A12 Chelmsford to A120 widening scheme

TR010060

6.1 ENVIRONMENTAL STATEMENT CHAPTER 9 BIODIVERSITY

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

August 2022

Infrastructure Planning

Planning Act 2008

A12 Chelmsford to A120 widening scheme

Development Consent Order 202[ ]

ENVIRONMENTAL STATEMENT
CHAPTER 9 BIODIVERSITY

Regulation Reference	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010060
Application Document Reference	TR010060/APP/6.1
Author	A12 Project Team & National Highways

Version	**Date**	**Status of Version**
Rev 1	August 2022	DCO Application

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9.1 Topic introduction

9.1.1 This chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) to be provided in the Environmental Statement for the proposed A12 Chelmsford to A120 widening scheme (the proposed scheme) in respect of biodiversity.

9.1.2 This chapter provides an assessment of the likely significant effects of the proposed scheme on biodiversity in accordance with the Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity (Highways England, 2020c). The effects of both construction and operation of the proposed scheme have been assessed.

9.1.3 Biodiversity is concerned with the variety of living organisms and their relationships with each other and their environment. The conservation of biodiversity is paramount in maintaining populations of fauna and flora and the communities which they constitute. In addition, biodiversity is the subject of a wide variety of legislation and policies and therefore is a material consideration within the planning system. Impacts to ecological receptors could constitute an offence under relevant legislation.

9.1.4 This chapter considers the following biodiversity matters:

- Statutory designated sites - sites designated at all levels for nature conservation reasons, including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites, Sites of Special Scientific Interest (SSSIs), national nature reserves (NNRs) and local nature reserves (LNRs)
- Non-statutory designated sites (designated by local authorities under local policy) - local wildlife sites (LWSs) and local road verges
- Notable habitats - habitats of conservation importance such as priority habitats or habitats of principal importance
- Protected and notable species - these include animal and plant species protected by legislation, and species of conservation importance such as priority species or species of principal importance

9.1.5 This chapter is supported by the following figures [TR010060/APP/6.2]:

- Figure 9.1 Biodiversity Designated Sites
- Figure 9.2 Biodiversity Important Habitats
- Figure 9.3 Biodiversity Results for Protected Species Surveys

9.1.6 This chapter is supported by the following appendices [TR010060/APP/6.3] and the Habitats Regulations Assessment (HRA) No Significant Effects Report [TR010060/APP/6.8]:

- Appendix 9.1 Aquatic Ecology Survey Report
- Appendix 9.2 Badger Survey Report
- Appendix 9.3 Barn Owl Survey Report
- Appendix 9.4 Bat Survey Report
- Appendix 9.5 Breeding Bird Survey Report
- Appendix 9.6 Dormouse Survey Report
- Appendix 9.7 Hedgerow Survey Report
- Appendix 9.8 Phase 1 Habitat Survey Report
- Appendix 9.9 Reptile Survey Report
- Appendix 9.10 Riparian Mammal Survey Report
- Appendix 9.11 Terrestrial Invertebrate Survey Report
- Appendix 9.12 Wintering Bird Survey Report
- Appendix 9.13 Great Crested Newt Survey Report
- Appendix 9.14 Biodiversity Net Gain Report
- Appendix 9.15 Assessment of Air Quality Impacts on Ecology Receptors
- Appendix 9.16 Draft Bat Licence
- Appendix 9.17 Draft Badger Licence

9.2 Competent expert evidence

9.2.1 This assessment has been undertaken and reported by a team of competent biodiversity specialists. The competent expert responsible for the assessment is an Associate Director of Ecology BSc, MSc, full member of the Chartered Institute of Ecology and Environmental Management (CIEEM), and Chartered Environmentalist with over 15 years' experience of undertaking biodiversity impact assessments for major infrastructure and linear projects, including highways, for which the process of EIA (Environmental Impact Assessment) has been required.

9.3 Stakeholder engagement

9.3.1 Details of stakeholder engagement undertaken as part of this assessment are described in Table 9.1.

Table 9.1 Stakeholder engagement for biodiversity aspect

Stakeholder	Details
Natural England	Meeting held 27/01/2020 • Call to discuss the district level licensing (DLL) process for great crested newts (GCN) *Triturus cristatus*. Following the call, information was submitted to Natural England to begin determining where breeding ponds would be affected and the requirements for new offsite habitat creation.
Natural England	Discretionary Advice Service meeting held 03/09/2020 • Meeting to discuss the proposed scheme design, programme for ecological assessments and findings of ecological assessments undertaken. Natural England confirmed the broad suitability of the assessment and survey approach. A full written summary of methods, including any deviations from best practice, was issued to Natural England for review. • Natural England raised that no bat surveys were undertaken in April (due to Covid-19) however, this is not considered likely to have significantly constrained the baseline (see Appendix 9.4 of the Environmental Statement [TR010600/APP/6.3]). Natural England also suggested winter activity surveys, but in the absence of roosts for rare bat species and considering the habitat types present (predominantly arable) it was assessed that the standard level of survey as per best practice guidance was appropriate for the proposed scheme. • Natural England advised that the HRA should consider air quality impacts from the affected road network (ARN, i.e. all roads that trigger the traffic screening criteria and adjoining roads within 200m).
Natural England	Discretionary Advice Service meeting held 26/11/2020 • Summary of survey findings since the previous meeting. • Set out general principles for mitigation, including options for artificial badger *Meles meles* setts. Natural England confirmed the broad suitability of the mitigation approach and provided specific comments on the proposed locations for two artificial badger setts. • Discussion on Natural England's high-level comments on the Environmental Scoping Report (Highways England, 2020a). • Natural England provided advice on monitoring an otter *Lutra lutra* holt to determine likely impacts. • Natural England submitted comments on the proposed survey methodologies. Comments are summarised below: - Bats: Applicant should describe how constraints relating to missed surveys in April were mitigated and provide justification for not undertaking winter bat activity surveys. - Hazel dormouse *Muscardinus avellanarius*: Applicant should clearly state the sampling methods used, and reasons for any limitations, also stating what impacts this might have on the overall survey.

Stakeholder	Details
Natural England	Discretionary Advice Service meeting held 18/02/2021 • Summary of survey findings since the previous meeting. • Discussed outcomes of the assessment to be reported in the Preliminary Environmental Information Report (PEIR). • Discussed Natural England's Scoping Opinion (Planning Inspectorate, 2021) comments. • Further discussion on options for badger artificial sett locations. Further assessment was undertaken in early 2021 to identify the most suitable locations. • Requested input to the proposed river realignments and Natural England confirmed that there were no specific comments.
Essex Wildlife Trust	Meeting held 01/12/2020 • Described the proposed scheme design and programme, and summarised findings of ecological assessments undertaken. • Essex Wildlife Trust confirmed the broad suitability of the proposed approach. • Discussed identifying groundwater dependent terrestrial ecosystems (GWDTEs), i.e. wetland habitats which rely on groundwater flows to persist, and mitigation for impacts to Whetmead LNR. • Presented proposed borrow pit locations and discussed options for restoration. Essex Wildlife Trust proposed natural water bodies and grassland habitats as part of borrow pit restoration. • Discussion on potential enhancements. • Essex Wildlife Trust discussed findings of a population of dormice approximately 8km (measured along the A12) to the south of junction 19 (Boreham interchange), south of Chelmsford, within a wooded and scrubby road verge south of Galleywood. However, there is limited connectivity between the recorded dormouse population to the south of this junction and the proposed scheme, in particular across the River Chelmer.
Environment Agency	Meeting held 19/01/2021 • Geomorphology and water quality specialists introduced aspects of the EIA in relation to the Water Environment (Water Framework Directive) Regulations 2017. It was agreed to arrange a follow-up meeting to discuss aquatic ecology.

Stakeholder	Details
Environment Agency	Meeting held 10/02/2021 • Presented findings of baseline surveys undertaken in 2020. The Environment Agency agreed with the survey findings and agreed that white-clawed crayfish *Austropotamobius pallipes* are likely absent from the study area. • Requested confirmation regarding the biodiversity river metric and the Environment Agency confirmed that the scope of the biodiversity river metric should relate to the proposed scheme's aim for no net loss to biodiversity and be proportional. • Provided an overview of otter survey results, details regarding construction of new culverts, and details on minor realignments of Rivenhall Brook, Roman River and Domsey Brook. The Environment Agency confirmed that they would prefer open span bridges to culverts.
Essex Wildlife Trust	Meeting held 25/02/2021 • Summary of survey findings since the previous meeting. • Discussed water voles, including options for enhancements within the proposed scheme and surroundings. Also discussed other potential improvements which the proposed scheme could work with Essex Wildlife Trust to deliver.
Essex County Council	Meeting held 18/03/2021 • Presented findings of baseline surveys undertaken in 2020, likely impacts and proposed mitigation. • Discussed potential mitigation and improvements relating to Whetmead LNR and options for borrow pit restoration.
Essex Wildlife Trust and Local Planning Authorities	Meeting held 29/04/2021 • Briefing session to present findings of the PEIR to local planning authorities.
Environment Agency	Meeting held 16/09/2021 • Presented current watercourse crossing and realignment designs. • The Environment Agency considered the current biodiversity and hydromorphology mitigation and enhancements were not sufficient given the scale of the proposed scheme and the pre-existing issues with the impacts of the A12 on watercourses.
Witham Town Council	Meeting held 23/09/2021 • Presented likely impacts on Whetmead LNR. • Discussed potential mitigation and improvements relating to Whetmead LNR, including the potential for Shelley's Meadow to provide habitat links to Whetmead LNR. • Site visit of Witham River Walk, Shelley's Meadow and Whetmead LNR.

9.3.2

Stakeholder	Details
Natural England	Issued a letter stating Natural England was in agreement with the HRA Stage 1 Screening Assessment conclusion that no likely significant effects on any sites within the national site network are anticipated, when considered alone or in combination with other plans and projects (letter dated 19/10/21).
Environment Agency	Meeting held 22/11/2021 • Presented current watercourse crossing and realignment designs and received feedback from the Environment Agency. • Proposed construction methodology discussed and received feedback from the Environment Agency. • Discussed consenting and permits that will be required across the proposed scheme.
Witham Town Council	Meeting undertaken 09/03/2022 • Presented likely impacts on Whetmead LNR including loss of habitat within the LNR. • Discussed mitigation proposals relating to Whetmead LNR, including the potential for the proposed scheme to support aspirations that Witham Town Council has, to provide habitat links between Shelley's Meadow, River Walk and Whetmead LNR.
Essex Wildlife Trust and Local Planning Authorities	Meeting held 16/03/2022 Briefing session to present findings of the Environmental Statement to local planning authorities.
Place Services	Meeting held 26/05/2022 Presented a summary of: • Bat survey methods and results, with a focus on barbastelle bats. • Dormouse surveys undertaken and results. • The proposed location of reinstated habitats at the Flagship Biodiversity Site (restored Colemans Farm Quarry).

9.3.2 Table 9.2 identifies the feedback received from the Scoping Opinion (Planning Inspectorate, 2021), on which this chapter is based. The Planning Inspectorate agreed dormouse could be scoped out of the Environmental Statement as implemented in the PEIR (Highways England, 2021). Since production of the PEIR, the Order Limits have increased to include additional land to the east of the River Brain where further dormouse surveys are planned for 2022. As these surveys will not be completed at the time of Development Consent Order (DCO) submission, dormouse has been scoped back into the assessment for the area of the site not surveyed (see Appendix 9.6: Dormouse Survey Report [TR010060/APP/6.3]).

Table 9.2 Scoping Opinion feedback for biodiversity

Stakeholder	Comment	Response
Planning Inspectorate	Agree that Marks Tey Brickpit SSSI, all other SSSIs, NNRs, and invasive species can be scoped out of the Environmental Statement provided reasoning for these decisions is included in the Environmental Statement.	These matters have been scoped out of the assessment as agreed, with the exception of Tiptree Heath SSSI and River Ter SSSI. Reasoning is provided in Section 9.5 of this chapter.
Planning Inspectorate	Dormice can be scoped out of the Environmental Statement provided that sufficient evidence is provided to support this decision.	Dormouse has been scoped out of the Environmental Statement for areas of the site where surveys undertaken in 2017 and 2020 were completed following current best practice guidelines (Bright *et al.*, 2006) as no dormice or evidence of dormice was recorded. There are no dormouse records within 2km of the proposed scheme within the last 10 years, and the recent record to the south of Chelmsford has gaps in connectivity with habitats within the Order Limits. Further details are provided in Appendix 9.6 of the Environmental Statement [TR010060/APP/6.3]. Dormouse is, however, scoped in for the small part of the site not surveyed to the east of the River Blackwater in 2020, prior to the identification of the need to divert the gas main (see Appendix 9.6 TR010060/APP/6.3]).
Planning Inspectorate	The applicant should consider whether baseline information collected in 2017 would still be representative, if not then these data should be updated. The applicant should consult with relevant statutory consultees on baseline data used within assessments.	Feedback on survey methodologies and on the age of baseline data from Natural England is documented within Table 9.1. Table 9.7 (in Section 9.5 of this chapter) summarises the dates in which surveys were undertaken.

Stakeholder	Comment	Response
Planning Inspectorate	The proposed scheme's Order Limits overlap with Whetmead LNR and border Brockwell Meadows LNR and LWS. The Environmental Statement should include an explanation as to why it is necessary for the Order Limits to encroach on and border these sites and effort should be made to agree any site-specific mitigation measures required. Details should be included within the Environmental Statement and secured through the DCO.	Chapter 2: The proposed scheme, of the Environmental Statement [TR010060/APP/6.1] outlines the need for the scheme. Due to the narrow corridor along which the A12 is located close to Whetmead LNR/LWS, there is no alternative but to encroach on the LNR/LWS site boundary. Section 9.10 of this chapter describes detailed mitigation proposals for Whetmead LNR/LWS and how they will be secured. This has been agreed with Witham Town Council (meeting dated 09/03/2022) (see Table 9.1).
Planning Inspectorate	The Environmental Statement should state specific locations and details of mitigation in order to assist with the assessment of effectiveness.	Specific mitigation proposals for all receptors are detailed in Section 9.10 of this chapter and shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].
Planning Inspectorate	The Environmental Statement should detail the assessment to determine ecological impacts arising from any river realignments, which should be agreed upon with the relevant local authority.	Sections 9.9 and 9.11 of this chapter identify the ecological impacts arising from the realignment of the Roman River, Rivenhall Brook and Domsey Brook. Consultation has been undertaken with the Environment Agency (see Table 9.1).
Planning Inspectorate	Any translocation of animals from the site should be described in the Environmental Statement including any identified receptor sites.	Mitigation proposals include the translocation of reptiles. Further details of the proposed mitigation are provided in Section 9.10 of this chapter and receptor sites are shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].
Planning Inspectorate	The invasive species management plan (ISMP) should follow appropriate guidance and the Environmental Statement should state how the ISMP would be secured through the DCO.	The ISMP will be produced by the Principal Contractor and will be secured through the Register of Environmental Actions and Commitments (REAC), which is included in the first iteration Environmental Management Plan (EMP) [TR010060/APP/6.5]. See Section 9.10 of this chapter for further details.
Environment Agency	Existing A12 infrastructure should be improved where possible to mitigate impacts to aquatic ecology as a result of unsympathetic design.	Details on mitigation for aquatic receptors are provided in Section 9.10 of this chapter.

Stakeholder	Comment	Response
Environment Agency	Clear span bridges should be favoured over culverts, however where culverts are used, these should be of suitable design to allow safe passage for wildlife.	Clear span bridges have been considered at all crossings; however, they were not a practicable option for the proposed scheme. New and modified culverts have been designed where practicable to allow safe passage by wildlife under all flow conditions through the provision of mammal ledges above the 1 in 100 year flood level.
Environment Agency	The biodiversity river metric should be used to ascertain impacts on watercourses and what mitigation and enhancement measures are required.	The biodiversity river metric (Defra 3.0) has been used to assess impacts to watercourses, as set out in Section 9.13 of this chapter.
Environment Agency	Attenuation ponds should be designed to be wildlife-friendly, for example with shallow margins and marginal vegetation.	Design of attenuation ponds will be refined at the detailed design stage to ensure they are sympathetic to wildlife.
Environment Agency	Lighting design should be designed to prevent light pollution.	Permanent lighting is to be designed sensitively, such as through the use of horizontally mounted flat glass lanterns, modern light-emitting diodes (LEDs), and designing lighting with zero tilt to produce no upward glare and minimal back light. Design will be carried out in accordance with the latest BS 5489 standard (British Standards Institution, 2020) and National Highways' specifications. The design will also take into consideration guidance notes from the Institution of Lighting Professionals, including Guidance Note 1 for the Reduction of Obtrusive Light (2021) and Guidance Note 8 for Bats and Artificial Lighting (2018).
Environment Agency	SSSIs with connectivity to the proposed scheme through hydrology should be considered in the assessment.	SSSIs with hydrological connectivity to the proposed scheme are identified in Section 9.8 and assessed in Section 9.11 of this chapter.

