82 Latrines are indicators of territorial behaviour, which in turn generally correlates with water vole breeding activity. If water voles were found to be present, both breeding and non-breeding activity would be recorded and presented.

8.3.83 The otter survey was undertaken in accordance with current best practice methods (Chanin, 2003, Ref. 8-31) and evidence of use by otters searched for included: spraints/latrines; anal jelly; places of refuge; footprints, trails and slides; and foraging evidence. The location of all field signs was mapped, and the centroid grid reference recorded.

8.3.84 For the purposes of recording types of otter refuge in this report, the following terms are used:

- A ‘holt’ means a well-enclosed refuge, including excavated tunnels (often in steep banks amongst tree roots) and cavities in rocks or man-made structures;
- A ‘laying-up area’ or ‘lie-up’ is a partially enclosed or screened refuge; and
- Birth of cubs may occur at a ‘natal holt’, typically above normal flood levels and occupied for up to three months, or in a ‘couch’ constructed in reeds; these are difficult to locate or recognise and may be at some distance from main water bodies and other otters.

8.3.85 The methods and results of the Riparian Mammal Survey can be found in the PEA Report in ***ES Volume 2: Appendix 8A***. An update to the riparian mammal survey is scheduled to be undertaken in spring 2020. New data will be incorporated into an addendum during the determination period.

Assessment Methodology

8.3.86 The 'Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland' issued by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016, Ref. 8-32) ('the CIEEM EcIA guidelines') provide guidance on the process of identifying the value of ecological features, characterising impacts upon them and assessing whether these impacts are significant. The 'mitigation hierarchy' of avoidance, mitigation, compensation and enhancement underpin the CIEEM EcIA guidelines.

8.3.87 The significance of the predicted impacts on important ecological features arising from the potential impacts associated with the Proposed Scheme, including designed-in and additional mitigation measures, were assessed. The significance of the effects were assessed as negative, positive or not significant.

8.3.88 The CIEEM EcIA guidelines (2016) state that *“A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project... A*

significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects can be lawfully permitted following Environmental Impact Assessment (EIA) procedures as long as the mitigation hierarchy has been applied effectively as part of the decision making process. In broad terms, significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)."

8.3.89 As per the CIEEM EcIA guidelines, the following definitions were used for the terms 'impact' and 'effect':

- Impact – Actions resulting in changes to an ecological feature.
- Effect – Outcome to an ecological feature from an impact.

8.3.90 The CIEEM EcIA guidelines focus on assessment of impacts in a geographic context and set out the following process for assessment:

- Identification of potential impacts, based on the nature of the construction and operation phases of a proposed development;
- Incorporation of measures to avoid and mitigate (and so reduce) these impacts;
- Assessment of the significance of any residual effects after mitigation;
- Identification of compensation measures to avoid, reduce or offset significant residual adverse effects; and
- Identification of opportunities for ecological enhancement.

Assessment of Importance of Ecological Features

8.3.91 It is impractical and inappropriate for an assessment of the ecological effects of a proposed development to consider every species and habitat that may be affected. Instead, it should focus on important ecological features. These are defined by the CIEEM EcIA guidelines as "*species and habitats considered to be important and potentially affected by the project"*.

8.3.92 The importance of sites, populations of species, species assemblages and habitats were evaluated with reference to their importance in terms of biodiversity conservation value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations), their legal status and geographical context (see Table 8-10).

8.3.93 The importance of ecological features relates to various characteristics including valuation of species populations, assemblages of species and habitats and use accepted criteria; examples (adapted from CIEEM 2016) include:

- Animal or plant species, that are rare or uncommon or seasonally transient;
- Habitats which are decreasing in area;
- Species which are declining in number and/or range;
- Ecosystems and their component parts, which provide the habitats required by important species, populations and/or assemblages;
- Habitat diversity and/or habitat connectivity;
- Species-rich assemblages of plants and animals;
- Large populations of species or concentrations of species considered uncommon or threatened in a wider context; and

- Plant communities that are considered to be typical of important natural/semi-natural habitat types.

Table 8-10 Ecological Resource Evaluation Criteria

Geographical level at which ecological feature is important	*Example Criteria*
International (High)	An internationally important site, e.g. Special Protection Area (SPA), Special Area of Conservation (SAC) or Ramsar; a regularly occurring population of an internationally important species (listed on Annex IV of the Habitats Directive)
National (High)	A nationally designated site, e.g. Site of Special Scientific Interest (SSSI), or a site considered worthy of such designation; a large regularly occurring population of a nationally important species.
County (Medium)	A site designated as a Local Wildlife Site; a regularly occurring, locally significant number of a nationally important species. A species or habitat identified as of priority within Section 41 of the NERC Act (2006).
Borough (Low)	Areas of habitat identified in a sub-county (district/borough); sites or features that are scarce within the district or borough or which appreciably enrich the district or borough habitat resource; a diverse or ecologically valuable hedgerow network.
Local (Very Low)	A typical example of a common or widespread habitat in the local area.
Negligible	No ecological value

Identification and Characterisation of Potential Impacts

8.3.94 The likely impacts of the Proposed Scheme during construction and operation, and the potential ecological effects associated with it were identified and characterised. This took into consideration the following criteria:

- Positive or negative – whether the effect will result in net loss or degradation of an important ecological feature or whether it would improve or enhance it;
- Magnitude – the size and intensity of the effect measured in relevant terms, e.g. number of individuals lost or gained, area of habitat lost or created, or the degree of change to existing conditions;
- Extent – the spatial scope of the effect;
- Reversibility – the extent to which effects were reversible either spontaneously or through active mitigation;
- Duration – the length of time over which the effect occurred; and
- Timing and frequency – consideration of the timing of events in relation to ecological change; some impacts might be of greater significance if they took place at certain times of year.

8.3.95 Potential impacts were characterised initially in the absence of any mitigation, except where this was integral to the design of the Proposed Scheme. A sequential process was applied to avoid, mitigate and compensate for any significant effects. Any additional mitigation or compensation proposed was subsequently identified and its likely effectiveness assessed.

Assessment of Impact Magnitude

8.3.96 Important ecological features include sites, habitats, species assemblages or communities, or populations or groups of a species. Professional judgement was be used to assign the impacts on the important ecological features to one of four classes of magnitude (see Table 8-11).

Table 8-11 Definition of Magnitude of Impacts

Magnitude	*Example Criteria*
High	A permanent or long-term impact on the extent or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to substantially enhance its conservation status.
Medium	A permanent or long-term impact on the extent or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is unlikely to threaten its sustainability; if beneficial, this is likely to be sustainable but unlikely to enhance its conservation status.
Low	A permanent or long-term reversible impact on a site, habitat, species assemblage or community, population or group whose magnitude is detectable but will not threaten its integrity.
Very low	A short-term but reversible impact on the extent or size or integrity of a site, habitat, species assemblage or community, population or group that is within the normal range.

Significance of Effects

8.3.97 The significance of the predicted effects on important ecological features arising from the potential impacts associated with the Proposed Scheme, including designed-in and additional mitigation measures, was assessed. The significance of the effects was assessed as negative, positive or not significant in line with the CIEEM EcIA guidelines and the categories adapted to ensure consistency of approach with the wider ES (see paragraph 8.3.95 below).

Negative effects

8.3.98 For habitat areas and species, an effect was considered significant if the favourable conservation status of an important ecological feature will be compromised by the Proposed Scheme. Conservation status is defined by CIEEM (2016) as being:

- Habitats – "*conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area"*.
- Species – "*conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area".*

8.3.99 The decision as to whether the favourable conservation status of an important ecological feature is likely to be compromised was made using professional judgement through consideration of multiple factors in relation to the predicted effects of the project.