Stakeholder	Comment	Response
Essex County Council	The proposed scheme should identify and pursue opportunities for securing measurable net gains for biodiversity, rather than aiming for no net loss. The Defra 2.0 metric should be used to help demonstrate that biodiversity net gain (BNG) is achieved.	There is no legal or policy requirement for BNG provision for the proposed scheme. However, the Applicant has sought to maximise biodiversity delivery and the Defra 3.0 metric has been used to calculate BNG. Net loss or gain calculations are summarised within Section 9.13 of this chapter; a separate net gain report is provided in Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3]. Where practicable, the proposed scheme has provided like-for-like replacement of priority habitats. Principles of habitat creation are provided within Section 9.10 of this chapter and are shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].
Essex County Council	Colemans Farm Quarry is a 'flagship' biodiversity site for the Essex Minerals Local Plan 2014 and supported by Supplementary Planning Guidance: Mineral Site Restoration for Biodiversity (June 2016). A comparable site of at least similar size will need to be sought to provide at least an equivalent level of compensation and enhancement to that already permitted.	Mitigation for Colemans Farm Quarry was discussed with Place Services during a meeting on 26/05/2022 to gain agreement on what is proposed (see Table 9.1). It has been agreed that the proposed scheme would only need to mitigate for the area of the restored site which is lost to construction. Areas which can be retained and planted with appropriate habitat would not need to be offset.
Essex County Council	It is not agreed that dormice should be scoped out from further consideration. Further information on how the survey was undertaken and details of habitat assessment are required in order to justify likely absence.	Details of dormouse survey methodology including habitat assessments and results are documented in the dormouse survey report (Appendix 9.6 of the Environmental Statement [TR010060/APP/6.3]). This was presented to Place Services at a meeting on 26/05/2022 prior to submission of the Environmental Statement (see Table 9.1).
Essex County Council	Deviation from the Bat Conservation Trust (BCT) guidelines (BCT, 2016) would not be supported by Essex County Council unless there is certainty of likely impacts on the bat populations at the local level, which would be necessary to support a European Protected Species Mitigation (EPSM) licence needed for the proposed scheme. There is a need for sufficient survey and	National Highways is confident that the data obtained are sufficient to support a draft EPSM licence for bats (and will update the data in order to obtain an EPSM licence, post-DCO consent), and that the data are sufficient to identify significant impacts on bats to inform the Environmental Statement. The survey methodology was discussed with Place Services in a meeting on 26/05/2022 prior to the submission of the Environmental Statement (Table 9.1).

Stakeholder	Comment	Response
	assessment on bats and trees affected by the proposed scheme. It needs to be evidence-led and therefore may not be appropriate for this scheme.	
Natural England	Natural England's main concern regarding European sites is the potential for air pollution and water pollution to indirectly impact the Essex Estuaries SAC, Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Colne Estuary (Mid-Essex Coast Phase 2) SPA from both the construction works and the increased traffic use once the road is operational.	Impacts to the Essex Estuaries SAC, Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Colne Estuary (Mid-Essex Coast Phase 2) SPA have been fully assessed within the HRA No Significant Effects Report [TR010060/APP/6.8]. All sites within the national site network are outside the 200m buffer around the construction and operational ARNs and hence there would be no impacts to the sites through changes in air quality (see Section 9.11 of this chapter). The HRA Stage 1 Screening Report has been submitted to Natural England which has confirmed its agreement with the outcome of the assessment (see Table 9.1).
Natural England	Natural England would encourage ambitions towards environmental net gain. Development provides opportunities to secure net gains for biodiversity and wider environmental gains, as outlined in the National Planning Policy Framework (NPPF) (paragraphs 8, 72, 102, 118, 170, 171, 174 and 175). It is advised to follow the mitigation hierarchy as set out in paragraph 175 of the NPPF and firstly consider what existing environmental features on and around the site can be retained or enhanced. Additionally, consider what new features could be incorporated into the development proposal. Where onsite measures are not possible, offsite measures should be considered.	There is no legal or policy requirement for BNG provision for the proposed scheme. However, the Applicant has sought to maximise biodiversity delivery. Net loss or gain has been calculated using the Defra 3.0 metric and is summarised within Section 9.13 of this chapter. In addition, further detail is provided within the Biodiversity Net Gain report (Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3]).

Stakeholder	Comment	Response
Braintree District Council	The Environmental Scoping Report (Highways England, 2020a) sets out a range of potential ecological mitigation measures. The Council is in agreement that biodiversity mitigation and enhancement measures are of importance, particularly for a scheme of this size. More information is required as to the detail of such measures including location, justification and importantly the long-term management strategy for new or enhanced habitat.	Details of mitigation and enhancement measures, including the location and justification strategies, are included within Section 9.10 of this chapter and shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. Details of long-term management strategies are included within the Landscape and Ecology Management Plan (LEMP), which is an appendix to the first iteration of the EMP [TR010060/APP/6.5].
Braintree District Council	The Environmental Scoping Report (Highways England, 2020a) makes specific mention of tree and hedgerow planting to create linear habitats and provide new connectivity between existing green habitat areas. The proposed scheme is extensively linear by necessity and provides a unique opportunity to carry out the above on a major scale. Again, detailed information is required to understand the applicant's approach to doing this successfully and in a meaningful way. New planting would also need to be quantified against the loss of existing trees and hedgerows, which could be extensive.	Details on the creation of linear habitats are included within Section 9.10 of this chapter. Section 9.13 of this chapter summarises the net loss or gain calculations for the proposed scheme quantified using the Defra 3.0 metric. Further detail is provided within the Biodiversity Net Gain report (Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3]).

9.3.3 The full Scoping Opinion, as well as the Applicant's response regarding how and where comments have been addressed in the Environmental Statement and draft Development Consent Order (DCO), is included within Appendix 5.1 of the Environmental Statement [TR010060/APP/6.3].

9.3.4 Table 9.3 identifies the feedback received from the statutory consultation. All comments raised during the statutory consultation, as well as the Applicant's responses, are included in the Consultation Report [TR010060/APP/5.1].

Table 9.3 Statutory consultation feedback for biodiversity

Consultee	Comment	Response
Chelmsford City Council	There are badger setts in proximity to junction 19 and concern is raised as to how the proposed scheme will seek to avoid mortality of the species during construction and operation. Further clarity is required on the means of mitigation; it is noted that badger proof fencing is proposed but it is unclear how this will be managed and maintained in perpetuity and whether other measures, such as mammal underpasses, are to be considered.	Works at junction 19 would not result in any increased fragmentation of badger setts as the works are limited to improvements or widening of existing infrastructure. Therefore, impacts from mortality during operation are not anticipated. Mitigation for construction impacts is detailed in Section 9.10 of this chapter.
Chelmsford City Council	The current upgrades associated with Beaulieu, particularly new trees and scrub planting, should be carefully considered to ensure its new tree planting is not prematurely lost as a direct result of the proposed scheme.	Where practicable the design has minimised the loss of vegetation across the proposed scheme. Where vegetation loss is unavoidable, mitigation would be provided in the form of compensation habitat so there is no net loss of habitats due to construction of the proposed scheme.
Chelmsford City Council	Drainage features around junction 19 need to be designed to encourage movement of the nearby water vole populations.	A series of ponds and ditches are proposed within an environmental mitigation area to the south of junction 19 providing considerable increase in habitat for the local water vole *Arvicola amphibius* population (see Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]).
Colchester Borough Council	The PEIR could provide greater information on the landscape, green infrastructure or biodiversity features to be lost and how they will be mitigated and compensated for including net gain.	Design changes have been implemented where practicable to avoid impacts to ecological receptors. An approach to maximising biodiversity delivery is being applied to the proposed scheme to ensure it is completed with an overall positive impact on the local natural environment. A summary of BNG calculations is provided in Section 9.13 of this chapter and more detail is included within Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3]. Sections 9.10 and 9.11 of this chapter detail the mitigation proposed for, and residual impacts to, biodiversity features.

Consultee	Comment	Response
Colchester Borough Council	The PEIR does not acknowledge the existence of, or any proposed removal of, numerous sections of hedgerow protected under the Hedgerows Regulations 1997 along the route of the proposed scheme, or under what authority any removal is being proposed.	Section 9.11 of this chapter details the losses of important hedgerows and these are shown on the Retained and Removed Vegetation Plans [TR010060/APP/2.14]. Proposed mitigation is detailed in Section 9.10 of this chapter and shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. DCO consent would provide the authority to remove important hedgerows.
Colchester Borough Council	The PEIR identifies that, at the time of submission, the Defra 2.0 metric was being applied to the proposed scheme, and that the scheme will be seeking net gains for biodiversity. We assume that following the publication of Defra 3.0 metric this will be updated and would encourage a minimum of 10% to be delivered in line with, but more aspirational than, the Environment Bill's requirement for 10%. The Council supports Natural England's encouragement towards environmental net gain not just biodiversity net gains.	The proposed scheme would secure no net loss to biodiversity. Net loss or gain numbers have been calculated using the Defra 3.0 metric and are summarised within Section 9.13 of this chapter. In addition, further detail is provided within Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3].
Colchester Borough Council	The Landscape and Environment Management Plan and Environmental Masterplan need to clearly demonstrate how sites are connected to the road network/corridor and not in fact isolated/fragmented habitat areas.	Details of how mitigation areas are connected to the wider landscape are included in the LEMP, within the first iteration of the EMP [TR010060/APP/6.5], and Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].
Colchester Borough Council	Whilst the physical elements of Colemans Reservoir may not change, it is considered that the implications for the wildlife of the road corridor coming closer to the habitat area, such as disturbance and air quality, have not been sufficiently addressed.	In accordance with DMRB, aquatic habitats are not sensitive to nitrogen deposition and so there would be no impact to Colemans Reservoir due to changes in air quality. Impacts to wildlife are assessed as part of the wider assessment of impacts from the proposed scheme in Section 9.11 of this chapter.

Consultee	Comment	Response
Colchester Borough Council	The proposed mitigation does not reflect the knock-on implications for the rest of Colemans Farm Quarry and its restoration. For example, the knock-on effects of the A12 widening include there potentially being insufficient material to enable the creation of priority habitats as part of the restoration of the Biodiversity Flagship site. The newly created priority habitats will also be closer to the A12, which could create air quality implications for them. This should all be taken into account in proposing proportionate mitigation.	Import of materials is assessed within Chapter 11: Material assets and waste, of the Environmental Statement [TR01006/APP/6.1]. Assessment of air quality impacts on ecological receptors has been undertaken in accordance with DMRB LA 105 (Highways England, 2019), which focuses on designated sites. To reduce the effects of nitrogen deposition, some of the newly created habitats such as grassland would be sown on subsoil to minimise the nutrient load. Section 41 priority habitats mitigating for those included in the Colemans Farm Quarry restoration scheme would be close to the A12. At detailed design, locations furthest from the road would be sought to site those priority habitats most likely to be impacted by nitrogen deposition.
Essex County Council	We do not agree that the Hazel Dormouse should be scoped out from any further consideration. We query the methodology undertaken. In particular, we have concerns about the following statement: '*The number of tubes will be appropriate for the habitats to be surveyed, with at least ten tubes in each sample area.*' Ten tubes are unlikely to be sufficient sample size to identify presence/absence per habitat block (50 tubes per habitat section would be preferable). Furthermore, we have not found any details on the habitat assessment to accompany the presence/likely absence survey. This would be necessary to allow us to have certainty that surveys have been carried out in appropriate locations to further justify likely absence.	Dormouse nest tubes (a total of 2,388) were installed at approximately 20m intervals within the survey area (a 250m buffer around the proposed scheme). All areas of optimal and sub-optimal habitat were surveyed where access was permitted. The assessment of habitat is detailed within Appendix 9.6 [TR01006/APP/6.3] which will be made available to Essex County Council.

Consultee	Comment	Response
Essex County Council	We are concerned that the significance of the effects is currently judged to be 'neutral' for bats, including barbastelle bats, without having all the data. Depending on current usage by bats, and particularly large bats such as barbastelle bats, their movement across the landscape could be severely impaired. It should also be acknowledged that there is currently a general level of uncertainty as to the effectiveness of bat crossings over major roads, such as hop overs. The evaluation needs to be amended now and reviewed when further information is available.	The assessment on bats, including barbastelle bats, has been reviewed following the completion of surveys and the significance of effects updated in Section 9.11 of this chapter.
Essex County Council	We believe that barbastelle bats should be considered as higher than of county importance due to their rarity and international protection and they should be considered at least of regional importance. A map showing the commuting and foraging routes for bats - particularly barbastelles – should be included to help demonstrate how they utilise the landscape and whether the proposed scheme will impact on the ability of barbastelle bats to effectively use the landscape in the way that they are currently doing.	The assessment acknowledges the rarity of barbastelle bats, however this species is valued at County level, for reasons as described in Section 9.8 of this chapter. Commuting and foraging areas have been identified following the completion of surveys and the significance of effects updated in Section 9.11 of this chapter. A map showing the commuting and foraging routes for bats, including barbastelles, has been produced alongside Appendix 9.4: Bat survey report [TR010060/APP/6.3].
Essex County Council	Consideration must also be given to likely non-significant impacts on designated sites (international, national and local), protected species and priority habitats and species - not just significant ones.	In line with the EIA regulations, this chapter has focused on the identification of likely significant effects and associated mitigation. Mitigation is secured through the REAC, which is included in the first iteration EMP [TR010060/APP/6.5], and mitigation licences (Appendix 9.16: Draft bat licence, and Appendix 9.17: Draft badger licence [TR010060/APP/6.3]).

Consultee	Comment	Response
Essex County Council	Proposed watercourse and river crossings are in some cases particularly poor for biodiversity and look likely to contribute to compounding existing ecological damage, including by contributing to more otter deaths on the road. Further mitigation for loss and damage to river habitat is required. The Roman River, Domsey Brook and River Blackwater crossings look to be overly long and will cause problems for wildlife through habitat loss and river ecosystem fragmentation.	Roman River: A realignment is proposed which would be gently sinuous with a two-stage channel. The low-flow channel would be of varied widths, and sediment augmentation along the realignment would produce pool-riffle sequences which would provide habitat variability. Baffles would be installed along the base of the culvert to improve flow dynamics, facilitate sediment conveyance, and encourage fish passage. This would sufficiently mitigate for any effects as a result of the widening of the Roman River crossing. At Domsey Brook Bridge the crossing would be extended by approximately 34.6m. The crossing is close to J24 so any reduction in width would be a departure from DMRB design standards. There is a proposed realignment at this crossing where the planform is considered to be an improvement on the existing alignment. Mitigation measures include creating a narrow stage-one channel along Domsey Brook to facilitate fine sediment entrainment and flush the fine sediment observed to be aggrading at the outlet downstream; sediment augmentation to replicate pool-riffle sequences resulting in improved habitat diversity; and the introduction of baffles at the base of the culvert to improve flow dynamics, facilitate sediment conveyance and promote fish passage. River Blackwater: The design proposals are to widen Ashmans Bridge by approximately 10.1m. No change has been proposed on the spanning structure, but to stitch the extension onto the existing bridge. The structure at present is wide and light-filled and would remain this way when widened. A realignment is also proposed at the Rivenhall Brook. The proposed realignment design would result in an overall shortening of the watercourse. Augmented sediment would be used to create step-pools or pool-riffles depending on gradient, which would improve habitat as well as regulate flow. Fencing (the location of which would be developed during detailed design) would be used to dissuade otters from crossing the proposed scheme in the vicinity of watercourses. Where practicable, new and modified culverts with mammal ledges or other means of wildlife passage would allow for continued

Consultee	Comment	Response
		connectivity for otter commuting and foraging across the wider landscape. Realigned watercourses are designed to be beneficial for wildlife.
Environment Agency	The Roman River crossing has always caused problems for wildlife. The proposed scheme presents an opportunity to improve on the current poor design, but that opportunity has not yet been taken.	At this crossing the existing culvert is to be extended to the south with the watercourse being realigned further to the south and around to the east. The crossing is currently a box culvert, the extension of which would likely lead to localised scour of the bed and banks. As mitigation for the culvert extension, coarser sediment would be added upstream and along the downstream realignment to improve the riverine environment. Baffles would also be added to the base of the culvert to improve sediment conveyance, flow dynamics, and facilitate fish passage.
Environment Agency	The current River Brain crossing has a high cill. The proposals should be revisited to see what improvements can be made. The current result is inhospitable for wildlife in summer.	The cill forms part of the foundation of the River Brain crossing abutments and removal would lead to significant implications on the structural integrity of the crossing. To remodel the foundations would involve construction of a temporary offline road to the south through sensitive habitats, some of which are protected under legislation. Furthermore, this would be an enhancement to improve upon an existing problem, rather than mitigation for the effects of the proposed scheme. National Highways would not be permanently acquiring the land localised to Brain Bridge and are therefore unable to secure the necessary long-term maintenance of BNG enhancements in this location. Furthermore, improvements to in-channel features may increase flood risk to properties near the River Brain Bridge.
Environment Agency	The proposed mitigation for river species is currently insufficient, and in some cases, likely to be ineffective.	Proposed mitigation includes, where practicable, new meandering sections of watercourse to include two-stage channels and sediment augmentation where possible to create pool-riffle sequences which would provide new habitat for aquatic species. At some crossings the addition of baffles has been proposed to improve sediment conveyance, flow diversity and encourage fish passage. Vegetation and trees would be used at the entrances and exits of culverts to provide a gradual transition of light to encourage migration of fish species through crossings.

Consultee	Comment	Response
Environment Agency	The proposed river crossings appear to be designed as canalised drains. There is the potential for biodiversity to be significantly adversely affected with the proposals as they are presently set out, and we could not currently agree that the new crossings would result in neutral impacts on fish and otter.	Crossing design has been considered following this comment and prior to the meeting with the Environment Agency on 16 September 2021 where potential changes to design and additional mitigation measures were discussed. Ecological improvements including baffles and natural sediment base have been proposed in existing culverts.
Environment Agency	Following channel realignment of Rivenhall Brook, Ordinary Watercourse 15a would be disconnected from its source. This would have negative impacts on the ecology of the watercourse, and therefore alternative options should be considered.	Ordinary Watercourse 15a is a largely dry, heavily vegetated channel. It is thought to only receive flow during periods of heavy rainfall. Under the proposed scheme, Ordinary Watercourse 15a would be cut off from its source. Mitigation has not been considered for this watercourse, however, the excavation and use of a new outfall structure at Ordinary Watercourse 15a would provide the watercourse with sufficient flow once active. Crossing design has been considered following this comment and prior to the meeting with the Environment Agency on 16 September 2021, and additional mitigation measures minimise the loss of the existing habitat wherever practicable.
Environment Agency	Ordinary Watercourse 11 is proposed to be extensively culverted. It should be explained why such extensive culverting is required, as watercourses should be culverted for the shortest possible lengths for both flood risk and biodiversity reasons.	It is acknowledged that the series of culverts present at Ordinary Watercourse 11 is extensive. Amending the angle of the culvert to reduce its length has been considered, however, this would require a channel realignment that would likely encroach on an active quarry. This option is therefore not considered feasible and no harm is predicted for biodiversity.

Consultee	Comment	Response
Environment Agency	The Domsey Brook and River Blackwater have long dark crossings which extend beyond the footprint of the road. We would like to see this revised to deliver the shortest possible length of road crossing. Dark crossings discourage almost all life from large mammals such as badgers, deer and otters to aquatic life including fish and invertebrates. Unfortunately mammal fencing cannot always provide the solution. We could not currently agree that the new crossings would result in neutral impacts on fish and otter. We would like to see some new meandering sections designed to compensate for the lengths of river darkened by increased crossing length.	At Domsey Brook Bridge the crossing would be widened by approximately 34.6m. The crossing is close to J24 so any reduction would be a departure from DMRB design standards. Proposed mitigation currently includes the following: • Baffles along the base of the culvert which allow streambed material to accumulate within the culvert and provide favourable conditions for fish passage • Sediment augmentation along the Domsey Brook realignment to create self-cleaning channels, replicating pool-riffle sequences which would create additional aquatic habitat and promote habitat diversity At all crossings, wherever practicable (with flood risk consideration required), fish passage would be encouraged by introducing natural vegetation at entrances and exits, which provides a gradual transition of light to dark. A natural bed material would be added under crossing structures to ensure adequate flow and depth of water is available for fish passage as well as to encourage habitat diversity. River Blackwater: Ashmans Bridge would be widened by approximately 10.1m. No change has been proposed on the spanning structure, but to stitch the extension onto the existing bridge. The structure at present is wide and light filled and would remain this way when widened. Fencing would be used to dissuade otters from crossing the proposed scheme. Considering operational and maintenance requirements such as headroom and health and safety risk assessments mammal ledges would be created within newly constructed or modified existing culverts at Domsey Brook (east) and Domsey Brook (west), Rivenhall Brook and the Roman River and would allow for continued connectivity for otter commuting and foraging across the wider landscape. Realignments of Roman River, Domsey Brook and Rivenhall Brook are designed to maximise biodiversity delivery.

Consultee	Comment	Response
		• Roman River: A realignment is proposed which would be gently sinuous with a two-stage channel, where a low-flow channel is of varied widths. Sediment augmentation would be used to produce pool-riffle sequences for habitat creation. • Rivenhall Brook: The proposed realignment is currently shorter than the existing alignment. Proposed mitigation involves augmenting sediment to create step-pools or pool-riffles, depending on gradient, to provide additional aquatic habitat, regulate flow and reduce likelihood of channel instability.
Forestry Commission	Looking through the other online consultation documents we could not find any reference to new woodland creation to compensate for the loss at Rivenhall End. Given that BNG will become a requirement by autumn 2021, could you confirm what provision is being made to plant compensatory new woodland.	There is no legal or policy requirement for BNG provision for the proposed scheme. However, the Applicant has sought to maximise biodiversity delivery. Loss of part of the woodland at Rivenhall End is unavoidable to facilitate construction of a side road required as part of the Braxted Road diversion. Replacement woodland planting is proposed around the proposed scheme in this location, and it has been designed to link to retained woodland in this area. Planting proposals are shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].
Natural England	We recommend caution with regard to the application of 2km Zones of Influence (ZoI) for nationally/ internationally designated sites pending the outcome of the detailed assessment and given the potential for impacts to occur over significantly greater distance e.g. through water-mediated effects.	This chapter assesses potential impacts to all SSSIs within 2km of the proposed scheme, and 200m of the ARN, or which have hydrological connectivity to the proposed scheme, therefore including any sites beyond 2km where there is potential for impacts to occur over greater distances.

9.4 Legislative and policy framework

International obligations

9.4.1 The provisions of international legislation, incorporated into UK law and relevant to this chapter, are identified below. The Convention on Wetlands of International Importance especially as Waterfowl Habitat (the 'Ramsar Convention') requires contracting parties to formulate and implement planning to promote the conservation of wetlands included in the Ramsar List and as far as possible, the wise use of wetlands in their territory.

9.4.2 The United Nations Convention on Biological Diversity 1992 and Strategic Plan for Biodiversity 2011–2020 (the 'Aichi' targets) established a legal framework for biodiversity conservation with the goals of conserving biological diversity, sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources.

Legislation

9.4.3 The legislation relevant to this chapter at a national and species-specific level, including details of how each relates to the biodiversity assessment, are set out below:

- The Conservation of Habitats and Species Regulations 2017 (as amended) set out criteria for the designation of certain protected sites. They also afford protection to specific species of animals and plants and their associated habitats. Some of these species and sites occur within the study area, as set out in Section 9.7 of this chapter, so this legislation is pertinent to the assessment.

- The Wildlife and Countryside Act 1981 (as amended) gives protection to native species of animals, birds, plants and certain habitats (especially those at threat), controls the release of non-native species, provides for the notification, confirmation, protection and management of SSSIs and builds upon the rights of way in the National Parks and Access to the Countryside Act 1949. As many species and sites covered by this legislation occur within the study area, it is pertinent to the assessment.

- The Hedgerows Regulations 1997 provide for the protection of certain 'important' hedgerows as set out by the criteria of the regulations. On this basis, an assessment of hedgerows has been undertaken as part of this assessment and is reported within Appendix 9.7 of the Environmental Statement [TR010060/APP/6.3]. Impacts to important hedgerows are assessed within this chapter.

- The Eels (England and Wales) Regulations 2009 commit the competent authority to take actions to halt and reverse the decline in the European eel stock, aiming to meet a target set for the number of mature adult eels leaving each river basin to return to spawn at sea. The regulations require that any in-channel works are designed in a way that permits the escapement of eels from the catchment (and also allows their return). It is designed primarily for intake/outfall screening but can be more broadly

applied to any in-channel works including culvert design. As eels have been recorded within watercourses in the study area, this legislation is pertinent to the assessment.

- The Protection of Badgers Act 1992 makes it an offence to kill, injure or take a badger, or to damage or interfere with a sett unless a licence is obtained from a statutory authority. As badgers have been recorded in the study area and their setts could be impacted, this legislation is relevant to the proposed scheme.
- The Wild Mammals (Protection) Act 1996 makes it an offense for any person to mutilate, kick, beat, nail or otherwise impale, stab, burn, stone, crush, drown, drag or asphyxiate any wild mammal with intent to inflict unnecessary suffering.
- The Natural Environment and Rural Communities Act 2006 (NERC), section 40 places a duty on public authorities, including local authorities and government departments, to consider the purpose of conserving biodiversity in a manner consistent with their normal duties, such as policy and decision-making (biodiversity duty). Species and habitats of principal importance for the conservation of biodiversity in England are required to be listed under section 41 of NERC (NERC s41). This list is used to guide decision-making by public bodies, in exercising their biodiversity duty. The species and habitats listed are priorities for nature conservation action and therefore require due consideration within this assessment.
- The Salmon and Freshwater Fisheries Act 1975 regulates the movement, killing and obstruction of fish and also focuses on the obstruction of waterways and the impact on migratory fish species. As watercourses with migratory fish occur in the study area, this legislation is relevant to the assessment.
- The Environment Act 2021 provides for the setting of government environmental targets related to air, biodiversity, waste and water. In addition, the Secretary of State must, by regulations, set a new species abundance target to be met by the end of 2030. Draft legislation to provide for these targets must be laid before Parliament by 31 October 2022. The Act will amend section 40 of the NERC Act 2006 by defining ‘the general biodiversity objective’ for public authorities as being the conservation and enhancement of biodiversity in England. The Environment Act 2021 will amend the Planning Act 2008 so as to provide for biodiversity gain objectives to be set out in a statement of government policy for DCO projects, although it is unlikely that this will be in place prior to the determination of the DCO application for the proposed scheme. Other provisions to be brought into force at future dates include Local Nature Recovery Strategies to direct investment in nature where most needed; Species Conservation and Protected Site Strategies aimed at safeguarding the future of species and protected sites at greatest risk; and amendments to the Conservation of Habitats and Species Regulations 2017 to support

domestic biodiversity priorities. It is not clear whether the relevant changes will be in force and applicable to the proposed scheme.

- The Invasive Alien Species (Enforcement and Permitting) Order 2019 (as amended) makes it an offence to release or allow to escape into the wild any specimen of an invasive alien species and provides for the permitting of activities relating to invasive alien species. Fourteen species are identified under the legislation as being widespread in England and Wales and requiring management.

National policy

National Policy Statements

9.4.4 The National Networks National Policy Statement (NNNPS) (Department for Transport, 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects on the national road and rail networks in England. The Secretary of State uses the NNNPS as the primary basis for making decisions on DCO applications.

9.4.5 Policy from the NNNPS relevant to this aspect is set out in Table 9.4.

Table 9.4 NNNPS requirements for biodiversity

NNNPS paragraph	NNNPS requirement	How this is addressed in the assessment
5.22	The applicant's assessment should describe any likely significant effects on internationally, nationally and locally designated sites of ecological conservation importance, protected species, habitats, and other species identified as being of principal importance for the conservation of biodiversity.	Section 9.8 of this chapter identifies the designated sites which could be impacted by the proposed scheme. Section 9.11 of this chapter (supported by a HRA No Significant Effects Report [TR010060/APP/6.8]) describes the significant effects on internationally, nationally and locally designated sites of ecological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity.
5.23	The applicant should describe how the project plans to conserve and enhance biodiversity conservation interests.	The proposed scheme has taken into account the locations of valuable and priority habitats, including important connective habitats (i.e. hedgerows, watercourses and treelines) and the location of protected species. The mitigation hierarchy has been followed to, where practicable, modify the design to avoid impacts to these features. In addition, opportunities to enhance biodiversity have been proposed. Mitigation and enhancement measures are described within Section 9.10 of this chapter.

NNNPS paragraph	NNNPS requirement	How this is addressed in the assessment
5.25	Development should avoid significant harm to biodiversity conservation interests, including through appropriate mitigation and consideration of alternatives.	Design changes have been implemented where practicable to avoid impacts to ecological receptors. Furthermore, the approach of maximising biodiversity delivery is being applied to the proposed scheme.
5.26	Appropriate weight should be attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment.	Sections 9.9 to 9.11 of this chapter detail impacts, mitigation and significant effects to ecological receptors such that the Secretary of State can be informed in the decision-making process.
5.29	Development should not have an adverse effect on an SSSI. Where an adverse effect on the site's notified special interest features is likely, an exception should be made only where the benefits of the development at this site clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSIs.	There are no SSSIs designated for ecological value within 2km of the proposed scheme, and only two SSSIs with a hydrological connection to the proposed scheme or within 200m of the ARN (River Ter and Tiptree Heath respectively). The assessment has shown there would be no significant impacts to these sites through construction or operation of the proposed scheme (see Sections 9.9 to 9.11 of this chapter for more detail on potential impacts, mitigation, and significant effects).
5.32	Development should not result in the loss or deterioration of irreplaceable habitats including ancient woodland and veteran trees.	Sections 9.9 to 9.11 of this chapter detail that the proposed scheme would not directly impact any areas of ancient woodland. Perry's Wood is located within 200m of the ARN and has been assessed for impacts from changes in air quality. An assessment of the significance of the effects is presented in Appendix 9.15 of the Environmental Statement [TR010060/APP/6.3] and Section 9.11 of this chapter. No verified veteran trees would be directly impacted by construction of the proposed scheme. However, five potential veteran trees (i.e. trees not formally designated, but assessed as part of A12 field surveys to as veteran trees) would be removed during construction (T236, T316, T367, T452 and T542). Where practicable, the design of the proposed scheme was refined to avoid

NNNPS paragraph	NNNPS requirement	How this is addressed in the assessment
		impacts, however, loss of these five trees was unavoidable. This is irreplaceable habitat and while these cannot be directly replaced, mitigation to reduce the impacts would be provided in the form of young trees of the same species as that which is removed would be planted with sufficient space around them to encourage development of an open crown. The air quality assessment has shown there would be changes in air quality at one veteran tree, four potential veteran trees and one potential ancient tree during construction; and changes in air quality for six verified veteran trees, 16 potential veteran trees and one ancient tree during operation. There would also be a change in air quality for one ancient woodland (Perry's Wood). An assessment of the significance of the effects is presented in Appendix 9.15 of the Environmental Statement [TR010060/APP/6.3] and Section 9.11 of this chapter.
5.33	Development proposals potentially provide many opportunities for building in beneficial biodiversity or geological features as part of good design. The applicant should maximise such opportunities in and around developments.	Proposals for enhancements are detailed within Section 9.10 of this chapter.
5.35	Other habitats and species identified as being of principal importance should be protected from the adverse effects of development.	Section 9.11 of this chapter presents an assessment of the effects on species and habitats of principal importance for biodiversity. Data searches and field surveys have been used to identify protected and notable habitats and species within the zone of influence. Impacts to these receptors have been assessed and where necessary, measures to avoid, minimise and mitigate these impacts have been proposed.

NNNPS paragraph	NNNPS requirement	How this is addressed in the assessment
5.36	Appropriate mitigation measures are considered an integral part of a proposed development and the applicant should include these in their assessment, including identifying how these measures will be secured. The applicant should demonstrate that: • they will seek to ensure that activities will be confined to the minimum areas required for works during construction; • standard mitigation will be followed to ensure that risk of disturbance or damage to species or habitats is minimised during construction and operation; • developments and landscaping will be designed to provide green corridors and minimise habitat fragmentation; and • opportunities will be taken to enhance existing habitats and create new habitats within the site landscaping proposals.	Mitigation measures are detailed within Section 9.10 of this chapter. Impacts would be minimised by reducing the construction footprint as far as practicable, following standard mitigation, and through landscape design and provision of enhancements where practicable.
5.192	The applicant should consult Natural England with regard to assessment of noise on designated nature conservation sites, protected landscapes, protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account.	The assessment of noise arising during both construction and operational phases of the proposed scheme on biodiversity is presented in this chapter. It includes consideration of disturbance to protected species as a result of changes in noise levels. EPSM licences will be sought from Natural England for species where noise disturbance is considered to be significant.

9.4.6 As set out in Chapter 1: Introduction, of the Environmental Statement [TR010060/APP/6.1], the assessment has considered the Overarching National Policy Statement for Energy (EN-1) (Department of Energy and Climate Change, 2011a) and National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Department of Energy and Climate Change, 2011b) in relation to the diversion of an existing high pressure gas main (the 'gas main diversion') owned and operated by Cadent Gas Limited (hereafter referred to as 'Cadent'). Draft versions of the updated EN-1 and EN-4 have also

been considered (Department for Business, Energy and Industrial Strategy, 2021a; 2021b).

9.4.7 A review of the relevant requirements of EN-1 and EN-4 (including the draft updated versions), relating to the EIA of the gas main diversion works, identified that the requirements are not materially different to those set out in the NNNPS. As such, it is considered that by meeting the NNNPS requirements set out in Table 9.4, the requirements of EN-1 and EN-4 are also met.

National Planning Policy Framework (NPPF)

9.4.8 The NPPF (Ministry of Housing, Communities & Local Government, 2021) sets out the government's planning policies for England and how these should be applied. The requirements of the NPPF for this aspect are not materially different from the NNNPS, with a focus on protecting and enhancing sites of biodiversity value, minimising impacts on, and providing net gains for biodiversity, taking a strategic approach to maintaining and enhancing networks of habitats and green infrastructure.

Local policy

9.4.9 In addition to the national policy set out in the NNNPS, the proposed scheme has also had regard to relevant local plans and policy. A summary of the policy framework is provided in Appendix 1.1 of the Environmental Statement [TR010060/APP/6.3]. Local policies relevant to this aspect are included in Table 9.5.

9.4.10 Local planning policies relevant to biodiversity encourage good design and seek to protect, conserve, and enhance biodiversity and promote net gain of habitats. As mentioned above, there is no legal or policy requirement for BNG provision for the proposed scheme. However, policies referencing BNG are included in Table 9.5 below for completeness. Designations defined by planning policy are presented in Section 9.8 of this chapter.

9.4.11 Table 9.5 presents key local planning policy for biodiversity within the main policy 'themes' relevant to biodiversity. There are also other environmental policies relevant to biodiversity, including those relating primarily to veteran trees (considered within Chapter 8: Landscape and visual, of the Environmental Statement [TR010060/APP/6.1]).

Table 9.5 Local plans and policy provision for biodiversity

Local body	Legislation / local plans	Policy
Essex County Council	Essex Green Infrastructure Strategy (2020)	Policy 7.3 and 7.4 Use of planning policy to improve, repurpose and create multi-functional green spaces in and around the site boundaries through the application of green infrastructure promotion schemes such as BNG, biodiversity offsetting and creation of compensation habitats.