8.3.100 A similar procedure was adopted for designated sites that will be affected by the Proposed Scheme, except that the focus in this case is on the effects on the integrity of each site. This assessment was made with reference to the features for which a site has been classified/notified (where possible) and involved combining assessments of the effects on the conservation status of each of these features.

Positive effects

8.3.101 As per CIEEM 2016 EcIA guidelines, a positive effect was considered significant if it results in *"a change that improves the quality of the environment e.g. by increasing species diversity, extending habitat or improving water quality. Positive effects may also include halting or slowing an existing decline in the quality of the environment"*.

8.3.102 Effects can be permanent or temporary, direct or indirect, and can be cumulative. These factors were brought together to assess the magnitude of the impact on particular important ecological features and, wherever possible, the magnitude of the impact was quantified. Table 8-11 above presents the categorisation of the magnitude of impacts.

Categorisation of effects

8.3.103 For this assessment, a matrix approach was used where ecological importance and magnitude of impact are cross referenced to categorise effects as shown in Table 8-12.

Table 8-12 Classification of effects

Geographical level at which ecological feature is important	*High*	*Medium*	*Low*	*Very Low*
International and National (High)	Major	Major	Moderate	Minor
County (Medium)	Major	Moderate	Minor	Negligible
Borough (Low)	Moderate	Minor	Negligible	Negligible
Local (Very low)	Minor	Negligible	Negligible	Negligible

8.3.104 The assignment of importance to an ecological feature requires that the assessor make use of relevant published evaluation criteria (where available). Where published evaluation criteria do not exist, it will be necessary to apply professional judgement, supported by a carefully reasoned argument.

8.3.105 The valuation of the importance of a site is made with reference to the level at which they are designated (e.g. SSSIs are all of national importance, being designated by UK legislation) and reflect the geographical context of the valuation. The categories shown in Table 8-12 will be applied to give geographic context. Although the categories differ slightly from those recommended within CIEEM (2016) EcIA guidelines, they are based on the EcIA guidelines and are considered appropriate to ensure consistency of approach with the wider ES.

8.3.106 Making reference to Table 8-12, the following seven-point scale was used to categorise effects:

- Major adverse (significant)
- Moderate adverse (significant)
- Minor adverse
- Negligible
- Minor beneficial
- Moderate beneficial (significant)
- Major beneficial (significant)

8.3.107 Effects assessed as moderate or major (both adverse and beneficial) are considered to be 'significant'; whilst effects predicted to be negligible or minor are considered to be acceptable/non-material and therefore 'not significant'.

8.3.108 In accordance with the aims of the CIEEM guidelines, supporting text is provided in this chapter to explain the rationale for assessment of magnitude of impacts and significance of effects.

Cumulative Effects Assessment

8.3.109 A review has been undertaken of schemes in terms of their potential for ecological cumulative effects. The schedule of developments considered in the cumulative effects assessment is provided in ***ES Volume 2: Appendix 4A***.

Assumption and Limitations

Desk study

8.3.110 Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular habitats or species does not necessarily mean that the habitats or species do not occur in the study area. Likewise, the presence of records for particular habitats and species does not automatically mean that these still occur within the area of interest or are relevant in the context of the Proposed Scheme.

8.3.111 Populations of annual plant species may fluctuate markedly between years dependent on the growing conditions present in any given season.

8.3.112 Where habitat boundaries coincide with physical boundaries recorded on OS maps the resolution is as determined by the scale of mapping. Elsewhere, habitat mapping is as estimated in the field and/or recorded by hand-held GPS. Where areas of habitat are given, they are approximate and should be verified by measurement on Site where required for design or construction.

Black Poplar Surveys

8.3.113 Due to access constraints, it was not possible in all instances to survey the hedgerows from both sides in accordance with best practice or access all areas of the Site for the black poplar survey (namely residential and commercial land in the west, along B4443 Lower Road). However, as all hedgerows were accessible for survey from at least one side, as black poplar trees are usually visible from some distance due to their size and as semi natural habitats within inaccessible areas typically only comprised residential gardens (based on aerial imagery and viewing from site boundaries) this is not considered to pose a significant constraint to these surveys.

Bat Surveys

8.3.114 During the dusk emergence survey of the black poplar tree on 5th September 2017, light rain occurred between 38 minutes and 1 hour 18 minutes after sunset. However, bats were recorded during this period and the rain is not considered to be a constraint to this survey.

8.3.115 SM2bat+ detectors did not record at Location D in June and Location H in May. However, all other detectors within these months did record and therefore sufficient data was gathered within these months.

8.3.116 The following SM2bat+ detectors did not record for the full five nights:

- Location A in April 2017 recorded for four nights;
- Location B in May 2017 recorded for four nights; and
- Location F in August 2017 recorded for four nights.

8.3.117 However, given the high volume of data collected across the Site including for over five nights data collected on 35 occasions this is not considered to pose a constraint to the survey results.

8.3.118 Due to access constraints, it was not possible to conduct assessments of suitability to support roosting bats on buildings adjacent to the Site. Whilst some sections of buildings could be partially viewed from adjacent site boundaries, it was not possible to conduct a comprehensive survey of each building. However, these buildings are more than 10m from the Proposed Scheme and are considered to be well maintained and in a good state of repair and as such are likely to have a negligible to low grading for roosting bats. Due to their distance, any potential bat roost will not be lost or disturbed by the proposed works.

8.4 Baseline Conditions

Statutory Designated Sites

8.4.1 There is one internationally designated site within 10km; namely Chilterns Beechwoods Special Area of Conservation (SAC). There are seven nationally designated sites for nature conservation; six are designated as Sites of Special Scientific Interest (SSSI) and one as a Local Nature Reserve (LNR) all present within 5km of the Site. See ***ES Volume 2: Appendix 8A*** for further details.

Table 8-13 Statutory Designated Sites

Designation	*Reason for Designation*	*Size (ha)*	*Relationship to Site*
Weston Turville reservoir Site of Special Scientific Interest (SSSI)	The reservoir feeds the Wendover arm of the Grand Union Canal and contains reed beds, wet woodland and supports a variety of wildfowl species. Shoveler, pochard, ruddy duck, water rail, reed warbler and nightingale have all been recorded on site.	19.04	2.3km east of Site boundary
Bugle Quarry SSSI	The site shows a sequence of late Jurassic sedimentary rocks including the topmost marine Portland and basal, partly non-marine, Purbeck Bed.	0.1	3.28 north west of Site boundary
Bierton Clay Pit SSSI	Site contains the only permanent section in the lower Portland Beds north of Oxford and thus at the northern extremity of the Portland outcrop.	0.07	3.78 km north of Site boundary
Bacombe and Coombe Hills SSSI	The site supports species rick chalk grassland with areas of mixed scrub. The site also supports the fringed gentian *Gentianella ciliata*.	76.86	3.8km south-east of Site boundary
Bacombe Hill Local Nature Reserve (LNR)	A valuable area of downland, scrub and woodland. The site supports some rare chalk grassland flowers, including orchids, and butterflies.	24.56	4.18km south-east of Site boundary
Ellesborough and Kimble Warrens SSSI	The site contains deciduous woodland mainly beech and sycamore. The site supports notable butterfly species and a local chalkhill snail *Abida secale.*	69.49	4.31km south of Site boundary
Aston Clinton Ragpits SSSI	Site supports species rich chalk grassland and interesting scrub matrix; including 27 species of butterfly.	2.5	4.75km east of Site boundary
Chilterns Beechwoods Special Area of Conservation (SAC)	Beech and bluebell woodlands which include a diversity of habitats ranging from chalk grassland and to the country's most extensive areas of beech woodland.	142.28	4.5km south of Site boundary

Non-Statutory Designated Sites

8.4.2 Three non-statutory designated sites are present within 2km of the Site, namely Grassland at North Lee, Aylesbury Arm and Bear Brook. All three sites are designated at Biological Notification Sites (BNS). See ***ES Volume 2: Appendix 8A*** for further details.

Table 8-14 Non-Statutory Designated Sites

Designation	*Reason for Designation*	*Size (ha)*	*Relationship to Site*
Grassland at North Lee	An area of neutral grassland on a site that was the former BOCM agricultural Research Centre.	14.6	1.43km south of the Site boundary.
Aylesbury Arm	A stretch of canal and towpath which is dominated by greater tussock-sedge. The banks of the canal also provide nesting habitat for wildfowl species.	0.5	2.0km north of the Site boundary.
Bear Brook	A small stream.	0.3	1.98km north of the Site boundary.

Habitats

8.4.3 The Site predominantly comprises arable habitat. Species poor intact hedgerows typically dominated by hawthorn (*Crataegus monogyna*) were recorded across the Site; primarily forming field boundaries. Scattered semi mature and immature broadleaved trees were recorded adjacent to the railway line to the west of the Site. Improved grassland and species poor semi improved grassland habitat was recorded to the north and north-east of the Site in publicly accessible areas.

8.4.4 Individual mature broadleaved trees were recorded intermittently across the Site with scattered semi mature and mature groups of trees to the north and west of the Site. Dense bramble (*Rubus fruticosus* agg.), rose (*Rosa* sp.) and blackthorn (*Prunus spinosa*) scrub was primarily recorded to the north and north-west of the Site, with some smaller areas of broadleaved plantation and tall ruderal habitat. Standing water in the form of wet ditches was recorded intermittently across the Site, with Bedgrove Brook to the north-east. The updated Phase 1 habitat survey undertaken in December 2019 confirmed the habitats were the same type and condition as recorded in 2017. See ***ES Volume 2: Appendix 8A*** for further details.

Hedgerow Survey and Assessment

8.4.5 A total of 15 hedgerows were surveyed as part of the assessment.

8.4.6 Of these, four (H1, H3, H4, H6) were species rich (containing five or more native woody species per 30m length) and 11 were species poor. Hedgerows predominantly comprised hawthorn and/or blackthorn (*Prunus spinosa*) as the dominant woody species. No notable associated ground flora was recorded.

8.4.7 All hedgerows demarked field boundaries, with the surrounding habitats typically being arable land. The majority of hedgerows were connected to at least one other hedgerow.

8.4.8 Based on the criteria, none of the hedgerows qualify as important under the Hedgerow Regulations 1997.

8.4.9 See ***ES Volume 2: Appendix 8B*** for further details.

Black Poplar Survey

8.4.10 A total of 24 black poplars were recorded within the Site, 17 of which were immature, see ***ES Volume 2: Appendix 8B*** for further details. No black poplars will be impacted as a result of the Proposed Scheme. As such, this species is not considered further in this assessment.

Botanical Survey

8.4.11 No rare or notable plant species were recorded during the botanical survey. The semi improved neutral grassland, tall ruderal, broadleaved tree and scattered scrub habitats surveyed comprises common and widespread species within a largely mesotrophic habitat, which are not of any significant conservation value other than adding to the mosaic of habitats for wildlife within the Site and the wider area. See ***ES Volume 2: Appendix 8A*** and ***ES Volume 2: Appendix 8B*** for further details.

Protected and/or Otherwise Notable Species

Desk study

8.4.12 The desk study returned records of nine bat species within 5km of the Site, and records of great crested newt, badger, 35 species of bird including barn owl and 24 protected and/or notable species of invertebrate within 2km of the Site in the last 10 years. See ***ES Volume 2: Appendix 8A*** for further details. An update to the desk study is to be undertaken in spring 2020.

Riparian Mammals

8.4.13 Wet ditches and Bedgrove Brook located within the Site provide sub optimal - poor habitat for water vole and otter due to the lack of suitable marginal vegetation and low water levels.

8.4.14 No signs of water vole or otter were recorded during the survey. See ***ES Volume 2: Appendix 8A*** for further details. An update to the riparian mammal survey is to be undertaken in spring 2020.

Bats

Assessment of trees and buildings to support roosting bats

8.4.15 Two black poplar trees were assessed as having moderate suitability to support roosting bats. One black poplar was located to the west of the railway line; the second tree was located to the far west of the Site, adjacent to the Site boundary. See ***ES Volume 2: Appendix 8C*** for further details. Due to the distance from the Proposed Scheme, no further survey of the second black poplar was required.

8.4.16 Nine trees were assessed as having low suitability to support roosting bats. In accordance with the BCT Guidelines (Ref. 8-23) and no further survey was recommended for these trees. See ***ES Volume 2: Appendix 8C*** for further details.

8.4.17 Due to access constraints, it was not possible to conduct assessments of suitability to support roosting bats on buildings within or adjacent to the Site. However, as these buildings are more than 10m from the Proposed Scheme, any bat roosts present within the buildings would not be lost or disturbed by the proposed works. The foraging and commuting routes of bats that may be roosting within the buildings, if a roost is present, has been assessed and any impacts appropriately mitigated. An update to the bat roost potential survey is to be undertaken in spring 2020.

Emergence and re-entry survey

8.4.18 No bats were recorded emerging from or re-entering the black poplar tree subject to survey. However, it retains a moderate suitability to support roosting bats. See ***ES Volume 2: Appendix 8D*** for further details. Further emergence/re-entry surveys or updates to these surveys may be required, depending on the outcome of the bat roost potential survey update. If required, these surveys will be undertaken between spring and autumn 2020.

Activity survey

8.4.19 During the activity and static automated detector surveys, seven species were identified to species level; common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Nathusius' pipistrelle (*Pipistrellus nathusii*), Leisler's bat (*Nyctalus leisleri*), noctule (*Nyctalus noctula*), serotine (*Eptesicus serotinus*) and brown long-eared bat (*Plecotus auritus*). *Myotis* species were also recorded[1].

8.4.20 Bats were predominantly recorded commuting and foraging along the hedgerows and field margins throughout the Site; with levels of bat activity being higher in the east of the Site. See ***ES Volume 2: Appendix 8D*** for further details. Updates to these surveys are to be undertaken between April and September 2020.

Badger

8.4.21 No setts were recorded within the survey area; however numerous badger field signs, including sightings of badger, were recorded within the Site. A used, two-hole outlier sett was recorded in the broadleaved plantation adjacent to the northern Site boundary.

8.4.22 The badger survey recorded well-used badger runs within the rough grassland area and along the western railway embankment, with many short runs showing access points into the site and across field boundaries. Snuffle holes and three latrines were also recorded in the rough grassland area to the north. In addition, a badger was recorded within an arable field margin. Suitable foraging habitat exists for badger within the Site in the form of rough grassland, arable field margins and scrub habitat, including along the railway embankments.

8.4.23 See ***ES Volume 2: Appendix 8A*** for further details. An update of the badger survey will be undertaken in spring 2020. Badger survey data will be used during detailed design to determine suitable locations for suitable mammal crossing locations along the Scheme.

Birds

Wintering birds

A range of common wintering birds were recorded across the Site in the later part of the 2017 winter season and during the 2019-2020 winter season9. No significant gathering of roosting or feeding birds were recorded. No species of particular value were recorded. See ***ES Volume 2: Appendix 8E*** for further details. Breeding birds

8.4.24 A range of common breeding birds were recorded across the Site in the nesting season. No significant populations or species of particular value were recorded. Several Red list species of conservation concern were recorded nesting on the Site within suitable habitat. These were house sparrow (*Passer domesticus)*, linnet (*Carduelis cannabina)*, skylark (*Alauda arvensis)*, song thrush (*Turdus philomelos)*, starling (*Sturnus vulgaris)*, yellow wagtail (*Motacilla flava)* and yellowhammer (*Emberiza citrinella)*. Of these seven, yellow wagtail is the only species not considered to be breeding within the Site at this time, but likely

[1] *Myotis* bat calls can be very similar; therefore, have been classified as *Myotis* species unless call characteristics or observations of the bat and behaviour have been recorded to enable species level identification.

breeding on land nearby. See ***ES Volume 2: Appendix 8F*** for further details. Updates to these surveys are to be undertaken between April and June 2020.