Local body	Legislation / local plans	Policy
Braintree District Council	Braintree District Council – Publication Draft Local Plan (2017)	Policy LPP 67, 68 and 70 Development proposals shall provide protection of biodiversity and include mitigation or compensation of adverse effects. Where adverse effects to priority habitats cannot be avoided, the developer must provide adequate mitigation to ensure no net loss to priority habitats. Off-site compensation may be required to ensure no net loss to priority habitat where residual impacts remain. A mitigation plan that ensures no harm to protected species and no net loss to priority species both present or immediately adjacent to site must be in place. Additionally, enhancement of biodiversity should be included in all proposals, proportionate with the scale of the development.
	The Braintree District Core Strategy Local Development Document (2011)	Policy CS5 and CS8 Development outside town, village and industrial limits will be controlled to uses appropriate to the countryside in order to protect and enhance biodiversity. Development should create and enhance the biodiversity value of wildlife corridors. Development will promote wildlife enhancements which will contribute to the habitat and species restoration targets set out in the Essex Biodiversity Action Plan.
Chelmsford City Council	Chelmsford Local Plan (2020)	Strategic Priority 7; Strategic Policy S4; Strategic Policy S9; Policy DM16 Development proposals should ensure a net gain in biodiversity, where possible. When greenfield land will be lost, green infrastructure should be used to create wildlife corridors for ecological connectivity and new developments should seek to improve water-related biodiversity following Water Framework Directive (WFD) objectives and River Basin Management Plan actions. Infrastructure necessary to support new development must provide net gain in biodiversity. All development proposals should conserve and enhance habitats, species and sites and give appropriate weight to their importance. Development proposals should also avoid negative impacts on biodiversity, mitigate unavoidable impacts and as a last resort compensate for residual impacts.
	Chelmsford Green Infrastructure Strategic Plan (2018)	Policy 6.3 Development should ensure net gain for biodiversity including BAP (Biodiversity Action Plan) species and habitats including the enhancement and linking of existing woodlands.

Local body	Legislation / local plans	Policy
Colchester Borough Council	Colchester Borough Council – Emerging Local Plan (2017)	Policy ENV1 For development proposals to be supported, appropriate ecological surveys should be completed and where found, the needs of protected species or habitats must be provided for. Beneficial biodiversity conservation features and habitat creation must also be included in these proposals.
	Core Strategy (2014b)	Policy ENV1 Development should protect, conserve or enhance the interests of natural and historic assets. Development should also protect habitats and species and conserve and enhance the biodiversity of the Borough; and provide for any necessary mitigating or compensatory measures.
	Local Development Framework – Development Policies (2014a)	Development Policy 21 Development would be supported where there are acceptable ecological surveys, where it would conserve or enhance biodiversity value of greenfield and brownfield sites and minimise fragmentation of habitats, where it would maximise opportunities for restoration, enhancement and connection of natural habitats in accordance with the Essex BAP and incorporate beneficial biodiversity conservation features and habitat creation.
Maldon District Council	Maldon District Council – Local Development Plan (2017)	Policy D1, N1, N2 All development must make a positive contribution in terms of the natural environment, particularly in relation to designated and non-designated biodiversity sites. Development which results in the creation, restoration, enhancement, expansion or interconnection of areas of significant biodiversity interest will be encouraged. Development proposals should seek to deliver net biodiversity gain, where possible. Proposals should include an ecologically sensitive design which includes mitigation for compensatory habitat that is ecologically functional in advance of any loss. Mitigation that includes the creation or relocation of habitat must ensure no net loss of habitats and that any replacement habitat is delivered as close to the development site as practicable.

9.5 Assessment methodology

Assessment scope

9.5.1 Biodiversity matters scoped in or out of the assessment are in line with the Scoping Opinion and are detailed in Table 9.6.

9.5.2 Since the time of writing the Environmental Scoping Report, Tiptree Heath SSSI has been scoped in for operational impacts with regard to changes in air quality as it is located within 200m of the operational ARN, and the River Ter SSSI has been scoped in due to hydrological connectivity. SSSIs were previously scoped out (Highways England, 2020a).

9.5.3 While dormouse has been scoped out with regard to the main works of the proposed scheme, surveys are ongoing with regard to the gas main diversion and therefore dormouse has been scoped in for the gas main diversion pending the results of field surveys in 2022.

9.5.4 NNRs, white-clawed crayfish and INNS have been scoped out of this assessment. INNS are not considered to be of ecological value and were agreed in the Scoping Opinion to be scoped out. All other matters have either been scoped in for construction impacts, operational impacts or both.

9.5.5 The following applies to all biodiversity resources that are considered valued, and brought forward to the detailed ecological impact assessment stage:

- Their value is assessed as being important at local level or higher
- They are potentially vulnerable to significant effects from the proposed scheme

Table 9.6 Biodiversity matters scoped in or out of the assessment

Matter	Scoped in – construction	Scoped in – operation	Justification where scoped out
European designated sites (SAC, SPA and Ramsar)	Yes	Yes	-
Marks Tey Brickpit SSSI	No	No	Geological SSSI – covered within Chapter 10: Geology and soils [TR010060/APP/6.1]
Tiptree Heath SSSI	No	Yes	No pathway to impact during construction.
River Ter SSSI	Yes	Yes	-
NNRs	No	No	None within 2km of the proposed scheme. Agreed in Scoping Opinion could be scoped out.
LNRs within 200m of the ARN and 1km of the Order Limits	Yes	Yes	-
LWSs within 200m of the ARN and 1km of the Order Limits	Yes	Yes	-
Ancient Woodland Inventory sites and ancient woodland habitat within 1km of the Order Limits	Yes	Yes	-

Matter	Scoped in – construction	Scoped in – operation	Justification where scoped out
Veteran trees	Yes	Yes	-
Potential veteran trees	Yes	Yes	-
Priority habitats	Yes	Yes	-
Notable vascular plants	Yes	Yes	-
Badgers	Yes	Yes	-
Bats	Yes	Yes	-
Birds – breeding, wintering and schedule 1 species (including barn owl)	Yes	Yes	-
Dormice	Yes (for gas main diversion only)	Yes (for gas main diversion only)	Based on no evidence of dormice being identified during surveys along the rest of the proposed scheme and a lack of nearby desk study records (and continuity of habitat with the record south of Chelmsford), dormice have been scoped out for the rest of the proposed scheme.
Freshwater fish, macro-invertebrates and macrophytes	Yes	Yes	-
White-clawed crayfish	No	No	None recorded during surveys. Agreed in Scoping Opinion could be scoped out.
GCN	Yes	Yes	-
Otter	Yes	Yes	-
Reptiles	Yes	Yes	-
Terrestrial invertebrates	Yes	Yes	-
Water vole	Yes	Yes	-
Priority species	Yes	Yes	-
INNS – plants and animals	No	No	Matter considered to be a construction issue and addressed in the first iteration EMP [TR010060/APP/6.5].

General approach

9.5.6 This chapter has been prepared in accordance with the latest best practice guidance for ecological impact assessment and specifically the ecological assessment of road schemes:

- DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020b)
- DMRB LA 108 Biodiversity (Highways England, 2020c)
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018, Version 1.1 updated September 2019)

9.5.7 A staged approach has been taken in assessing the ecological value of the study area. This involved an initial desk study, which informed subsequent detailed baseline field surveys and assessments.

9.5.8 Species-specific and habitat surveys have been carried out between 2016 and 2021 (see Table 9.7) to inform the design and assessment. Surveys are ongoing with regard to Inworth Road and the gas main diversion and will be completed in 2022 (see Section 9.6 of this chapter). Current best practice guidance documents for the survey and assessment of specific species and habitats have been used for all surveys and are referenced in the appropriate survey reports that support this chapter (Appendices 9.1 to 9.13 [TR010060/APP/6.3]). There has been a deviation from best practice in relation to bats (as detailed in Appendix 9.4: Bat survey report [TR010060/APP/6.3]), which has been agreed with the relevant stakeholders (see Table 9.1).

9.5.9 The impact assessment is based on a construction phase lasting approximately four years, with main works commencing in 2024 (as described in Chapter 2: The proposed scheme, of the Environmental Statement [TR010060/APP/6.1]). Some mitigation areas would need to be created as part of advanced works to allow time for the establishment of habitats. Further details are provided in Section 9.10 of this chapter.

9.5.10 The assessment takes a worst-case scenario approach. As discussed in Chapter 5: Environmental assessment methodology, of the Environmental Statement [TR010060/APP6.1], biodiversity receptors can be impacted from multiple sources. Consideration of these combined impacts (intra-project effects) is an integral part of assessing the effect on biodiversity. The assessment of the effects on biodiversity matters has therefore been informed by relevant information collated by other environmental aspects, notably Chapter 6: Air quality, Chapter 8: Landscape and visual, Chapter 12: Noise and vibration and Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1].

9.5.11 Assessment of the potential air quality impacts on designated sites and habitats which are sensitive to nitrogen deposition, (hereafter referred to as ‘N deposition’) including SACs, SPAs, Ramsar sites, SSSIs, LNRs, LWS, nature improvement areas, ancient woodland and veteran trees within 200m of the ARN, have been undertaken in accordance with DMRB LA 105 (Highways England, 2019) (see Chapter 6: Air quality [TR010060/APP/6.1]) and are

reported in Appendix 9.15 of the Environmental Statement [TR010060/APP/6.3].

9.5.12 The air quality assessment (Chapter 6: Air quality [TR010060/APP/6.1]), following DMRB LA 105, lists the sites and trees that are screened in for ecological assessment following modelling of N deposition rates. Screened-in sites have a predicted total N deposition rate above the minimum critical load, and a predicted change in N deposition of more than 1% of the lower critical load and greater than 0.4kg N/ha/year. Further assessment, based on the duration and extent of the change and characteristics of the habitats, is presented in Appendix 9.15 [TR010060/APP/6.3]) and is summarised in Section 9.11 of this chapter.

9.5.13 Noise data have been used to inform the assessment of disturbance impacts for sensitive species, in particular bats. A literature review identified 68dB as the lowest threshold at which commuting and foraging bats are likely to be disturbed (Barber *et al*., 2010; Bennett and Zurcher, 2013; Finch *et al*., 2020; Luo *et al*., 2015; Schaub *et al*., 2008; and Siemers and Schaub, 2010). Construction and operational noise data were used to identify receptors which would experience a change in noise level from below 68dB to above this level, or any receptor currently over 68dB where there is an increase in noise of 1dB or more.

9.5.14 The identification of baseline conditions has been informed by a combination of desk study, field surveys, air quality and noise modelling and stakeholder consultation.

9.5.15 Mitigation has been designed and implemented in line with Section 5.5 of Chapter 5: Environmental assessment methodology [TR010060/APP/6.1]. In addition to mitigation, opportunities for enhancements for biodiversity have been identified. Enhancements have not been included in the assessment of likely significant effects. Section 9.10 of this chapter sets out the mitigation and potential enhancements for the biodiversity aspect.

9.5.16 The requirements of protected and controlled species legislation are detailed in Section 9.4 of this chapter. An EPSM licence would be required for bats and a licence from Natural England would be required to interfere with (close) badger setts. A district level licence (DLL) would be obtained for GCN (see Section 9.10 of this chapter). Draft species licences (Appendix 9.16: Draft bat licence and Appendix 9.17: Draft badger licence [TR010060/APP/6.3]) have been prepared and agreed with Natural England for these species alongside the Environmental Statement. A formal application to Natural England for EPSM licences would be required following the grant of the DCO application.

9.5.17 In parallel with the EIA process, the effects of the proposed scheme on the national site network (the former Natura 2000 SPA, SAC, and Ramsar sites) has been assessed in accordance with DMRB LA 115 Habitats Regulations Assessment (Highways England, 2020d), Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (The Planning Inspectorate, 2017), and legislative requirements.

9.5.18 The HRA is a separate legal process from the EIA, although there is an overlap in relation to the potential impact on the national site network and the processes are undertaken in parallel. The HRA No Significant Effects Report [TR010060/APP/6.8] has been submitted as part of the DCO application.

9.5.19 The likelihood of a habitat and/or species to be present and affected by the proposed scheme was identified by a combination of desk study, consultation and field survey. Table 9.7 summarises the surveys carried out between 2016 and 2021 to establish an accurate baseline to inform a robust impact assessment. The results of the various field surveys undertaken are summarised in this chapter, with more detail provided in the survey reports within Appendices 9.1 to 9.13 [TR010060/APP/6.3].

9.5.20 Appendices 9.2 and 9.3 (badger and barn owl respectively) [TR010060/APP/6.3] are considered to hold ecologically sensitive information on protected species and are therefore identified as confidential and not provided with the main Environmental Statement. These appendices have been shared with the relevant stakeholders.

Table 9.7 Field survey areas and timings

Field survey	Field survey areas	Field survey timings
Phase 1 habitat survey (including INNS, important hedgerow assessment and National Vegetation Classification)	All areas within 600m of the proposed scheme (excluding areas of considerable urban development).	Surveys were conducted between 2016 and 2020 and included the Cadent gas main diversion.
River Habitat Survey	Relevant water bodies within 500m of the proposed scheme.	Surveys were conducted between 2017 and 2020.
Predictive System for Multimetrics (PSYM)	Ponds that would be lost to the proposed scheme or those which are hydrologically connected.	Surveys were conducted in 2020.
Bats (trees, buildings and structures)	Surveys up to 100m from the proposed scheme comprising ground-based roost assessments of trees, buildings and structures, tree-climbing surveys for bat roost suitability, internal inspections of buildings including hibernation surveys and crossing-point surveys. Ground roost assessments were conducted within 30m of the gas main diversion and Inworth Road areas that were not included in the initial proposed scheme survey area. A reduced survey area was used as impacts from the gas main diversion would be more localised and temporary.	Surveys for the proposed scheme were conducted between 2017 and 2021. Surveys for the gas main diversion and Inworth Road areas were conducted in 2021. Emergence and re-entry, and/or summer climbing inspections, are planned for 2022.

Field survey	Field survey areas	Field survey timings
	Hibernation surveys of trees identified during the ground-based assessment as having the potential to support hibernating bats, were also conducted. Dusk emergence or dawn re-entry surveys, and/or summer climbing inspections, will be undertaken for 10 trees assessed as having moderate suitability to support roosting bats in a small area of the site impacted by the gas main diversion, and along Inworth Road.	
Bats (transects, back-tracking) and static bat detectors)	Surveys up to 1km from the proposed scheme.	Surveys were conducted between 2020 and 2021.
Badger	Standard badger field surveys were conducted within 250m of the proposed scheme. Bait marking surveys were undertaken for specific setts considered at risk of direct impact by the proposed scheme. Standard badger field surveys within 30m of the gas main diversion and Inworth Road were undertaken to cover areas of land outside the previous survey area. A reduced survey area was used as impacts from the gas main diversion would be more localised and temporary.	Standard badger field surveys of the proposed scheme were conducted between 2017 and 2020. Bait marking surveys were conducted in 2021. Surveys for the gas main diversion and Inworth Road areas were conducted in 2021.
Riparian mammals (otter and water vole)	All water bodies within 200m of the online sections of the proposed scheme and up to 500m from offline sections were surveyed for riparian mammals. Otter holts and couches that were identified during these surveys were later monitored.	Riparian mammal surveys were conducted between 2017 and 2020. Monitoring of otter holts and couches was conducted in 2021.
Dormouse	Surveys extended up to 250m from the proposed scheme where habitat connectivity exists. Surveys will be undertaken to cover areas not previously surveyed in the original survey area for the gas main diversion (see Appendix 9.6: Dormouse Survey Report [TR010060/APP/6.3]).	Surveys were conducted between 2017 and 2020. Surveys of the gas main diversion are planned for 2022.

Field survey	Field survey areas	Field survey timings
Barn owl	Stage 1 and 2 (on-site scoping and investigative field) surveys used a buffer of 200m from the proposed online works, 50m from the proposed borrow pits and 1,500m from the proposed offline works. Stage 3 (nest verification) surveys used a modified buffer of 200m from the proposed online works, 50m from the proposed borrow pits and 500m from the proposed offline works for a more focused approach.	Surveys were primarily undertaken in 2019 and 2020, informed in part by surveys conducted in 2017.
Breeding bird	Surveys were undertaken within 250m of the proposed scheme.	Surveys were conducted in 2017 and 2020.
Wintering bird	Surveys were undertaken up to 500m from the proposed scheme.	Surveys were conducted in the winters of 2017-2018 and 2019-2020.
Reptile	Surveys were conducted within the footprint of the proposed scheme.	Surveys were conducted in 2017. Natural England has agreed that when considered in combination with additional data and a precautionary approach to reptile mitigation, these data can still be considered valid.
Great crested newt	Habitat suitability index (HSI) assessments of water bodies within 500m of the proposed scheme. Traditional/ population estimate surveys and environmental DNA (eDNA) surveys were undertaken on water bodies considered to have been at least 'below average' according to the original HSI classifications in 2017.	HSI assessments were originally conducted in 2017 and then again in 2020 to renew the data. Traditional/ population estimate surveys and eDNA surveys were conducted in 2017. Natural England has agreed that these data are valid for the district-level licence.
White-clawed crayfish	Surveys were conducted on watercourses which cross the proposed scheme.	Surveys were conducted in 2017 and 2020.