Barn owl

8.4.25 A single barn owl was observed foraging and flying over arable and rough grassland habitat in the centre of the Site, to the west of the railway line on the 13th July 2017 at 21:53pm. Barn owls were not observed during the other five surveys. Barn owl utilise the Site for foraging, but no records or evidence of nesting were recorded. An update to the barn owl habitat assessment, undertaken on 9th December 2019, confirmed that the habitats are still suitable for barn owl. For this reason, it is assumed that barn owl still use the Site for foraging and commuting. See ***ES Volume 2: Appendix 8G*** for further details.

Great Crested Newt

8.4.26 Wet ditches were recorded across the Site; however, these were assessed to be unsuitable for great crested newts due to the lack of suitable aquatic vegetation, very low water levels and likelihood of drying out. In addition, Bedgrove Brook to the north east of the Site was assessed to be unsuitable for this species based on the presence of flowing water at low levels.

8.4.27 Two ponds were recorded on aerial mapping as being within the Site; however, one of these was dry at the time of survey and the other was no longer present.

8.4.28 One additional pond was recorded within 500m of the Proposed Scheme, immediately adjacent to the western Site boundary at Hall End Farm. This was given a suitability rating of 0.57 (below average) in the HSI assessment; however, since these surveys were undertaken, new evidence has come to light; a survey undertaken of Hall End Farm by HS2, has indicated presence of great crested newts. HSI and eDNA surveys are therefore scheduled to take place in April 2020 and will consider Hall End Farm and all other potential waterbodies within 500m of the Site. If great crested newts are found to be present within Hall End Farm or other waterbodies, additional mitigation features may need to be considered.

8.4.29 Suitable terrestrial habitat for foraging and hibernating great crested newt is present in the form of rough grassland and scrub habitat to the north-west of the Site however these habitats are poorly connected to the wider landscape. An update of the extended Phase 1 habitat survey, undertaken on 9th December 2019, confirmed that these habitats were of the same condition as previously recorded. See ***ES Volume 2: Appendix 8A*** for further details. An additional appendix, concerning the findings of the great crested newt surveys will be submitted during the determination period as an addendum.

Reptiles

8.4.30 No reptiles were recorded during the surveys. Therefore, widespread reptile species (slow worm, common lizard, adder and grass snake) are assumed to be absent from the Site following the completion of presence/absence surveys. However, habitat within the Site remains suitable to support common reptile species. See ***ES Volume 2: Appendix 8A*** for further details. Updates to these surveys are to be undertaken between April and May 2020.

Importance of Ecological Features

8.4.31 With reference to Table 8-10, on the basis of the desk study and fieldwork undertaken, the important ecological features considered within this assessment are evaluated in Table 8-13 below.

Table 8-15 Evaluation of Ecological Features

Receptor	*Value*	*Rationale*
Chilterns Beechwoods SAC	International (Very high)	At its closest point the Chilterns Beechwood SAC is 4.5km south of the Site. The SAC is designated for its woodland habitats. As it is considered unlikely that the Proposed Scheme would materially alter the traffic flows, percentage of heavy duty vehicles or average speeds on any roads within 200m of the SAC, impacts on the SAC are unlikely. Therefore, this site has not been considered further in this assessment.
Sites of Special Scientific Interest (SSSI)	National	Six SSSIs are located within 5km of the Site. The closest is Weston Turville Reservoir SSSI, located 2.3km from the Site. The distance, lack of connectivity and lack of functional linkage to and from the Site means impacts on SSSIs are unlikely and therefore these sites are not considered further in this assessment.
Bacombe Hill Local Nature Reserve	Regional	Bacombe Hill LNR is located 4.18km south-east of the Site. The distance from the Site means impacts on the LNR are unlikely, and therefore this site has not been considered further in this assessment.
Biological Notification Sites (BNS)	Local	Three BNS are located within 2km of the Site. The closest is Grassland at North Lee, located 1.43km south of the Site. The distance from the Site means impacts on the BNS are unlikely, and therefore this site has not been considered further in this assessment.
Habitats within the Site	Regional	Hedgerows are present within the Site. These are an example of a Habitat of Principal Importance listed under Section 41 of the NERC Act (2006). As the Proposed Scheme will result in the loss of hedgerows, effects are included in the assessment presented in this ES chapter.
Black poplar	Local	24 black poplar trees were recorded within the survey area. However, none of these will be impacted as a result of the Proposed Scheme. Black poplar trees are afforded protection through the Wildlife and Countryside Act (1981, as amended) and may not be uprooted without permission of the landowner. However, as no black poplar will be impacted by the Proposed Scheme they are not considered further in this assessment.
Trees assessed as having a low or moderate suitability to support roosting bats	Local	No bats were recorded roosting within the tree subject to the emergence survey. However, the tree retains a moderate suitability to support roosting bats. In addition, nine trees retain a low suitability to support roosting bats. Therefore, roosting bats are included in the assessment presented in this ES chapter.
Bats	Regional	The Site supports at least seven bat species. Bat foraging and commuting activity was recorded along hedgerows and field margins throughout the Site. The Proposed Scheme will result in the loss or fragmentation of hedgerows and grassland habitats, which has the potential to result in bats crossing the proposed road, increasing the likelihood of bat fatalities due to vehicle strikes. There may also be impacts on bats due to the proposed lighting scheme. Therefore, bats are included in the assessment presented in this ES chapter.
Badger	Local	No setts were recorded within the Site; however, badger and signs of badgers foraging and commuting were recorded towards the north and centre of the Site. Prior to mitigation, the construction works have the potential to cause loss of foraging habitat. Therefore, badgers are included in the assessment presented in this chapter.

Receptor	*Value*	*Rationale*
Barn owl	Local	A single barn owl was recorded foraging within the Site. Prior to mitigation works the Proposed Scheme has the potential to cause loss of foraging habitat. Therefore, barn owl is included in the assessment presented in this chapter.
Birds (wintering and breeding)	Local	A concentration of red and amber listed species was recorded within the central rough tussocky grassland/scrub in the centre of the Site bordering the railway line. The arable fields and associated network of hedgerows, ditches and grass margins provide foraging opportunities for farmland birds and birds of prey. Prior to mitigation works the Proposed Scheme has the potential to cause a loss of foraging habitat for these species. Therefore, birds are included in the assessment presented in this chapter.
Great crested newt	Currently negligible – likely to change depending on updated survey findings	Initially, no suitable waterbodies were recorded within the Site. One pond recorded within 500m of the Site scored a rating of 'below average' in the HSI assessment. However, due to a survey undertaken by HS2, it is believed that this pond supports great crested newts. Therefore, great crested newts must therefore be considered within this assessment once further survey data is collected. The assessment on great crested newts will therefore be updated once survey data is available. This will be presented in an appendix of this chapter, which will be submitted during the planning application's determination period.
Otter	Negligible	No signs of otter were recorded during the surveys. Therefore, otters have not been considered further in this assessment. An update survey will be undertaken in spring 2020. The assessment will be updated if findings differ from the initial survey.
Reptiles	Negligible	No reptiles were recorded during the surveys. Therefore, reptiles have not been considered further in this assessment. Update surveys will be undertaken in spring 2020. The assessment will be updated if findings differ from the initial survey.
Water vole	Negligible	No signs of water vole were recorded during the surveys. Therefore, water vole was not been considered further in this assessment. An update survey will be undertaken in spring 2020. The assessment will be updated if findings differ from the initial survey.