Field survey	Field survey areas	Field survey timings
Freshwater fish	Surveys were conducted on watercourses which cross the proposed scheme.	Surveys were conducted in 2017 and 2020.
Terrestrial invertebrates	Surveys were conducted at sites identified as providing optimal habitats within 600m of the proposed scheme.	Surveys were conducted between 2016 and 2020.
Freshwater macro-invertebrates	Surveys were conducted on watercourses which cross the proposed scheme.	Surveys were conducted in 2020.
Freshwater macrophytes	Surveys were conducted on watercourses which cross the proposed scheme.	Surveys were conducted in 2020.
Targeted botanical survey of designated sites	Surveys were conducted at sites which have the potential to be affected by changes in air quality.	Surveys were conducted in 2021 and 2022.

Assessing the significance of effects

9.5.21 The importance of biodiversity resources has been assessed in line with DMRB LA 108 (Highways England 2020c). Table 9.22 in Section 9.8 of this chapter describes the importance criteria.

9.5.22 The general approach to assessing the significance of effects is set out in Chapter 5: Environmental assessment methodology, of the Environmental Statement [TR010060/APP/6.1], based on DMRB LA 104 (Highways England, 2020b) and DMRB LA 108 (Highways England, 2020c). Where DMRB LA 104 refers to 'magnitude', the term 'level of impact' is used for this aspect. Descriptions of level of impact differ slightly from descriptions of magnitude in DMRB LA 104 (see Table 9.8).

Table 9.8 Levels of impact (DMRB LA 108, Highways England 2020c)

Level of impact (change)		Typical description
Major	Adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or characteristics of the resource
	Beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or characteristics of the resource

Level of impact (change)		Typical description
Moderate	Adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or characteristics of the resource
	Beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or characteristics of the resource
Minor	Adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or characteristics of the resource
	Beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or characteristics of the resource
Negligible	Adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or characteristics of the resource
	Beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or characteristics of the resource
No change		No observable impact, either positive or negative

9.5.23 For the purposes of this assessment, the CIEEM definition of magnitude has been used whereby magnitude refers to size, amount, intensity and volume. It has been quantified where possible and expressed in absolute or relative terms: e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population (CIEEM, 2018 Version 1.1 updated September 2019).

9.5.24 The significance matrix as presented in DMRB LA 108 has been used, as this considers resource importance in geographical terms which is more applicable for biodiversity matters (see Table 9.9).

Table 9.9 Significance matrix (DMRB LA 108, Highways England 2020c)

		Level of impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Resource importance	International or European importance	Neutral	Slight	Moderate or large	Large or very large	Very large
	UK or national importance	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Regional importance	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	County or equivalent authority importance	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Local importance	Neutral	Neutral or slight	Neutral or slight	Neutral or slight	Slight

9.5.25 The impact assessment work to be undertaken for the proposed scheme and reported in the Environmental Statement is proportionate, focusing on potential significant adverse effects within the zone of influence (as defined in Section 9.7 of this chapter). A likely significant effect would occur if the level of impact on a resource resulted in a moderate or above residual impact (see Table 9.9).

9.6 Assessment assumptions and limitations

9.6.1 Where feasible, nationally recognised standard survey methodologies have been used to reduce limitations for ecological evaluation and impact assessment, and where deviations have occurred, agreement has been sought from stakeholders (see Table 9.1).

9.6.2 Specific limitations for each survey, such as land access constraints, are detailed in the relevant survey reports within Appendices 9.1 to 9.13 of the Environmental Statement [TR010060/APP/6.3]. The survey-specific constraints are not considered to compromise the ecological impact assessment, especially when considering the proposed scheme's embedded mitigation and standard mitigation measures.

9.6.3 Figures in the survey reports may show 'provisional' Order Limits from an earlier design. This is because these were the Order Limits at the time the surveys were undertaken.

9.6.4 No access was permitted to the Blue Mills area to confirm the location of otter holts, water vole habitat and to assess trees for bat roost potential. It is anticipated that impacts to these species could be avoided. However, pre-construction surveys would be undertaken and mitigation implemented where necessary.

9.6.5 The assessment presented in this chapter is based on the data available at the time of writing. At the time of assessment, field surveys for protected species in relation to Inworth Road and the gas main diversion are ongoing and include:

- summer climbing and/or emergence/re-entry surveys of trees of moderate or higher bat roost potential along Inworth Road and the gas main diversion corridor (to be completed May to September 2022)
- dormouse surveys of the gas main diversion corridor (to be completed April to November 2022)

9.6.6 The absence of the above data is not considered a significant constraint to the assessments undertaken in this chapter. The majority of data will be used to refine mitigation proposals, and if further additional bat roosts are identified these would be mitigated for. Mitigation for additional roosts would be achievable within the Order Limits.

9.6.7 If dormouse are identified as present, any potential impacts would be sufficiently mitigated for through standard mitigation techniques (see Section 9.10 of this chapter) and therefore impacts would not be significant (see Section 9.11 of this chapter).

9.6.8 Vegetation clearance to accommodate the gas main diversion would include clearance of all habitats within the 30m working width along the extent of the diversion.

9.6.9 All Main River crossing(s) for the gas main diversion would be installed using trenchless techniques. These could be techniques such as horizontal directional drilling.

9.6.10 Details on the assumptions made with respect to the BNG calculations and the gas main diversion are provided within Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3].

9.6.11 The BNG report is based on the design and Order Limits from April 2022 to allow time for the BNG calculations to be undertaken. There have been minor refinements to the design since then (reflected in the design and Order Limits submitted with the DCO application). These changes do not have a material affect on the conclusions of the BNG calculations.

9.6.12 The likely significant effects concluded within this assessment differ slightly to the likely significant effects concluded within the PEIR (Highways England, 2021). This is because the proposed scheme design has developed as a result of consultation and environmental assessment, and the design assessed at PEIR was different to the final proposed scheme assessed within the Environmental Statement.

Limits of deviation

9.6.13 The horizontal limits of deviation shown on the Works Plans [TR010060/APP/2.2] have been taken into account in the preparation of this chapter, and the potential impacts of a deviation within the permitted limits have therefore been assessed. It has been assumed that in accordance with the REAC, which is included in the first iteration EMP [TR010060/APP/6.5], there would be no net change to the balance of vegetation retained or removed in areas of the proposed scheme affected by the use of the limits of deviation (see Retained and Removed Vegetation Plans [TR010060/APP/2.14]).

9.6.14 To assume a worst case, all trees at risk of removal have been assumed as lost, except in relation to the gas main diversion. While the Retained and Removed Vegetation Plans [TR010060/APP/2.14] illustrate trees at risk within the full extent of the lateral limits of deviation (for the gas main diversion), this assessment assumes vegetation loss would be restricted to a 30m corridor.

9.6.15 Vertical limits of deviation are relevant to this aspect where there is potential for impacts from groundwater to affect biodiversity receptors. Vertical limits of deviation with respect to groundwater are detailed within Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR0100/60/APP/6.1].

9.7 Study area

9.7.1 The study area for biodiversity relates to the main areas of construction activity, including construction compounds, haul roads and borrow pits. It excludes survey of (and buffers around) those sections within the existing highway boundary at either end of the proposed scheme where only installation of new signage is proposed. This is because the impacts of these activities would be restricted to short durations and are located within the existing highway verges, which cannot be safely surveyed at this time; however, pre-construction surveys of these areas would be undertaken with traffic management in place.

9.7.2 The study area for biodiversity also excludes an area within the Order Limits to the north of Marks Tey where an existing layby is included for the purpose of use by rescue and recovery vehicles during construction of the proposed scheme. This is because the layby is already constructed and in use by vehicles and therefore no additional impacts with respect to biodiversity would occur.

9.7.3 A desk-based assessment of designated sites and records of protected and notable habitats and species was undertaken, comprising the following:

- SACs, SPAs and Ramsar sites where the proposed scheme meets one or more of the following criteria:
  - is within 2km of a Ramsar site, SPA or SAC, or functionally linked land (land occurring outside a designated site which is considered to be critical to, or necessary for, the ecological or behavioural functions in a relevant season of a qualifying feature for which the site has been designated)
  - is within 30km of a SAC, where bats are noted as one of the qualifying interests

  - crosses or lies adjacent to, upstream of, or downstream of, a watercourse which is designated in part or wholly as a site within the national site network
  - has a potential hydrological or hydrogeological linkage to a Ramsar site, SPA or SAC containing a GWDTE
  - has an ARN within 200m of the national site network
  - would have a pathway to effects
- SSSIs within 2km of the proposed scheme and 200m of the ARN, or which have hydrological connectivity to the proposed scheme.
- LNRs, LWSs, Local Road Verges (LRV), notable habitats such as ancient woodland and GWDTEs within 1km of the proposed scheme and 200m of the ARN.
- Records of protected and notable species within 2km of the proposed scheme (5km for bats and barn owls) requested from Essex Wildlife Trust Biological Records Centre (EWTBRC), the Barn Owl Conservation Network, Essex Badger Group, Essex Bat Group, and Essex Field Club (EFC), obtained in 2017 and updated in 2020 where appropriate.

9.7.4 Details of field surveys that were undertaken, are planned or are ongoing are provided in Table 9.7.

9.7.5 Full survey methodologies for the above are detailed in the survey reports (Appendices 9.1 to 9.13 of the Environmental Statement [TR010060/APP/6.3]).

9.8 Baseline conditions

Baseline sources

9.8.1 The following baseline sources have been used:

- EWTBRC provided data records in 2017 and 2020 for protected and designated species, invasive species, non-statutory LWS and LRV within 2km of the proposed scheme (increased to 5km for bats and barn owl). Additional LWS data were also requested in 2021 in relation to the assessment of air quality impacts due to changes in the location of the ARN.
- EFC provided data records in 2017 and 2020 for notable and protected species within 2km of the proposed scheme (increased to 5km for bats).
- The Ancient Woodland Inventory (Natural England, 2021) was reviewed to identify ancient woodland habitats.
- The Barn Owl Conservation Network was contacted for their barn owl breeding records in 2017. Further records were requested in 2021 and have not been received at the time of writing. This is not considered a significant constraint due to the extensive existing data collected through recent field surveys informing the baseline.

- Essex Badger Group were contacted for their records in 2017. This data request has not been updated more recently due to the extensive existing data collected through recent field surveys informing the baseline.
- Essex Bat Group were contacted for their records in 2017.
- Dormouse records were obtained from Essex Wildlife Trust through consultation in 2020.
- Environment Agency monitoring data for aquatic ecological features were reviewed in 2020.
- Aerial photography and Ordnance Survey maps were reviewed between 2016 and 2021.
- International and national statutory designated sites, priority habitats and granted EPSM licences were identified on the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Defra, 2021).
- A review was conducted of Natural England data from Great Crested Newts eDNA Pond Surveys for District Level Licensing (England) (Natural England, 2020a).
- GCN Risk Zones (Essex) (Natural England, 2020b).
- GCN Class Licence Returns (England) (Natural England, 2020c).
- A National Biodiversity Network (NBN Atlas Partnership, 2021) data search was performed to identify any records of freshwater macro-invertebrates or macrophytes from ponds within the study area.
- Records of verified veteran and ancient trees were obtained from the Woodland Trust Ancient Tree Inventory in October 2021.
- Results of various detailed species and habitat surveys conducted between 2016 and 2021 (Appendices 9.1 to 9.13 and Appendix 8.4: Arboricultural Impact Assessment [TR010060/APP/6.3]).

Baseline information

Designated sites

9.8.2 There are no confirmed or potential SPAs, SACs, or Ramsar sites (collectively known as the national site network) located within the 2km study area around the Order Limits or within 200m of the ARN, and no SACs designated for bats within the 30km study area (see Figure 9.1 [TR010060/APP/6.2]).

9.8.3 There are five designated sites beyond 2km from the proposed scheme that are hydrologically linked to it: Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar; Essex Estuaries SAC; and Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar, all of which are designated for Annex I habitats.

9.8.4 There are fifteen sites where there is possible interaction between the proposed scheme and ranging bird species associated with those designated sites: Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar; Abberton Reservoir SPA and Ramsar; Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar; Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) SPA and Ramsar; Dengie (Mid-Essex Coast Phase 1) SPA and Ramsar; Outer Thames Estuary SPA; Stour and Orwell Estuaries SPA and Ramsar; and Alde-Ore Estuary SPA and Ramsar.

9.8.5 The HRA No Significant Effects Report [TR010060/APP/6.8] provides a detailed assessment of the potential impacts of the proposed scheme to these sites. The Stage 1 Screening Report was submitted to Natural England for pre-application consultation in September 2021. A response was received from Natural England in October 2021 agreeing with the Stage 1 HRA conclusion that no likely significant effects on any sites within the national site network are anticipated, when considered alone or in combination with other plans or projects. The Stage 1 Screening Report was then updated to include the response from Natural England and is presented as the HRA No Significant Effects Report [TR010060/APP/6.8].

9.8.6 Marks Tey Brickpit SSSI is located approximately 80m from the Order Limits, north-west of junction 25 (Marks Tey interchange). Marks Tey Brickpit SSSI is designated for geological reasons and therefore its value does not relate to ecological conservation. This site is therefore not considered further in this chapter but is covered in Chapter 10: Geology and soils, of the Environmental Statement [TR010060/APP/6.1].

9.8.7 There is one SSSI with hydrological connectivity to the site, the River Ter SSSI (geological designation), which is located approximately 8km upstream of the proposed scheme to the north of Boreham.

9.8.8 One SSSI (Tiptree Heath SSSI, designated for heathland habitats) is located within 200m of the ARN (see Figure 9.1 [TR010060/APP/6.2]).

9.8.9 Two LNRs, Whetmead LNR, and Brockwell Meadows LNR, are located within 2km of the proposed scheme (see Table 9.10 and Figure 9.1 [TR010060/APP/6.2]). The Order Limits encroach approximately 100m across the western boundary of Whetmead LNR between junction 21 (Witham South interchange) and junction 22 (Colemans interchange); and Brockwell Meadows LNR is located approximately 55m west of the proposed scheme in Kelvedon between junction 23 (Kelvedon South interchange) and junction 24 (Kelvedon North interchange).

Table 9.10 Local Nature Reserves within 2km of the proposed scheme

Site name	Interest and designated features	Location
Whetmead	Previous landfill site now comprising unimproved grassland and lagoons. Supports a range of butterflies and dragonflies, and seed-eating birds.	Partially within the Order Limits, located between junctions 21 and 22.
Brockwell Meadows	Associated with the River Blackwater, comprising a water meadow, woodland, a pond and hedgerows.	55m west of the Order Limits, located south of Kelvedon between junctions 23 and 24.

9.8.10 Whetmead LNR and a further three LNRs are located within 200m of the construction or operational ARN (Table 9.11). These are Hilly Fields LNR, Spring Lane Meadows LNR and Galleywood Common LNR.

Table 9.11 Local Nature Reserves within 200m of the construction or operation ARN

Site name	Interest and designated features	Approximate distance (m), and direction from construction ARN	Approximate distance (m), and direction from operation ARN
Hilly Fields	Comprises a range of grassland, hedges, scrub and woodland vegetation in both wet and dry areas, including acid grassland, marsh, tall ruderal and sown agricultural meadows.	N/A – more than 200m	15m south of ARN
Spring Lane Meadows	Wildflower meadow and riverside habitats supporting a variety of wildlife, including otters, kingfisher and snipe.	N/A – more than 200m	18m south of ARN
Whetmead	Previous landfill site now comprising unimproved grassland and lagoons. Supports a range of butterflies and dragonflies, and seed-eating birds.	7m east of ARN	3m east of ARN
Galleywood Common	Areas of scrub, heathers, grasses, bare ground and wetlands.	55m north of ARN	N/A – more than 200m

9.8.11 There are 37 LWSs within 1km of the proposed scheme (Table 9.12 and Figure 9.1 [TR010060/APP/6.2]). The Riverview Meadows LWS, Perry's Wood LWS, Whetmead LWS and River Chelmer LWS are all partially within or adjacent to the Order Limits. Whetmead LWS and Brockwell Meadows LWS both overlap the LNRs of the same name. Marks Tey Brickpit LWS overlaps with Marks Tey Brickpit SSSI. There are 11 LWSs within 200m of the construction ARN and 27 LWSs within 200m of the operational ARN.