8.5 Potential Effects

8.5.1 The key potential effects on ecological receptors that have been considered are:

- Direct loss of wildlife habitats through land take;
- Severance, where the Proposed Scheme may create a barrier and divide existing habitats or wildlife corridors;
- Killing of individual animals once operational;
- Interference to wildlife from new structures, such as bridges or gantries;
- Disturbance to wildlife from new lighting; and
- Temporary construction disturbance.

8.5.2 The following potential effects on ecological receptors have not been considered further in this section:

- Disruption to the local hydrology, as otter and water vole were not recorded within the Site;

- Pollution from road run-off, as no habitats sensitive to pollution were recorded within the Site;
- Air pollution from traffic flows, as no habitats or designated sites sensitive to pollution were recorded within or adjacent to the Site; and
- Spray from roads (salt), as no habitats sensitive to spray from roads were recorded within the Site.

8.6 Design, Mitigation and Enhancement Measures

8.6.1 Potential effects on ecological receptors will be avoided, prevented, reduced or offset through design and / or management by measures for the construction and operational phases.

Construction Phase

8.6.2 Embedded measures to reduce impacts during the construction phase are contained within the Outline CEMP and include the following:

- Following best practice methods as outlined in the Environment Agency's Pollution Prevention Guidance set out in PPG5 (Ref. 8-33), PPG1 (Ref. 8-34) and PPG6 (Ref. 8-35);
- Avoiding works at night to avoid noise, light and disturbance impacts at night;
- Measures to minimise the production of, and dispersal of any particulates such as dust;
- Secure waste storage and appropriate management;
- Commitments to maintain all plant in accordance with manufacturer's requirements;
- Storage of fuel securely;
- Any re-fueling of vehicles to be undertaken in designated areas with appropriate spill control measures and equipment in place;
- Education of workers on environmental matters, including ecological receptors within the Site and their sensitivity;
- Specification of a procedure for pollution incidents, including making spill kits available on Site;
- Protection of nesting birds through timing of vegetation clearance works or ecological survey to determine the absence of nesting birds prior to vegetation clearance;
- Precautionary felling of trees identified as having a suitability to support roosting bats under supervision of a suitably qualified ecologist and using hand tools;
- Avoiding directional lighting on any retained trees identified as being suitable to support roosting bats, and not undertaking works within 10m of these trees;
- Implementation of a construction lighting strategy that avoids directional lighting on bat foraging and commuting routes;
- Production of a Tree and Hedgerow Protection Plan which will be followed throughout the construction phase, in particular with regard to black poplar trees; and
- Mitigation of impacts on wild mammals by covering of all deep holes and trenches overnight and/or the provision of planked escape routes for any trapped wildlife. In addition, any liquids held on-site will be stored in a secure lock-up. Excavations will be visually checked each morning for the presence of wildlife.

Design Measures

8.6.3 The design of the Proposed Scheme has been developed with consideration of ways to minimise the effects on ecology. The following receptor-specific measures were identified and incorporated into the design of the Proposed Scheme:

Hedgerows

8.6.4 With input from ecology, the landscape design includes linear tree and shrub planting on either side of the road link, which will contribute to restoring severed ecological corridors across the Site as a result of hedgerow removal. In addition to this, new hedgerows will be created that connect to existing habitat within the landscape in order to compensate for the loss of ecological connectivity as a result of the Proposed Scheme.

Bats

8.6.5 Hedgerows and grassland habitats, including field margins have been retained within the landscape design wherever possible and any lost hedgerows or field margin habitats will be replaced within the Site.

8.6.6 Where the Proposed Scheme intersects existing hedgerows, tall tree and scrub planting is incorporated for both barn owl and bats. This aims to encourage bats to fly higher over the road by using tree planting to create a flight line above the traffic.

8.6.7 The proposed road bridge crossing the railway line has been designed to be sufficiently long enough to enable a north-south vegetated corridor to be maintained under the new bridge, avoiding the severance of bat flight lines and foraging habitat. As bats are known to roost within bridges (Ref. 8-38), it is assumed that bats will utilise the underpass rather than cross over the road. The Site's green infrastructure has been designed to provide linear habitat either side of the road, to funnel bats along the east-west corridor and encourage passage beneath the bridge.

8.6.8 In the east of the Site, at the proposed roundabout junction with the A413 Wendover Road, the landscape design includes new hedgerow planting to provide a continuation of the hedgerow along the northern boundary of the Site, to encourage bats to cross the A413 Wendover Road, north of the proposed roundabout.

8.6.9 Vegetation either side of the railway has been maintained where possible, to encourage bats to fly under the proposed bridge and maintain this existing commuting route.

Badgers

8.6.10 The loss of hedgerows, scrub and rough grassland has been avoided where possible. Where this is not possible, suitable badger foraging habitat has been created within the Site boundary to the north and south of the new road. The focus of this is the retention and enhancement of the north/south corridor adjacent to the west of the railway line in order for badgers to avoid crossing the Proposed Scheme and to maintain connectivity across the landscape for badger.

Access has been maintained for badger from north to south and vice versa in the form of a green corridor adjacent to the railway line under the proposed bridge. Species-rich grassland will be created alongside existing scrub to allow for landscape permeability and movement of animals such as badgers. Data collected during the update survey scheduled for spring 2020, will aim to identify frequently runs and commuting pathways, which will be used to identify the need for further wildlife crossings during detailed design.

Birds (wintering and breeding birds, including barn owl)

8.6.11 The loss of rough grassland, arable fields and the network of ditches and hedgerows has been avoided where possible. Where this was not possible, a like-for-like replacement of any habitats lost as a result of the Proposed Scheme has been undertaken in the form of hedgerows and woodland planting adjacent to the Proposed Scheme. The rough grassland forming a north-south corridor has been maintained underneath the proposed bridge.

8.6.12 In order to compensate for the loss of foraging habitat and severance of flight lines for barn owl between the north and south of the Site, targeted landscaping and planting have been incorporated into the road design plans. This includes closely spaced planting of tree, hedgerows and/or shrub lines of a specified height approximately 3-4m from both sides of the link road; thus, forcing passing barn owls to fly higher when crossing the road. This mitigation in turn will provide benefits for breeding and nesting birds along with other wildlife, such as commuting and foraging bats, nesting birds and terrestrial invertebrates.

8.6.13 In addition, the proposed road bridge crossing the railway line has been designed to be sufficiently long enough to enable the passage (flight lines) of barn owl (as well as bats), to be maintained under the new bridge. The proposed road bridge crossing cuts the central rough tussocky grassland/scrub habitat in the centre of the site at right angles and if a solid bridge, would totally severe this habitat. However, with ecological input into the design process, this important impact was built in and the bridge span is now being designed to be sufficiently long enough, aiming to maintain a green corridor underneath the span, to allow barn owl (and bats) to maintain flying north/south and avoiding severance of this valuable habitat. Although barn owls are likely to prefer flying over roads, barn owl pellets and roosts have been found beneath bridges (Ref. 8-39). The vegetation proposed east-west along the road will provide suitable flight paths to funnel barn owls to the underpass.

Great crested newts

8.6.14 Design measures relating to great crested newts will be considered once the updated great crested newt survey data is available.

Operational Phase

Bats

8.6.15 The outline lighting plan associated with the Proposed Scheme has been designed to minimise any impact on bats (see ***ES Volume 2: Appendix 2B***) in line with the best practice guidelines of the Bat Conservation Trust and Institute of Lighting Engineers (Ref. 8-37). Column locations have been considered to prevent them from being located in areas of bat activity, and the luminaires selected have the lowest acceptable light outputs, achieving the target light levels without requiring the use of shields. In addition, lanterns will be mounted at 0° tilt, meaning the upward light spill is virtually zero. Lighting columns around exit roads on the proposed roundabouts will be 10m tall, rather than 12m to reduce light spill. Cycle path lighting will comprise solar stud lighting or similar with ‘bat hoods’ to avoid upward light spill. Solar stud lights will be in the warm colour spectrum and will be low intensity, with 0 lux emitted at a distance of 1m from each light. The north-south vegetated corridor maintained under the proposed road bridge will be unlit. These features will be incorporated into the detailed design.

8.7 Assessment of Likely Significant Effects

Hedgerows

Construction

8.7.1 Of the 15 hedgerows surveyed, four were species-rich and the remaining species-poor. None were classified as ecologically ‘Important’ in accordance with the guidance outlined in the Hedgerow Regulations (1997).

8.7.2 It is anticipated that nine hedgerows will require complete or partial removal as a result of the Proposed Scheme.

8.7.3 All native hedgerows (including species poor ones) are listed under Section 41 of the NERC Act (2006) and are a Local Biodiversity Action Plan habitat. Hedgerow removal must be granted by the LPA through planning permission. The loss or partial removal of hedgerows is considered to be a low magnitude impact on a feature of local importance, with a resulting **minor** adverse effect, which is considered to be not significant.

Protected and/or Otherwise Notable Species

Bats – Roosting

Construction

8.7.4 No bat roosts were recorded within the Site; however as noted in Paragraphs 8.4.15 to 8.4.187, there are 11 trees within and adjacent to the Site that are suitable to support roosting bats. As set out in the Outline EMP (***ES Volume 2: Appendix 2A***), these trees will be felled using a precautionary felling method under the supervision of an ecologist. If these trees are retained, directional lighting will be avoided, and no works will be undertaken within 10m of the tree.

8.7.5 The removal of suitable bat roosting habitat will be a low magnitude of impact on a feature of regional importance, with a resulting **minor** adverse effect, which is not considered to be significant.

Bats – Commuting/Foraging

Construction

8.7.6 Commuting and foraging bats were recorded throughout the Site, with at least seven individual species recorded. The Proposed Scheme will result in the loss or fragmentation of hedgerows and grassland habitats within the Site, which is likely to fragment bat commuting and foraging routes. Until new planting has matured, the fragmentation of bat foraging and commuting habitat during construction will result in a medium magnitude of impact on a feature of regional importance, with a resulting, **moderate** adverse effect which is considered to be **significant**.

8.7.7 There is the potential for construction lighting to affect bat foraging or commuting routes. A lighting strategy during construction will avoid direct lighting onto these areas, as outlined in Section 8.6. The effect of lighting on bat foraging and commuting routes would result in a low magnitude of impact on a feature of regional importance, with a resulting **minor** adverse effect on the conservation status of the bat assemblage that is considered to be temporary and not significant.

Operation

8.7.8 The loss or fragmentation of hedgerows and grassland habitats within the Site is likely to fragment bat commuting and foraging routes. However, the landscape planting and retention of a wide green corridor under the new road enable bats to fly along the road embankment sides (at a safe distance) and fly under the new bridge, providing safe passage, without risk of traffic strike. This will result in a low magnitude of impact on a feature of regional importance with a resulting **minor** adverse effect, which is considered to be not **significant**.

8.7.9 Operational lighting could affect bat foraging or commuting routes. Light that spills onto bat commuting routes can result in bats not using a commuting route. This can consequently fragment the network of commuting routes available to bat species. The lighting strategy for the Proposed Scheme avoids direct lighting on to these areas and uses luminaires that achieve the lowest acceptable light outputs, with column lighting achieving the target light levels without requiring the use of shields and with the use of solar stud lighting or similar with ‘bat hoods’ to reduce upward light spill. Therefore, this is a low magnitude of impact on a feature of regional importance with a resulting **minor** adverse effect, which is considered to be permanent and not significant.

Badger

Construction

8.7.10 No setts were recorded within the Site; however, badger and signs of badgers foraging and commuting within the Site were recorded towards the north and centre of the Site, including along the western railway embankment.

8.7.11 Prior to any mitigation, the construction works have the potential to cause loss of foraging habitat where sections of hedgerows and/or scrub and rough grassland habitat are removed. As outlined in Paragraph 8.6.10 the landscape design retains the rough grassland habitat, creating a north-south corridor under the proposed road bridge. Therefore, the potential loss of badger foraging habitat is a low magnitude of impact on a feature of local importance with a resulting **negligible** adverse effect, which is not considered to be significant.

Operation

8.7.12 Although very unlikely with the designed in mitigation of the retention of the 'green' corridor passing under the new road to maintain connectivity of badger foraging areas, the part severance of these habitats may result in badgers crossing the Proposed Scheme, once the road is operational, creating a risk of badger fatalities due to vehicle strikes. Even with much of the retained north/south corridor in place there remains a small risk of badger fatalities. This is considered to be a medium magnitude of impact on a feature of local importance with a resulting **negligible** adverse effect, which is not considered to be significant. Nonetheless, additional wildlife crossing solutions will be considered within detailed design, as will potential exit points within the road's sound barriers to enable animals to escape if they become trapped upon the road.

Birds

Wintering birds

Construction

8.7.13 The arable fields and existing hedgerow network are of value to wintering birds. Wintering birds identified within the Site would be displaced by any loss of arable habitats. The landscape design includes replacement similar habitat and therefore this is a low magnitude of impact on a feature of local importance with a resulting **negligible** adverse effect, which is not considered to be significant.

Breeding birds

Construction

8.7.14 The loss of suitable habitat for breeding birds including arable fields and their associated network of hedgerows, ditches and grass field margins may reduce breeding opportunities for the species recorded within the Site, including amber and red listed birds. However, the landscape design includes replacement habitat or a similar nature and therefore this is a low magnitude of impact on a feature of local importance with a resulting **negligible** adverse effect, which is not considered to be significant.

Barn owl

Construction

8.7.15 The loss of rough grassland and arable field margin habitat within the Site will reduce foraging opportunities for barn owl. However, targeted landscaping and planting is incorporated in to the landscape design and the proposed road bridge crossing the railway has been designed to allow passage of barn owl to be maintained under the new bridge. Therefore, this is a low magnitude of impact on a feature of local importance with a resulting **negligible** adverse effect, which is not considered to be significant.

8.8 Mitigation and Monitoring Required

8.8.1 The management regimes and monitoring for habitats and nesting features are outlined in detail within the Landscape and Ecology Management Plan (LEMP) (***ES Volume 2: Appendix 2C***). The management prescriptions outlined within the LEMP are intended to cover the management and maintenance of the landscape and ecology scheme for the first 5 years following the handover of the works.

Mitigation and monitoring during the construction phase

Hedgerows

8.8.2 Hedgerows will be retained where possible. However, where hedgerows are to be lost these will be replaced within the Site or another appropriate location, as outlined in Section 8.6. Retained hedgerows within the Site will be strengthened and enhanced, including improving species diversity and addressing any gaps within hedgerows. A variety of appropriate, locally sources native tree and shrub species will be planted between October and March. Full details of hedgerow management and maintenance is outlined within the LEMP (***ES Volume 2: Appendix 2C***).

Bats

Roosting bats

8.8.3 The removal of trees with a suitability to support roosting bats will result in a loss of suitable roosting habitat. Therefore, replacement roosting habitat will be provided in the form of at least two bat boxes. These will be placed on retained trees within the Site at a suitable distance from the Proposed Scheme. Trees T62 and T69 shown on Drawing 60535364-DET-LSC-006 (see Appendix B of ***ES Volume 2: Appendix 2C***) are considered suitable locations for bat roost boxes.

Foraging/commuting bats

8.8.4 Replacement habitats have been designed and managed as part of the ecological mitigation package, to maximise foraging opportunities for bat species through the creation of grassland with a sympathetic management regime. Tree and scrub lines have been designed to encourage bat movement to the crossing beneath the bridge or push bats to a safe height above the road to allow safe passage across.