Table 9.12 Local Wildlife Sites within 1km of the proposed scheme and within 200m of the ARN

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the construction ARN (m)	Approximate distance from the operational ARN (m)
Boreham Road Gravel Pits	142	157	8
Braxted Park	614	N/A – more than 200m	5
Brockwell Meadows	1	N/A – more than 200m	12
Bulls Lodge Lagoons	254	N/A – more than 200m	N/A – more than 200m
Chantry Wood	272	N/A – more than 200m	N/A – more than 200m
Coggeshall Hall Farm	422	N/A – more than 200m	N/A – more than 200m
Cook's Lane, Lexden	N/A – more than 1km	29	19
Copford Hall Wood North	811	N/A – more than 200m	N/A – more than 200m
Cymbeline Meadows	N/A – more than 1km	N/A – more than 200m	16
Daisy Green Grove	994	N/A – more than 200m	N/A – more than 200m
Domsey Brook Pasture	749	N/A – more than 200m	N/A – more than 200m
Eden Wood	836	N/A – more than 200m	N/A – more than 200m
Feering Marsh	344	N/A – more than 200m	N/A – more than 200m
Galleywood Common	N/A – more than 1km	144	N/A – more than 200m
Gol Grove/Hanging Wood	N/A – more than 1km	N/A – more than 200m	31
Hatfield Peverel Special Roadside Verge	1,000	N/A – more than 200m	N/A – more than 200m
Hill Wood	404	N/A – more than 200m	N/A – more than 200m

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the construction ARN (m)	Approximate distance from the operational ARN (m)
Hilly Fields	N/A – more than 1km	N/A – more than 200m	11
Hoo Hall Meadow	489	N/A – more than 200m	N/A – more than 200m
Inworth Grange Pits	857	N/A – more than 200m	190
Inworth Wood	78	N/A – more than 200m	193
Keeper's Cottage Wood	691	N/A – more than 200m	N/A – more than 200m
Kelvedon Hall Wood	415	N/A – more than 200m	169
Kiln Wood	N/A – more than 1km	N/A – more than 200m	59
Lady Grove	N/A – more than 1km	18	N/A – more than 200m
Layer Wood	N/A – more than 1km	N/A – more than 200m	0
Lexden Springs	N/A – more than 1km	N/A – more than 200m	17
Long Wood Complex	363	N/A – more than 200m	N/A – more than 200m
Lost Wood	997	N/A – more than 200m	N/A – more than 200m
Lower Road, Birch Verges	N/A – more than 1km	N/A – more than 200m	0
Marks Tey Brickpit	542	N/A – more than 200m	N/A – more than 200m
Mope Wood Complex	196	N/A – more than 200m	N/A – more than 200m
Perry's Wood	Adjacent to the Order Limits	N/A – more than 200m	5
Pits Wood	479	N/A – more than 200m	N/A – more than 200m

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the construction ARN (m)	Approximate distance from the operational ARN (m)
Pods and Conyfield Woods	N/A – more than 1km	N/A – more than 200m	3
Ram Plantation	N/A – more than 1km	N/A – more than 200m	0
River Chelmer	Partially within the Order Limits	0	0
Riverview Meadows	Partially within the Order Limits	N/A – more than 200m	N/A – more than 200m
Sandon Pit	N/A – more than 1km	11	6
Sandon Riverside	169	21	19
Seven Star Green	753	N/A – more than 200m	N/A – more than 200m
Sir Hughes' Wood	N/A – more than 1km	22	N/A – more than 200m
Smythe's Green	N/A – more than 1km	N/A – more than 200m	3
Sparkey Wood	243	N/A – more than 200m	N/A – more than 200m
Spring Grove	N/A – more than 1km	126	126
Stanway Pits	924	N/A – more than 200m	191
Stonage Wood	N/A – more than 1km	N/A – more than 200m	49
The Grove	173	N/A – more than 200m	N/A – more than 200m
The Old Rectory Meadows	703	N/A – more than 200m	N/A – more than 200m
Tiptree Church	N/A – more than 1km	N/A – more than 200m	107
Tiptree Water Works	373	N/A – more than 200m	N/A – more than 200m
Titbeech Wood	500	N/A – more than 200m	N/A – more than 200m

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the construction ARN (m)	Approximate distance from the operational ARN (m)
Toppinghoehall Wood (Bra87)	507	N/A – more than 200m	N/A – more than 200m
Toppinghoehall Wood (Ch120)	683	N/A – more than 200m	N/A – more than 200m
West House Wood	N/A – more than 1km	11	11
Whetmead	Partially within the Order Limits	13	8

9.8.12 There are no LRV within 1km of the proposed scheme.

Habitats – desk study

9.8.13 There are 15 Ancient Woodland Inventory sites located within the 1km study area (see Figure 9.2 [TR010060/APP/6.2]), many of which are also designated as LWSs. The sites include both ancient semi-natural woodland and ancient replanted woodland habitat types. The closest Ancient Woodland Inventory site (Perry's Wood) is directly adjacent to the proposed scheme along Inworth Road. In addition, there are 36 veteran trees and seven ancient trees within 1km of the proposed scheme, with three veteran trees and no ancient trees within the Order Limits (Woodland Trust, 2021).

9.8.14 There is one Ancient Woodland Inventory site and 32 potential and verified veteran and ancient trees within 200m of the construction ARN; and seven Ancient Woodland Inventory sites, and 65 verified and potential veteran and ancient trees (which reside near to one of 52 receptor locations) within 200m of the operational ARN (see Figure 9.2 [TR010060/APP/6.2]).

9.8.15 The desk-based study identified a variety of UK BAP priority habitats within 1km of the proposed scheme. However, the confidence (assigned by the data source) in these classifications ranges between 'low' and 'medium' (Defra, 2021).

9.8.16 Two areas of wet woodland priority habitat were identified, one located along the River Ter and one along the River Blackwater (see Figure 9.2 [TR010060/APP/6.2]). These were classified as Annex I habitat 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (JNCC, 2022).

9.8.17 The Colemans Farm Quarry restoration plan includes areas of priority habitats which would be created within the Order Limits. These include open mosaic habitat on previously developed land, lowland meadow, coastal and floodplain grazing marsh and orchard.

9.8.18 Within a consultation response, Essex Wildlife Trust highlighted the presence of priority habitats including reedbed and wet woodland within the corridor of the Cadent gas main diversion. The woodland contains two very old black poplars *Populus nigra* estimated to be several hundred years old.

9.8.19 The following designated sites and habitats (Figure 9.1 and Figure 9.2 [TR010060/APP/6.2]) were identified through desk-based assessment as likely comprising GWDTEs. The list of sites has been refined since PEIR (Highways England, 2021) through a prioritisation of potential impacts using criteria defined in Appendix 14.4: Groundwater assessment, of the Environmental Statement [TR010060/APP/6.3] and through a more detailed assessment of the hydrological catchment, soils and geology (also detailed within Appendix 14.4):

- Brockwell Meadows LNR and LWS - adjacent to the Order Limits
- Riverview Meadows LWS - partially within the Order Limits for access road
- Marshy Grassland and Wet Woodland 1 - partially within the Order Limits and dewatering zone of influence (see Appendix 14:4 Groundwater Assessment, of the Environmental Statement [TR010060/APP/6.3])
- Wet Woodland 7 - partially within the Order Limits and dewatering zone of influence (see Appendix 14:4 of the Environmental Statement [TR010060/APP/6.3])
- Wet Woodland 8 - adjacent to Order Limits and dewatering zone of influence (see Appendix 14:4 of the Environmental Statement [TR010060/APP/6.3])

9.8.20 Further details of this assessment and the habitats identified are provided in Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1].

Habitats - field survey

9.8.21 The Phase 1 habitat survey (Appendix 9.8 [TR010060/APP/6.3]) found the study area to be a predominantly farmed landscape, with most land given over to arable cultivation. Arable areas contrasted with land use in the river floodplains, largely used for forestry. Other land uses within the surveyed area were localised, comprising pasture; residential and industrial areas; amenity areas in built-up areas; and quarries.

9.8.22 The survey confirmed the presence of seven priority habitats within the study area. These are summarised in Table 9.13.

Table 9.13 Summary of priority habitats recorded

Priority habitat	Study area	Order Limits
	Total area / length	Total area / length
Arable field margins	2.49ha	0ha
Eutrophic standing waters	13.36ha	10.36ha
Hedgerows	175.08km	39.24km

Priority habitat	Study area	Order Limits
	Total area / length	Total area / length
Lowland mixed deciduous woodland	47.89ha	13.78ha
Open mosaic habitats on previously developed land	3.80ha	4.74ha
Wet woodland	9.03ha	2.76ha
Wood pasture and parkland	45.85ha	0ha

9.8.23 The majority of grassland habitats identified were either improved grassland or cultivated or disturbed land. Species-poor neutral grassland was found, most often associated with field edges and road verges. Of more ecological interest were small and isolated areas of species-rich neutral grassland, unimproved neutral grassland (likely to have been sown) and marshy grassland associated with watercourses.

9.8.24 There were several rivers and numerous smaller streams within the surveyed area. Most of the study area is divided between the catchments of the River Chelmer, which extends across the study area between Chelmsford and Witham, and the River Blackwater, from Witham to Marks Tey. The north-eastern end of the study area, where the Roman River flows through Copford, falls within the catchment of the Colne.

9.8.25 Numerous bodies of standing water were mapped across the surveyed area. These were predominantly man-made features of a range of sizes and associated with a range of uses. The largest bodies of standing water were along the River Blackwater in the Witham area, comprising flooded former quarries used for angling. Smaller bodies of standing water were scattered across the survey area, comprising ponds in woodlands, field boundaries and gardens, and flooded depressions and ditches.

9.8.26 Ponds were surveyed using PSYM methods (Pond Action, 2002). No notable macro-invertebrates or macrophytes were recorded from ponds surveyed and no ponds in the top PSYM category (‘high’) for ecological quality (i.e. having a PSYM score ≥75%) were identified. Only two ponds met the criteria for UK BAP habitat, due to the presence of GCN.

9.8.27 The proposed scheme crosses seven Main Rivers: Boreham Brook, River Ter, River Brain, Rivenhall Brook, River Blackwater, Domsey Brook and the Roman River. Six are designated WFD waterbodies and they currently all achieve overall Moderate classification (Cycle 2, 2019) (Environment Agency, 2021).

9.8.28 River habitat surveys of these watercourses found that the River Ter, River Brain and River Blackwater achieved a habitat modification score of ‘severely modified’ predominantly due to extensive artificial modification and re-sectioning. In all cases, the survey reach included the existing A12 crossing whilst the historic effects of previous physical habitat intervention (for example embankments, re-sectioning and planting) maintain an effect on riverine functioning. The Domsey Brook achieved a habitat modification score of

'significantly modified' and the Roman River received a habitat modification score of 'predominantly unmodified'.

9.8.29 The rivers have been assessed against UK BAP criteria and having failed to meet the minimum requirements, are not UK BAP habitat.

9.8.30 Woodland stands were concentrated between Boreham and Witham with most of the larger stands of semi-natural woodland appearing to be long-established, though some were clearly more recent and associated with human activity, such as around former quarries, roads and railways. Extensive areas of plantation woodland were identified, largely found on river floodplains and used for the cultivation of willow (mainly cricket-bat willow *Salix alba* var. *caerulea)*. Plantation woodland elsewhere most frequently comprised small stands, such as along the A12 and around some larger residential properties in rural areas. Stands of scrub were common across the study area.

9.8.31 Some stands of woodland identified in the Ancient Woodland Inventory (Natural England, 2021), i.e. continuously wooded since at least 1600 AD, were recorded during field surveys, including Inworth Wood, Kelvedon Hall Wood, Titbeech Wood and Toppinghoehall Wood.

9.8.32 Thirteen other areas of potentially ancient woodland that are not identified in the inventory were recorded during field surveys (see Figure 9.2 [TR010060/APP/6.2]), including the following woodlands: The Grove and Porter's Grove, Bishop's Wood, Brewhouse Wood, Church Hills, Long Wood, Spitman's Garden, Sandpit Wood, The Grove, Job's Wood, Whitegate Grove, Jubb's Row and two unnamed woodlands. All of these are outside the Order Limits and located more than 200m from the ARN, with the exception of the Porter's Grove component of The Grove and Porter's Grove, which is located within 200m of the construction and operational ARN.

9.8.33 Within 15m of the Order Limits (extending to 30m where there were trees that could be assigned as a potential veteran/ancient tree) at the time of survey, 33 trees meeting the veteran tree criteria and two trees meeting the ancient tree criteria were identified. A full arboricultural survey has been completed, reported in Appendix 8.4 of the Environmental Statement [TR010060/APP/6.3], which has confirmed that all aforementioned trees meet the criteria to qualify as veteran trees or ancient trees, hereon referred to as 'potential veterans' or 'potential ancients' respectively.

9.8.34 Field boundaries, lanes and tracks support an extensive and complex network of ditches.

9.8.35 Hedgerow surveys recorded 302 hedgerows within the Order Limits, of which 12 were species-rich, 250 qualified as priority habitat and 53 were important under the wildlife and landscape criteria of The Hedgerows Regulations 1997 (note these criteria are not mutually exclusive).

9.8.36 Of the hedgerows surveyed, 81 showed a diversity of features indicating that they were long-established, likely ancient habitats and landscape features pre-dating 18th and 19th century agricultural enclosures. Such well-established habitats and landscape features are likely to be irreplaceable, meaning it would take a significant time, possibly centuries, to recreate or restore their species diversity or other features.

Protected and notable species – desk study

9.8.37 The desk study identified records for a range of protected and notable species within 2km of the proposed scheme (5km for bats and barn owl). These include bats, badger, otter, water vole, birds (including Schedule 1 species such as barn owl, hobby *Falco subbuteo*, kingfisher and red kite *Milvus milvus*), reptiles (common lizard *Zootoca vivipara*, grass snake *Natrix helvetica* and slow worm *Anguis fragilis*), GCN and white-clawed crayfish.

9.8.38 A single white-clawed crayfish record was identified from 2001 on the River Blackwater (NBN Atlas Partnership, 2021). Based on the age of this record and results of field surveys, white-clawed crayfish were not scoped into the assessment and are not considered further (see Table 9.6).

9.8.39 A record of dormice was shared by Essex Wildlife Trust through the stakeholder engagement process. The record was located approximately 8km along the A12 beyond the south-west limit of the proposed scheme roadside vegetation. A desk-based assessment was undertaken using aerial photography to identify potential connectivity between this record and the proposed scheme. Roadside verge habitats were fairly continuous along embankments of the existing A12, however it was determined that any connectivity is severed at multiple points including at junction 17 and junction 18, and at the River Chelmer, indicating that the proposed scheme has no connectivity with confirmed dormouse populations. No other records of dormouse were identified.

9.8.40 EWTBRC and EFC provided records for species of principal importance within the 1km study area (e.g. brown hare *Lepus europaeus*, common toad *Bufo bufo*, polecat *Mustela putorius* and hedgehog *Erinaceus europaeus*).

9.8.41 In a consultation response, Essex Wildlife Trust highlighted the presence of two otter holts and water vole east of the River Blackwater, near Ishams Chase.

9.8.42 The Environment Agency and EWTBRC provided records of protected and notable fish species, including brown trout *Salmo trutta*, bullhead *Cottus gobio* and European eel within the 1km study area. The EWTBRC, Essex Wildlife Trust and Environment Agency also provided records of a range of notable invertebrate and plant species, as well as invasive plants and animals listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

9.8.43 The desk study identified a number of records of INNS including Japanese knotweed *Fallopia japonica*, American mink *Neovison vison* and Turkish crayfish *Astacus leptodactylus*.

Protected and notable species – field survey

9.8.44 Results of surveys for protected and notable species are summarised in subsequent sections and shown on Figure 9.3 [TR010060/APP/6.2]. Further information is provided in Appendices 9.1 to 9.13 of the Environmental Statement [TR010060/APP/6.3].

Bats

9.8.45 A total of 72 bat roosts in trees, buildings and structures were recorded within the study area, with nine roosts located within the Order Limits (Table 9.14). Of the 72 roosts, 10 are within trees, buildings or structures where more than one species was present. For the purposes of this assessment, these have been considered separate roosts. In addition, 252 trees of moderate to high bat roost potential, 1,479 buildings of moderate to high potential, and two structures of moderate potential are located within the study area. Of these, 43 buildings, 109 trees and two structures are located within the Order Limits. Locations of roosts are shown on Figure 9.3 [TR010060/APP/6.2].

Table 9.14 Summary of bat roosts within the study area

Roost ID	Species	Roost type	Approximate distance from Order Limits (m)
Structure BE11	Common pipistrelle	Day	0
	Soprano pipistrelle	Day	0
Tree 17	Soprano pipistrelle	Day	8
Tree 69	Soprano pipistrelle	Day	85
Tree 79	Brown long-eared bat	Day	0
Tree 623	Common pipistrelle	Day	46
	Soprano pipistrelle	Day	46
Tree 634	Soprano pipistrelle	Mating	47
Tree 733	Soprano pipistrelle	Day	0
Tree 1149	Pipistrelle	Day	0
Tree 1692	Soprano pipistrelle	Day	17
Tree Untagged ex566880-120121-1	Brown long-eared bat	Maternity	24
Building B73	Common pipistrelle	Maternity	4
Building B107	Soprano pipistrelle	Day	56
Building B113	Common pipistrelle	Day	10
Building B118	Common pipistrelle	Day	0
	Soprano pipistrelle	Day	0
Building B350	Common pipistrelle	Day	37
Building B387	*Pipistrelle sp.*	Undetermined	27

Roost ID	Species	Roost type	Approximate distance from Order Limits (m)
Building B339	Common pipistrelle	Day	3
Building B631	Soprano pipistrelle	Day	18
Building B634	Common pipistrelle	Day	39
Building B637	Soprano pipistrelle	Day	4
Building B716	Common pipistrelle	Maternity	88
Building B923	Common pipistrelle	Day	0
Building B1249	Noctule	Day	30
Building B1250	Soprano pipistrelle	Day	34
Building B1252	Soprano pipistrelle	Day	23
Building B1291	Common pipistrelle	Day	5
	Brown long-eared bat	Hibernation	5
Building B1341	Soprano pipistrelle	Maternity	58
Building B1371	Undetermined	Undetermined	32
Building B1385	Common pipistrelle	Day	57
Building B1392	Soprano pipistrelle	Day	27
Building B1393	Soprano pipistrelle	Day	27
Building B1395	Soprano pipistrelle	Day	43
Building B1397	Soprano pipistrelle	Day	56
Building B1447	Soprano pipistrelle	Transitional	2
Building B1455	Soprano pipistrelle	Day	2
Building B1463	Common pipistrelle	Day	0
Building B1522	Common pipistrelle	Day	0
	Soprano pipistrelle	Day	0
Building B1543	*Myotis sp.*	Day	37
	Noctule	Day	37
	Common pipistrelle	Hibernation	37
	Soprano pipistrelle	Hibernation	37
Building B1549	Soprano pipistrelle	Transitional	4

Roost ID	Species	Roost type	Approximate distance from Order Limits (m)
Building B1585	Soprano pipistrelle	Day	23
Building B1665	Common pipistrelle	Maternity	14
Building B1679	Common pipistrelle	Day	6
Building B1928	Common pipistrelle	Day	28
	Soprano pipistrelle	Day	28
Building B1928c	Common pipistrelle	Day	16
Building B1992d	*Pipistrelle sp.* Or *Myotis sp.*	Transitional	9
Building B1997	Soprano pipistrelle	Day	3
Building B2042	Common pipistrelle	Day	8
	Soprano pipistrelle	Day	8
	Brown long-eared bat	Day	8
Building B2046	Soprano pipistrelle	Maternity	34
	Common pipistrelle	Day	34
Building B2937	Soprano pipistrelle	Transitional	24
Building B2944	Undetermined	Undetermined	76
Building B2974	Common pipistrelle	Day	87
Building B3621	Common pipistrelle	Maternity	0
	Soprano pipistrelle	Maternity	0
Building B3631	Common pipistrelle	Day	11
Building B3638	Common pipistrelle	Day	40
Building B3648	Undetermined	Hibernation and day	18
Building B3679	Common pipistrelle	Transitional	19
Building B3709	Common pipistrelle	Day	100
Building B3739	Soprano pipistrelle	Maternity	57
	Brown long-eared bat	Day	57

9.8.46 B599b was identified as a roost in the PEIR but not in this Environmental Statement. B599b is a pile of concrete blocks and was initially considered to be a roost due to the finding of presumed bat droppings during one of two hibernation inspections. No bats or other evidence of use by bats was found during these surveys. Subsequently the droppings were sent for DNA analysis and came back as positive for bank vole *Myodes glareolus.* Additionally, three summer emergence/re-entry surveys were conducted, and no roosts were identified. On this evidence, B599b has been declassified as a roost and therefore is not included in this assessment.