Birds

8.8.5 In addition to the replacement of suitable habitats within the Site through the landscape design, bird nest boxes will be provided, with a minimum of 15 of various shapes and sizes for a range of different species. It is recommended that ten standard bird nest boxes with circular holes and five nest boxes suitable for common nesting birds such as robin, wren and starling are provided. These should be evenly distributed across the Site with several boxes placed within areas which support existing trees. This includes trees T48, T50, T62 and T69, as well as any suitable trees found within the habitat defined as 'Linear belts of shrubs and trees' shown on Drawing 60535364-DET-LSC-006 (see Appendix B of ***ES Volume 2: Appendix 2C***). All boxes should be orientated between north and east unless shaded from direct sunlight.

Mitigation and monitoring once the Proposed Scheme is complete and operational

Hedgerows

8.8.6 In order to maintain the enhancement of hedgerows, a five-year monitoring and management programme will be implemented post-construction, including the following:

- Weed management using selective herbicides or low fertility mulch;
- Litter, rubbish and debris removal;
- The use of protective fencing, such as rabbit fencing, to prevent grazing damage; and

- Trimming the hedge each autumn until the required height is reached (minimum of 1.4m).

8.9 Residual Effects

8.9.1 A summary of residual effects on ecological receptors and their significance is provided in Table 8-16.

Table 8-16 Summary of residual effects

Description of effect	*Importance of receptor*	*Magnitude of change (incorporating environmental design and management)*	*Classification of effect and statement of significance (incorporating environmental design and management)*	*Mitigation and monitoring*	*Residual effect and statement of significance (incorporating mitigation and monitoring)*
Construction					
Loss or partial removal of hedgerows	Local	Low	Minor adverse Not significant	Hedgerows to be maintained as part of a five year monitoring and maintenance programme to be implemented post-construction.	Negligible Not significant
Removal of suitable bat roosting habitat	Regional	Low	Minor adverse Not significant	Provide at least two bat boxes as replacement roosting habitat.	Negligible Not significant
Removal and fragmentation of bat commuting and foraging habitat	Regional	Medium	Moderate adverse Significant	Manage replacement habitat to maximise foraging opportunities for bat species.	Minor adverse Not significant
Construction lighting affecting bat foraging or commuting routes	Regional	Low	Minor adverse Not significant	None beyond the embedded mitigation described in Section 8.6.	Minor adverse Not significant
Loss of badger foraging habitat	Local	Low	Negligible Not significant	None beyond the embedded mitigation described in Section 8.6.	Negligible Not significant
Loss of wintering bird habitat	Local	Low	Negligible Not significant	None beyond the embedded mitigation described in Section 8.6.	Negligible Not significant

Description of effect	*Importance of receptor*	*Magnitude of change (incorporating environmental design and management)*	*Classification of effect and statement of significance (incorporating environmental design and management)*	*Mitigation and monitoring*	*Residual effect and statement of significance (incorporating mitigation and monitoring)*
Loss of breeding bird habitat	Local	Low	Negligible Not significant	Provision of bird nest boxes and species that can provide a food source for birds.	Negligible Not significant
Loss of barn owl foraging habitat	Local	Low	Negligible Not significant	None beyond the embedded mitigation described in Section 8.6.	Negligible Not significant
Operation					
Bat fatalities due to vehicle strikes as a result of loss or fragmentation of hedgerows and grassland habitats within the Site fragmenting bat commuting and foraging routes	Regional	Low	Minor adverse Not significant	Manage replacement habitat to maximise foraging opportunities for bat species.	Negligible Not significant
Operational lighting affecting bat foraging and commuting routes	Regional	Low	Minor adverse Not significant	None beyond the embedded mitigation described in Section 8.6.	Minor adverse Not significant
Badger fatalities due to vehicle strikes	Local	Medium	Negligible Not significant	None beyond the embedded mitigation described in Section 8.6.	Negligible Not significant

Likely Significant Environmental Effects

8.9.2 No likely significant effects on Ecology and Nature Conservation have been identified with regard to the Proposed Scheme.

8.10 Cumulative Effects

8.10.1 A review of the schedule of cumulative developments agreed with BCC was undertaken, and it was identified that not all of the cumulative schemes were considered relevant in terms of ecological effects due to factors of distance, a lack of connectivity and lack of any functional linkage between those developments and the Proposed Scheme.

8.10.2 The following schemes have been considered as being relevant in considering the potential for ecological cumulative effects Further detail on these schemes is contained within the schedule provided in ***ES Volume 2: Appendix 4A*** and is not repeated here:

- Within the Vale of Aylesbury Local Plan (proposed submission 2017):
  - 'South Aylesbury'; immediately adjacent to the north and south of the Proposed Scheme;
  - 'South-west Aylesbury'; adjacent to the west of the Proposed Scheme; and
  - 'Aylesbury south of A41', adjacent to the east of the Proposed.
- Land At Thornbrook House & Roylands, Risborough Road, Stoke Mandeville (16/04243/AOP);
- Land Rear of Eskdale Rd & Station Rd, Stoke Mandeville (16/02673/APP);
- Land East of Lower Road, Stoke Mandeville (15/04341/AOP);
- Land North of Aston Clinton Rd, Weston Turville (15/03806/AOP & 18/01277/ADP);
- Land South of Marroway, Weston Turville (16/03542/AOP);
- Land Off Lower Road, Stoke Mandeville (16/04608/AOP & 18/00913/ADP);
- Land At Lower Road Stoke Mandeville Buckinghamshire (16/00448/AOP & 17/01221/ADP);
- NHS Trust, Stoke Mandeville Hospital, Mandeville Road, Aylesbury (07/00778/APP);
- Land West Of Wendover Road Stoke Mandeville Buckinghamshire (16/04238/AOP);
- Southern Link Road (and Hampden Fields access) (16/00424/AOP);
- Land Between Wendover Rd & Aston Clinton Rd, Weston Turville (Hampden Fds) (16/00424/AOP);
- Land at South West Aylesbury, Aylesbury (18/04346/AOP); and,
- Land to East of Lower Road, Stoke Mandeville (19/01628/AOP).

Cumulative Effects during Construction

8.10.3 There is the potential for cumulative effects on habitats and protected and/or otherwise notable species from noise, light and dust pollution if construction works are undertaken during overlapping timescales. However, with good practice construction environmental management plans in place, it is considered that cumulative effects on these receptors are unlikely to be significant.

8.10.4 There is also the potential for cumulative effects on habitats and protected and/or otherwise notable species through habitat loss within adjacent schemes. 'South Aylesbury' is located immediately adjacent to the north and south of the Proposed Scheme. A loss of hedgerows, trees and arable fields within the 'South Aylesbury' and 'Land to East of Lower Road' schemes are likely to impact on the same populations of species, such as nesting birds due to the loss of these habitats during the construction of the Proposed Scheme. The construction of the 'South-west Aylesbury', 'Land at South West Aylesbury' and 'Aylesbury south of the A41' schemes are also likely to impact on the wider ecological network. Mitigation has been built into the Proposed Scheme to assist in alleviating wider cumulative impacts, with the retention and enhancement of the north south corridor adjacent to the west of the railway line in combination with the planting up of green corridors east/west along both the northern and southern perimeters of the Proposed Scheme. Part of the land present within 'Land to East of Lower Road' was originally partially included within the railway corridor habitat enhancement for the Proposed Scheme. Under the final proposals it is no longer part of the Proposed Scheme. Despite this, the proposed habitat creation and enhancement for the 'Land East of Lower Road' proposed development will contribute to habitat connectivity along the railway corridor as originally intended. In addition, there will be a cumulative increased loss in suitable foraging habitat for barn owl and badger.