9.8.47 B1345 was identified as a roost in the PEIR but not in this Environmental Statement. B1345 was found to be a separate building to B1341 in 2020-2021 surveys. However, it was surveyed together with B1341 in 2017. On further analysis of the survey forms from 2017 (on which the roost classification is based) all the emergences were recorded on B1341 during these surveys so B1345 is no longer classified as a roost.

9.8.48 Activity of foraging and commuting bats was recorded throughout the study area, and species recorded comprised the following: barbastelle bat *Barbastella barbastellus*, brown long-eared bat*,* common pipistrelle, Leisler's bat *Nyctalus leisleri, Myotis spp*., Nathusius' pipistrelle *Pipistrellus nathusii*, noctule, and soprano pipistrelle. Most notable of these is the nationally rare International Union for Conservation of Nature (IUCN) threatened species barbastelle bat, which was recorded to the west of junction 25.

9.8.49 While bat activity was well distributed across the entire study area, hedgerows connecting woodland and arable fields as well as areas of trees near water bodies had the highest activity levels as well as the highest diversity of species recorded. This shows that bats in the study area heavily use linear features such as hedgerows, rivers and woodland boundaries as foraging habitat and commuting routes across the landscape.

9.8.50 Static detectors 6.2 (National Grid reference (NGR) TL 85314 17138, south of Feering) and 7.2 (NGR TL 88345 20431, north of Feering) (see Appendix 9.4: Bat survey report [TR010060/APP/6.3] for the location of the detectors) recorded the highest levels of general bat activity across the site. On a species-specific basis, the highest level of activity was different for each species, with the best areas for each distributed along the site. Of particular note are the data for barbastelle bats, which were recorded across the site but for which highest number of passes were recorded on static detector 8.1, located west of junction 25.

9.8.51 Barbastelle bats have been assigned County level importance based on the resulting score from Valuing Bats in Ecological Impact Assessment (Wray *et al*, 2010). This takes into consideration the rarity of species, numbers of individuals present, roosts or potential roosts nearby and the type and complexity of commuting/foraging habitats. The scores for barbastelles for commuting and foraging were 29 and 29 respectively (see Appendix 9.4 [TR010060/APP/6.3]). A score of 21-30 falls within County level importance, and therefore for the purposes of this assessment, barbastelle are considered to be of County level importance.

9.8.52 Across all crossing point locations along the existing A12, bats were found to more regularly cross safely under the A12 rather than flying over it. Of the 160 passes recorded at existing features (for example culverts), 155 were under the existing feature or at a safe height over the road. Therefore, bats had a 3.13% unsafe crossing rate at existing crossing points.

9.8.53 Full details on the bat surveys are provided in Appendix 9.4 of the Environmental Statement [TR010060/APP/6.3].

Badger

9.8.54 Badger activity was recorded throughout the study area including setts, latrines, pathways and snuffle holes. Notable clusters of badger setts and associated field signs were recorded south-east of junction 20a (Hatfield Peverel South interchange), to the south of junction 22 (Colemans interchange) and to the south of junction 25 (Marks Tey interchange). Due to the sensitive nature of the data, sett locations are not shown on Figure 9.3 [TR010060/APP/6.2] and detailed location descriptions are not included here. This information has been included within Appendix 9.2: Badger survey report [TR010060/APP/6.3] and shared with stakeholders.

9.8.55 In total, 128 setts were recorded within a 250m study area around the proposed scheme, of which 90 were active in recent surveys, including 18 main setts, four annex setts, 21 subsidiary setts, 84 outlier setts and one undetermined sett. Of the setts recorded, four main setts, two annex setts, seven subsidiary setts, 37 outlier setts and one undetermined sett were located within the Order Limits. Of the setts within the Order Limits, 36 (four main setts, one annex sett, three subsidiary setts and 28 outlier setts) showed signs of active use by badgers at the time of survey.

9.8.56 Full details on the badger surveys are provided in Appendix 9.2 of the Environmental Statement [TR010060/APP/6.3].

Otter

9.8.57 A total of 273 water features (ditches, ponds and lakes) and sections of watercourses were identified within the study area and surveyed for otter. Otter signs, including live sightings, spraints and confirmed resting places, were recorded within the study area (see Figure 9.3 [TR010060/APP/6.2]).

9.8.58 All Main Rivers and well-connected wet water features (ditches, ponds and lakes) surveyed have suitable habitat features for otter resting places and/or offer suitable commuting opportunities.

9.8.59 No holts or couches were recorded within the Order Limits. Otter signs including spraints and potential and confirmed resting places were recorded along six ditches and six ponds or lakes.

9.8.60 The highest spraint density was recorded within the Kelvedon area, on the River Blackwater, Domsey Brook and Rivenhall Brook, where otters were also sighted on two separate occasions. The nearest sprainting sites were found directly under the A12 on the River Blackwater and Domsey Brook.

9.8.61 The nearest holt was confirmed to be 57m north of the A12 on the River Blackwater (NGR TL 85690 17823), and an otter was observed swimming and entering the feature. Three otters were also observed swimming at the same location on a separate occasion. However, subsequent monitoring surveys of the holt via camera traps took place over three separate periods in 2021, for a total of 143 days. No footage of the holt being further used by otters was recorded. The likelihood of these three individual otters being from a natal holt is considered low given the absence of otter activity recorded during the further holt monitoring.

9.8.62 Full details on the otter surveys are provided in Appendix 9.10: Riparian Mammal Report, of the Environmental Statement [TR010060/APP/6.3].

Water vole

9.8.63 A total of 274 water features were identified as requiring further assessment for water vole. Of these, 98 ditches, 80 ponds or lakes and one river (Roman River) were concluded to be unsuitable or sub-optimal for water vole during the first visit and were therefore scoped out for a second visit. Of the remaining 95 water features, 17 were only surveyed once due to a lack of access or change of study area boundary. The remaining 78 water features were subject to a second water vole survey. Water vole signs, including latrines, burrows feeding remains, prints and runs were recorded within the study area and water vole signs were recorded in 10 water features within the study area. Of these, two were within the Order Limits (D135/D136 (D135 is an extension of D136) and D152).

9.8.64 Surveys identified the presence of water vole latrines and burrows on one watercourse (Domsey Brook to the south of the existing junction 24) and two ditches to the south of junction 19 (see Figure 9.3 [TR010060/APP/6.2]), indicating low-density populations of water vole in these areas.

9.8.65 Surveys carried out in 2017 identified higher numbers of water vole within the wider study area, suggesting a decline of the water vole population since this time, potentially due to predation, habitat degradation and habitat management.

9.8.66 Full details on the water vole surveys are provided in Appendix 9.10 of the Environmental Statement [TR010060/APP/6.3].

Dormouse

9.8.67 No dormice or evidence of dormice were recorded during field surveys in 2017 or 2020. Although dormice are known to be present within the wider landscape (as evidenced by the record of dormice shared by Essex Wildlife Trust to the south of junction 17 of the A12), connectivity between known populations and the proposed scheme is poor. The River Chelmer poses a partial barrier to dispersal of dormice between habitats south of junction 17 and the proposed scheme which is more than 8km north along the A12. The connectivity between the two locations is broken in several other locations along the A12, including a gap of approximately 90m in the roadside vegetation on the western carriageway verge. The vegetation on the eastern carriageway is sub-optimal, with gaps in woody vegetation of at least 25m. The road verges between junction 19 and junction 20a contain sporadic gaps in vegetation. Dormice are

therefore considered likely to be absent from the main part of the proposed scheme.

9.8.68 There are however suitable habitats to the east of the River Blackwater, in habitats which may be impacted by the gas main diversion. Habitats are connected to areas of broadleaved woodland further east. There is potential for dormice to be present in this part of the site.

9.8.69 This species has been scoped out from further assessment for the majority of the proposed scheme; however, because surveys of the gas main diversion are ongoing, potential impacts to dormice are assessed with respect to this part of the site.

9.8.70 The dormouse technical report has been provided to stakeholders as part of ongoing consultation to agree that the level of field surveys undertaken in 2017 and 2020 is adequate to assume likely absence of this species from the main part of the proposed scheme. Details of consultation are provided in Section 9.3 of this chapter.

9.8.71 Full details on the dormouse surveys are provided in Appendix 9.6: Dormouse Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Other mammals

9.8.72 Incidental observations of brown hare and hedgehog were recorded around the study area. Both are listed as species of principal importance under Section 41 of the NERC Act 2006.

9.8.73 Incidental observations of water shrew *Neomys fodiens* were also made in one pond in 2017, NGR TL 91614 23296.

9.8.74 Numerous sightings of rabbit *Oryctolagus cuniculus*, including burrows, were recorded around the study area. Rabbits are common, widespread and have no conservation status, and as such are not considered further in this chapter. However, details of how they would be protected from specific acts in accordance with the Wild Mammals (Protection) Act 1996 have been included within the REAC, which is included within the first iteration of the EMP [TR010060/APP/6.5] submitted with the DCO application.

9.8.75 Full details on other mammal surveys are provided in Appendix 9.10: Riparian Mammal Report, of the Environmental Statement [TR010060/APP/6.3].

Barn owl

9.8.76 A total of 24 barn owl roost sites (a location used by barn owls to rest but not breed) were identified within trees, nest boxes and buildings within the barn owl survey area. Of these, four were within the Order Limits. Additionally, nine nest sites (sites used by barn owls to lay eggs and raise young) were recorded within the survey area (see Figure 9.3 [TR010060/APP/6.2]). One of the nest sites (BOF26) fell within the Order Limits.

9.8.77 Surveys recorded limited suitable barn owl foraging habitat within the study area, as the largely arable landscape with urban and suburban areas provides limited potential to support barn owl prey species such as field voles *Microtus agrestis*. Of the areas identified as providing suitable foraging habitat for barn owls, the majority were classified as type 2 (sub-optimal habitat), and a

relatively small area was classified as type 1 (optimal) habitat (see Figure 9.3 [TR010060/APP/6.2]). Type 1 habitats were located in discrete parcels across the study area in proximity to junction 21, junction 23, junction 24 and junction 25, with the largest areas being outside the Order Limits.

9.8.78 Full details on the barn owl surveys are provided in Appendix 9.3: Barn Owl Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Breeding birds

9.8.79 A combined total of 90 bird species were recorded across the 27 transects surveyed within the study area in 2017 and 2020, of which 36 were confirmed breeders, 15 were probable breeders, 18 were possible breeders, and 21 species were non-breeders (feral or birds observed on migration). Several bird species recorded within the study area were listed as Red or Amber British Trust for Ornithology (BTO) Birds of Conservation Concern (BoCC), and species of principal importance under NERC S41 or the Essex Red Data List (ERL).

9.8.80 The surveys found that 50 recorded species have conservation or legal status indicating historical population declines or targeted conservation for certain species. Of these, 16 species are included on the BoCC Red List; 27 are on the BoCC Amber List; 16 are species of principal importance (NERC S41); 16 are included on the ERL and two species are cited under the Essex Local Biodiversity Action Plan (LBAP). In addition, six species are listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Species with a level of conservation concern or status are listed in Table 9.15.

Table 9.15 Status of bird species within the study area (breeding bird surveys)

Species name	Conservation status	Breeding status	SPA and Ramsar sites where a species is listed as a qualifying feature
Barn owl	Schedule 1	Confirmed breeder	-
Black-headed gull *Chroicocephalus ridibundus*	BoCC Amber	Non-breeder	Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar site
Bullfinch *Pyrrhula pyrrhula*	BoCC Amber, NERC S41, ERL	Possible breeder	-
Cetti's warbler *Cettia cetti*	Schedule 1	Possible breeder	-
Common gull *Laurus canus*	BoCC Amber	Non-breeder	-
Common sandpiper *Actitis hypoleucos*	BoCC Amber	Non-breeder	-

Species name	Conservation status	Breeding status	SPA and Ramsar sites where a species is listed as a qualifying feature
Common tern *Sterna hirundo*	BoCC Amber	Non-breeder	Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar site
Common whitethroat *Sylvia communis*	BoCC Amber	Confirmed breeder	-
Cuckoo *Cuculus canorus*	BoCC Red list, NERC S41	Non-breeder	-
Dunnock *Prunella modularis*	BoCC Amber, NERC S41	Confirmed breeder	-
Great black-backed gull *Larus marinus*	BoCC Amber	Non-breeder	-
Greenfinch *Chloris chloris*	BoCC Red	Probable breeder	-
Grey wagtail *Motacilla cinerea*	BoCC Amber	Possible breeder	-
Greylag goose *Anser anser*	BoCC Amber	Possible breeder	-
Herring gull *Larus argentatus*	BoCC Red, NERC S41	Non-breeder	-
Hobby *Falco subbuteo*	ERL, Schedule 1	Confirmed breeder	-
House martin *Delichon urbicum*	BoCC Red, ERL	Possible breeder	
House sparrow *Passer domesticus*	BoCC Red, NERC S41	Probable breeder	
Kestrel *Falco tinnunculus*	BoCC Amber	Confirmed breeder	
Kingfisher *Alcedo atthis*	Schedule 1	Possible breeder	
Lapwing *Vanellus vanellus*	BoCC Red, NERC S41, ERL	Confirmed breeder	
Lesser black-backed gull *Larus fuscus*	BoCC Amber	Non-breeder	Alde-Ore Estuary SPA and Ramsar site

Species name	Conservation status	Breeding status	SPA and Ramsar sites where a species is listed as a qualifying feature
Lesser redpoll *Acanthis cabaret*	BoCC Red, NERC S41	Possible breeder	-
Linnet *Linaria cannabina*	BoCC Red, NERC S41, ERL	Probable breeder	-
Little ringed plover *Charadrius dubius*	ERL, Schedule 1	Non-breeder	-
Mallard *Anas platyrhynchos*	BoCC Amber	Confirmed breeder	-
Marsh tit *Poecile palustris*	BoCC Red, NERC S41, ERL	Non-breeder	-
Meadow pipit *Anthus pratensis*	BoCC Amber	Non-breeder	-
Mistle thrush *Turdus viscivorus*	BoCC Red	Possible breeder	-
Moorhen *Gallinula chloropus*	BoCC Amber	Confirmed breeder	-
Red kite *Milvus milvus*	Schedule 1	Probable breeder	-
Reed bunting *Emberiza schoeniclus*	BoCC Amber, NERC S41, ERL	Possible breeder	-
Rook *Corvus frugilegus*	BoCC Amber	Not breeding	-
Sand martin *Riparia riparia*	ERL	Confirmed breeder	-
Sedge warbler *Acrocephalus arundinaceus*	BoCC Amber	Possible breeder	-
Shelduck *Tadorna tadorna*	BoCC Amber	Non-breeder	-
Shoveler *Anas clypeata*	BoCC Amber	Non-breeder	-
Skylark *Alauda arvensis*	BoCC Red, NERC S41, ERL, LBAP	Confirmed breeder	-
Song thrush *Turdus philomelos*	BoCC Amber, NERC S41, ERL, LBAP	Probable breeder	-

Species name	Conservation status	Breeding status	SPA and Ramsar sites where a species is listed as a qualifying feature
Starling *Sturnus vulgaris*	BoCC Red, NERC S41	Confirmed breeder	-
Stock dove *Columba oenas*	BoCC Amber	Probable breeder	-
Stonechat *Saxicola rubicola*	ERL	Possible breeder	-
Swift *Apus apus*	BoCC Red	Non-breeder	-
Turtle dove *Streptopelia turtur*	BoCC Red, NERC S41, ERL	Confirmed breeder	-
Willow warbler *Phylloscopus trochilus*	BoCC Amber	Probable breeder	-
Woodpigeon *Columba palumbus*	BoCC Amber	Probable breeder	-
Wren *Troglodytes troglodytes*	BoCC Amber	Probable breeder	-
Yellow wagtail *Motacilla flava*	BoCC Red, NERC S41, ERL	Probable breeder	-
Yellowhammer *Emberiza citrinella*	BoCC Red, NERC S41, ERL	Probable breeder	-

9.8.81 In general, the assemblage of species was typical of the habitats present, a mosaic of arable farmland, rough grassland, scrub, plantation woodland, water bodies and watercourses. A variety of species were recorded within these habitats that included 10 species of wildfowl, three species of wader, five species of gull, five species of raptor, 21 passerines and seven non-passerines.