Cumulative Effects Once the Proposed Scheme is Completed and Operational

8.10.5 There is the potential for cumulative effects on light-sensitive species once the Proposed Scheme is completed and operational. The 'South Aylesbury' development includes provision for housing and a school; 'Land to East of Lower Road' development similarly includes provision for housing. It is therefore assumed that these developments are likely to include street lighting. The cumulative increase in lighting with the Proposed Scheme and the 'South Aylesbury' scheme may impact on light-sensitive species recorded within the Site, including bats. As such, and as undertaken as part of this scheme, all other schemes within this area, where relevant, will include provision for biodiversity to minimise these impacts. All developments are responsible for minimising light spill and all developments will include suitable mitigation such as low lumen lighting, directed and shielded low spill lighting and the planting of 'green' and ecological corridors to both shield and protect species such as bats, but also to maintain and enhance the ecological networks across the whole of South Aylesbury, including to link in with that provided via the Proposed Scheme.

8.11 References

Ref. 8-1 Her Majesty's Stationary Office (HMSO), (2017) The Conservation of Habitats and Species Regulations 2017. Available: http://www.legislation.gov.uk/uksi/2017/1012/contents/made [Accessed: 09/10/2019]

Ref. 8-2 HMSO (1981) Wildlife and Countryside Act 1981. Available: https://www.legislation.gov.uk/ukpga/1981/69 [Accessed: 09/10/2019]

Ref. 8-3 Council of Europe, (1979) 'Convention on the Conservation of European Wildlife and Natural Habitats. Bern, 19.IX.1979'. Council of Europe. Available: https://rm.coe.int/1680078aff [Accessed: 09/10/2019]

Ref. 8-4 Council of Europe, (1979) Council Directive of 2 April 1979 on the Conservation of Wild Birds 79/409/EEC. Office for Official Publications of the European Communities. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al28046 [Accessed: 09/10/2019]

Ref. 8-5 HMSO, (2006) Natural Environment and Rural Communities Act 2006. Available: https://www.legislation.gov.uk/ukpga/2006/16/contents [Accessed: 09/10/2019]

Ref. 8-6 HMSO, (2000) Countryside and Rights of Way Act 2000. Available: http://www.legislation.gov.uk/ukpga/2000/37/contents [Accessed: 09/10/2019]

Ref. 8-7 HMSO (1992) Protection of Badgers Act 1992. Available: https://www.legislation.gov.uk/ukpga/1992/51/contents [Accessed: 09/10/2019]

Ref. 8-8 Department of Communities and Local Government (DCLG), (2019). National Planning Policy Framework (NPPF), Available: https://www.gov.uk/government/publications/national-planning-policy-framework--2 , [Accessed: 09/09/2019].

Ref. 8-9 Department for Communities and Local Government (2014 and subsequent updates) Planning Policy Guidance (PPG), Available: https://www.gov.uk/guidance/natural-environment, [Accessed: 09/09/2019].

Ref. 8-10 Aylesbury Vale District Council (2004). Local Plan. Available: https://www.aylesburyvaledc.gov.uk/sites/default/files/page_downloads/AVDLP-Full-Version.pdf [Accessed: 09/10/2019]

Ref. 8-11 Vale of Aylesbury (2017). Local Plan Proposed Submission November 2017. Available: https://www.aylesburyvaledc.gov.uk/section/vale-aylesbury-local-plan-valp-2013-2033 [Accessed: 09/10/2019]

Ref. 8-12 Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) (2014). Biodiversity and Planning Guidance Document. Available:

https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/countryside/naturalenvironment/Wholedocument.pdf [Accessed: 09/10/2019]

Ref. 8-13 Buckinghamshire and Milton Keynes Biodiversity Partnership (2015). Forward to 2020: Buckinghamshire and Milton Keynes Biodiversity Action Plan. Available: https://www.aylesburyvaledc.gov.uk/sites/default/files/page_downloads/CD.SLB_.004%20Bucks%20and%20Milton%20Keynes%20Biodiversity%20Action%20Plan%20Forward%20to%202020%20%28BMKNEP%20Jan%202015%29.pdf [Accessed: 09/10/2019]

Ref. 8-14 Department for Environment, Food and Rural Affairs (DEFRA). Multi-Agency Geographic Information for the Countryside (MAGIC). Available: http://magic.defra.gov.uk/MagicMap.aspx [Accessed: 09/10/2019]

Ref. 8-15 Buckinghamshire and Milton Keynes Environmental Records Centre (BMERC) (2018). Aylesbury Project, Aylesbury – Stoke Mandeville.

Ref. 8-16 Joint Nature Conservation Committee (2010) Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit. JNCC, Peterborough

Ref. 8-17 Eur-Lex (2016) Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. Accessed: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1417443504720&uri=CELEX:32014R1143 [Accessed: 09/10/2019]

Ref. 8-18 Oldham, R.S., Keeble, J., Swan, M.J.S. & Jeffcote, M. (2000) Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143 – 155.

Ref. 8-19 National Library of Scotland. Map Images. Accessed: https://maps.nls.uk/ [Accessed 09/10/2019]

Ref. 8-20 HMSO (1997). The Hedgerows Regulations 1997. Available: http://www.legislation.gov.uk/uksi/1997/1160/contents/made [Accessed 09/10/2019]

Ref. 8-21 Rodwell, J.S. (2006). NVC User's Handbook. JNCC, Peterborough.

Ref. 8-22 Harris, S., Cresswell, W. and Jeffries, D. (1989). Surveying Badgers. Mammal Society Occasional Publication No 9. Mammal Society, London.

Ref. 8-23 Collins, J. (ed). (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). London: The Bat Conservation Trust

Ref. 8-24 British Standards Institute (2015). BS8596 Surveying for Bats in Trees and Woodlands.

Ref. 8-25 Gillings, S., Wilson, A.M., Conway, G.J., Vickery, J.A., Fuller, R.J., Beavan, P., Newson, S.E., Noble, D.G. & Toms, M.P. (2007). Winter Farmland Bird Survey. British Trust for Ornithology

Ref. 8-26 Marchant, J. (1983). CBC Methodology. BTO.

Ref. 8-27 Gilbert, G., Gibbons, D.W. and Evans, J., (1998); 'Bird Monitoring Methods. A Manual of Techniques of Key UK Species'. RSPB, Sandy

Ref. 8-28 Gent, A. and Gibson, S. (1998). Herpetofauna Workers' Manual. Peterborough, UK. Joint Nature Conservation Committee.

Ref. 8-29 Froglife (1999). Reptile survey: An introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10. Froglife, Halesworth.

Ref. 8-30 Strachan, R., Moorhouse, T. and Gelling, M: 3rd edition (2011) Water Vole Conservation Handbook. Edition 3. The Wildlife Conservation Unit.

Ref. 8-31 Chanin, P. (2003). Monitoring the Otter Lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.

Ref. 8-32 Chartered Institute of Ecology and Environmental Management (2016). Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal. (2nd edn). Winchester: CIEEM

Ref. 8-33 Environment Agency (2008) Works and Maintenance in or Near Water, PPG5

Ref. 8-34 Environment Agency (2001) General Guidance to the Prevention of Pollution. PPG1

Ref. 8-35 Environment Agency (2010) Working at Construction and Demolition Sites. PPG6.

Ref. 8-36 Hinde, D. (2008). Interim Advice Note 116/08. Nature conservation advice in relation to bats. Available: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian116.pdf [Accessed 09/10/2019]

Ref. 8-37 Bat Conservation Trust and Institute of Lighting Engineers (2018). Bats and Lighting in the UK. Bats and the Built Environment Series. Available: https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/ [Accessed 09/10/2019]

Ref. 8-38 Bat Conservation Trust. Bats in Bridges. Specialist Support Series.

Ref. 8-39 Moysi, M., Christou M., Goutner, V., Kassinis, N., Lezekiel, S. (2018) Spatial and temporal patterns in the diet of barn owl (Tyto alba) in Cypress. J. Biol. Res. 25:9.