9.8.82 The study area supported scarce breeding bird species of county importance including hobby, turtle dove and sand martin. Cetti's warblers were observed in 2017 and the species is considered to be a possible breeder.

9.8.83 Extensive areas of lowland intensive arable farmland were observed to have been of limited value for notable breeding species. Although a range of red-listed species were observed as confirmed or probable breeders, these were recorded in small numbers relative to county populations.

9.8.84 Skylark represented the most widespread of the notable farmland species and was confirmed breeding within the study area at two locations.

9.8.85 Species diversity was observed within areas where a range of habitats were present. Colemans Reservoir south of junction 22 was particularly notable for a diverse range of species. The reservoir featured a large water body bordered by deciduous woodland and scrub adjacent to arable farmland.

9.8.86 A lack of quality linear hedgerow and woodland boundary features was evident within the study area, resulting in limited diversity of farmland birds. Areas of intact hedgerow north of Hatfield Peverel supported small numbers of notable farmland birds such as yellowhammer and house sparrow.

9.8.87 The River Blackwater and areas around Domsey Brook provide important habitats for a variety of species including Cetti's warbler, grey wagtail, kingfisher and reed bunting.

9.8.88 Full details on breeding bird surveys are provided in Appendix 9.5: Breeding Bird Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Wintering birds

9.8.89 A total of 42 target species (songbirds, waterfowl, waders and gulls) were recorded within the study area between 2017 and 2020.

9.8.90 The surveys recorded 31 species that have conservation or legal status indicating historical population declines or targeted conservation for certain species. Of these, 15 species are included on the BoCC Red List, 16 are on the BoCC Amber List, 12 are species of principal importance (NERC S41), 12 are included on the ERL and three species cited under the Essex LBAP. In addition, four species are listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). A number of birds recorded were also listed as qualifying features of nearby SPA and Ramsar sites.

9.8.91 Some species recorded are on the BoCC Green List, which means they are of least conservation concern. However, they were considered target species either because they are a qualifying feature for nearby SPA and Ramsar sites or because they are on the list of target winter farmland bird species (Gillings *et al.*, 2008).

9.8.92 These notable species, their conservation status and listing as qualifying features are shown in Table 9.16.

Table 9.16 Status of bird species within the study area (wintering bird surveys)

Species name	Conservation status	SPA and Ramsar sites where a species is listed as a qualifying feature
Black-headed gull *Chroicocephalus ridibundus*	BoCC Amber	-
Bullfinch *Pyrrhula pyrrhula*	BoCC Amber, NERC S41, ERL	-
Chaffinch *Fringilla coelebs*	BoCC Green	-
Common gull *Laurus canus*	BoCC Amber	-

Species name	Conservation status	SPA and Ramsar sites where a species is listed as a qualifying feature
Coot *Fulica atra*	BoCC Green	• Abberton Reservoir SPA and Ramsar site
Cormorant *Phalacrocorax carbo*	BoCC Green	• Abberton Reservoir SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Curlew *Numenius arquata*	BoCC Red, NERC S41	• Stour and Orwell Estuaries SPA and Ramsar site
Fieldfare *Turdus pilaris*	BoCC Red, Schedule 1	-
Golden plover *Pluvialis apricaria*	BoCC Green	• Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Goldfinch *Carduelis carduelis*	BoCC Green	-
Great black-backed gull *Larus marinus*	BoCC Amber	-
Great crested grebe *Podiceps cristatus*	BoCC Green	• Abberton Reservoir SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Great white egret *Ardea alba*	BoCC Amber	-
Green sandpiper *Tringa ochropus*	BoCC Amber, Schedule 1	-
Greenfinch *Chloris chloris*	BoCC Red	-
Grey partridge *Perdix perdix*	BoCC Red, NERC S41, ERL, LBAP	-
Hawfinch *Coccothraustes coccothraustes*	BoCC Red, NERC S41, ERL	-
Herring gull *Larus argentatus*	BoCC Red, NERC S41	-
House sparrow *Passer domesticus*	BoCC Red, NERC S41	-
Lapwing *Vanellus vanellus*	BoCC Red, NERC S41, ERL	• Stour and Orwell Estuaries SPA and Ramsar site

Species name	Conservation status	SPA and Ramsar sites where a species is listed as a qualifying feature
Lesser black-backed gull *Larus fuscus*	BoCC Amber	• Alde-Ore Estuary SPA and Ramsar site
Linnet *Linaria cannabina*	BoCC Red	-
Mallard *Anas platyrhynchos*	BoCC Amber	-
Meadow pipit *Anthus pratensis*	BoCC Amber	-
Mediterranean gull *Larus melanocephalus*	BoCC Amber, Schedule 1	-
Mistle thrush *Turdus viscivorus*	BoCC Red	-
Mute swan *Cygnus olor*	BoCC Green	• Abberton Reservoir SPA and Ramsar site • Alde-Ore Estuary SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Pied wagtail *Motacilla alba*	BoCC Green	-
Pochard *Aythya ferina*	BoCC Red, ERL	• Abberton Reservoir SPA and Ramsar site • Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar site • Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar site
Redwing *Turdus iliacus*	BoCC Amber, Schedule 1	-
Reed bunting *Emberiza schoeniclus*	BoCC Amber, NERC S41, ERL	-
Shoveler *Anas clypeata*	BoCC Amber, ERL	• Abberton Reservoir SPA and Ramsar site
Skylark *Alauda arvensis*	BoCC Red, NERC S41, ERL, LBAP	-
Snipe *Gallinago gallinago*	BoCC Amber, ERL	-
Song thrush *Turdus philomelos*	BoCC Amber, NERC S41, ERL, LBAP	-
Starling *Sturnus vulgaris*	BoCC Red, NERC S41	-

Species name	Conservation status	SPA and Ramsar sites where a species is listed as a qualifying feature
Stock dove *Columba oenas*	BoCC Amber	-
Tufted duck *Aythya fuligula*	BoCC Green	• Abberton Reservoir SPA and Ramsar site
Water rail *Rallus aquaticus*	ERL	-
Wigeon *Anas penelope*	BoCC Amber	• Abberton Reservoir SPA and Ramsar site
Woodcock *Scolopax rusticola*	BoCC Red	-
Yellowhammer *Emberiza citrinella*	BoCC Red, NERC S41, ERL	-

9.8.93 The survey recorded a diversity of birds from the large area sampled over three years. However, the diversity of species was uniform across most of the area sampled, and diversity and numbers of birds were generally low across smaller areas. Arable land, the predominant land use across the area sampled, often supported very few birds. Less extensive and more localised habitats appeared to be more important for birds.

9.8.94 More diverse assemblages of birds were associated with the lakes around Witham, such as Colemans Reservoir in proximity to junction 22, where the greatest numbers of wildfowl were recorded.

9.8.95 In general, the study area was not considered to be of particular importance to wintering birds within the context of the populations present in the wider county, and while some notable species were recorded, these were not in significant numbers for the region.

9.8.96 In addition, where species listed as qualifying features for SPA and Ramsar sites were present, these were generally in low numbers, and it is considered that the study area is not of particular importance to these species.

9.8.97 Full details on wintering bird surveys are provided in Appendix 9.12: Wintering Bird Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Reptiles

9.8.98 Reptile surveys were undertaken in 2017 at 28 sites assessed as having suitability for reptiles within the study. Habitats surveyed include rough grassland and interfaces of tall and short vegetation such as dense scrub or tall ruderal vegetation in field margins.

9.8.99 Three species of common reptile have been recorded in low to good numbers across the proposed scheme. A peak count of 13 common lizard, eight slow worm and one grass snake were recorded at any one survey site with a maximum of three reptile species recorded at Site 18 (A12 road verge west of Boreham, see Appendix 9.9: Reptile survey report [TR010060/APP/6.3] for the location). Survey Site 18 would therefore constitute a ‘reptile site’ in accordance with Froglife (1999).

9.8.100 Of the 28 sites surveyed, common lizard was recorded at 15 sites, slow worm at eight sites and grass snake at three sites. Reptiles were not detected during any of the survey visits at 10 of the sites. For the purpose of this assessment, it is assumed that any areas of suitable habitat types which were not surveyed support common reptiles.

9.8.101 An update to the field survey was not undertaken in 2020 because the habitats on site are not considered to have changed significantly since surveys were undertaken. Consequently, a precautionary approach to mitigation would be provided along the length of the proposed scheme based on the assumption that common reptiles are present within all areas of suitable habitat.

9.8.102 Full details on the reptile surveys are provided in Appendix 9.9 of the Environmental Statement [TR010060/APP/6.3].

Great crested newt

9.8.103 Surveys comprised HSI assessments undertaken in 2017 and 2020/2021, and eDNA surveys and presence/absence surveys undertaken in 2017.

9.8.104 In addition, 10 records of confirmed GCN breeding ponds were obtained from external sources: one from a review undertaken of Great Crested Newts eDNA Pond Surveys for District Level Licensing (England) (Natural England, 2020a), another from informal discussion with a landowner in 2020, and eight records were obtained from the GCN class licence survey returns database (Natural England, 2020c).

9.8.105 These sources identified the presence of breeding GCN in 21 ponds within the study area. Of these, one (P099) is located within the Order Limits within borrow pit E (see Table 9.17 and Figure 9.3 [TR010060/APP/6.2]). It is assessed that the ponds fall into 11 separate metapopulations (whereby a metapopulation is formed of multiple individual populations in close proximity to one another) indicating how fragmented the landscape has become.

9.8.106 For the purposes of this assessment, each metapopulation has been assigned a letter from A – K (see Table 9.17 below and Figure 1 of Appendix 9.13: Great Crested Newt Survey Report [TR0100/60/APP/6.3]).

Table 9.17 Locations and population estimates for positive GCN ponds

Pond ID	Location (NGR)	Source of data and year	Maximum count per survey	Population size	Metapopulation
P005	TL 91709 23325	Population survey, 2017	3	Small	J – Potts Green
P007	TL 91614 23296	Population survey, 2017	1	Small	J – Potts Green
P013	TL 91576 22918	Population survey, 2017	6	Small	J – Potts Green

Pond ID	Location (NGR)	Source of data and year	Maximum count per survey	Population size	Metapopulation
P014	TL 91081 22785	Population survey, 2017	54	Medium	J – Potts Green
P036	TL 88303 19838	Population survey, 2017	1	Small	H – Prested Hall
P058	TL 84941 17729	eDNA survey only, 2017	Unknown	Unknown	F – south-west of Kelvedon
P091	TL 81416 12903	Natural England (2020a)	Unknown	Unknown	D – south of Witham
P098	TL 80768 12532	Population survey, 2017	10	Small	D – south of Witham
P099	TL 79956 12708	eDNA survey only, 2017	N/A	N/A	C – north-east of Hatfield Peverel
P125	TL 88131 20780	Population survey, 2017	4	Small	I – north of Feering
P144	TL 77893 10794	eDNA survey only, 2017	Unknown	Unknown	B – Crix
P211	TL 80887 12045	Record obtained informally from landowner, 2019	Unknown	Unknown	C – north-east of Hatfield Peverel
P213	TL 80943 11992	Record obtained informally from landowner, 2019	Unknown	Unknown	C – north-east of Hatfield Peverel
P345	TL 83109 15844	Record obtained informally from landowner, 2020	Unknown	Unknown	E – north-east of Witham
P148	TL 740 079	Class survey licence returns database, dated 2014	Unknown	Unknown	A – Springfield Business Park, south of J19

Pond ID	Location (NGR)	Source of data and year	Maximum count per survey	Population size	Metapopulation
Likely P153	TL 739 080	Class survey licence returns database, dated 2014	Unknown	Unknown	A – Springfield Business Park, south of J19
P303	TL 740 083	Class survey licence returns database, dated 2014	Unknown	Unknown	A – Springfield Business Park, south of J19
Likely P156	TL 737 086	Class survey licence returns database, 2016	Unknown	Unknown	A – Springfield Business Park, south of J19
P306	TL 736 081	Class survey licence returns database, 2017	Unknown	Unknown	A – Springfield Business Park, south of J19
Likely P159	TL 736 083	Class survey licence returns database, 2015	Unknown	Unknown	A – Springfield Business Park, south of J19
P40	TL 877 189	Class survey licence returns database, 2017	Unknown	Unknown	G – Inworth Road
Un-numbered	TL 936 242	Class survey licence returns database, 2015	Unknown	Unknown	K – Copford

9.8.107 Suitable terrestrial habitat for GCN are located within the Order Limits, comprising 39.24ha of hedgerows, 29.86ha of heathland and scrub, 100.19ha grassland and 61.55ha of woodland and forest.

9.8.108 The proposed scheme falls within both the green (66.3%) and amber (33.7%) risk zones for GCN on the Natural England Impact Risk Map (last updated 12 June 2020b), which predicts newt presence through habitat suitability. There is no overlap with red (highest) risk zones. Green zones contain sparsely distributed GCN and are less likely to contain important pathways of connecting habitat for this species, while amber zones contain main population centres for GCN and comprise important connecting habitat that aids dispersal.

9.8.109 Full details on the GCN surveys are provided in Appendix 9.13 of the Environmental Statement [TR010060/APP/6.3].

Other amphibians

9.8.110 Incidental sightings of common frog *Rana temporaria*, smooth newt *Lissotriton vulgaris* and palmate newt *Lissotriton helveticus* were recorded during field surveys. These species are common and widespread and have no construction-related conservation status and are therefore not considered further in this chapter.

9.8.111 Common toad was recorded in five ponds and one ditch around the proposed scheme in 2017, as shown in Table 9.18. None of these water bodies are located within the Order Limits. Common toad is listed under NERC S41 as a species of principal importance.

Table 9.18 Locations of water bodies supporting common toad

Water body ID	Location (NGR)	Name of water body
P025	TL 89993 21509	Domsey Brook
P036	TL 88284 19834	P036
P036b	TL 88320 19860	P036
P037	TL 88252 19603	P037
P065	TL 84704 17051	P065
D059	TL 84774 16870	P347

Freshwater fish

9.8.112 Six watercourses were surveyed for freshwater fish, and species recorded are shown in Table 9.19. The locations of the watercourses are shown on Figure 9.3 [TR010060/APP/6.2].

9.8.113 Full details on the freshwater fish surveys are provided in Appendix 9.1: Aquatic Ecology Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Table 9.19 Summary of freshwater fish survey results

Watercourse	Location (NGR)	Species	Conservation Status
Boreham Brook	TL 74630 09787	Bullhead *Cottus gobio*	IUCN Red List Annex II of Habitats Regulations
		European eel *Anguilla anguilla*	UK BAP and NERC S41 IUCN Red List
		Three-spined stickleback *Gasterosteus aculeatus*	-

Watercourse	Location (NGR)	Species	Conservation Status
Domsey Brook	TL 87518 18978	Brown trout *Salmo trutta*	UK BAP and NERC S41
		Bullhead *Cottus gobio*	IUCN Red List Annex II of Habitats Regulations
		Dace *Leuciscus*	-
		European eel *Anguilla Anguilla*	UK BAP and NERC S41 IUCN Red List
		Gudgeon *Gobio gobio*	-
		Minnow *Phoxinus phoxinus*	-
		Stone loach *Barbatula barbatula*	-
		Three-spined stickleback *Gasterosteus aculeatus*	-
River Blackwater	TL 85562 17647	Brown trout *Salmo trutta*	UK BAP and NERC S41
		Bullhead *Cottus gobio*	IUCN Red List Annex II of Habitats Regulations
		Chub *Squalius cephalus*	-
		Dace *Leuciscus leuciscus*	-
		Gudgeon *Gobio gobio*	-
		Minnow *Phoxinus phoxinus*	-
		Perch *Perca fluviatilis*	-
		Pike *Esox lucius*	-
		Roach *Rutilus rutilus*	-
		Stone loach *Barbatula barbatula*	-
		Three-spined stickleback *Gasterosteus aculeatus*	-
River Brain	TL 82903 13721	Bullhead *Cottus gobio*	IUCN Red List Annex II of Habitats Regulations
		Chub *Squalius cephalus*	-
		Dace *Leuciscus leuciscus*	-

Watercourse	Location (NGR)	Species	Conservation Status
		European eel *Anguilla anguilla*	UK BAP and NERC S41 IUCN Red List
		Gudgeon *Gobio gobio*	-
		Minnow *Phoxinus phoxinus*	-
		Perch *Perca fluviatilis*	-
		Pike *Esox lucius*	-
		Roach *Rutilus rutilus*	-
		Stone loach *Barbatula barbatula*	-
River Ter	TL 78355 11358	Brown trout *Salmo trutta*	UK BAP and NERC S41
		Bullhead *Cottus gobio*	IUCN Red List Annex II of Habitats Regulations
		Chub *Squalius cephalus*	-
		Dace *Leuciscus leuciscus*	-
		European eel *Anguilla anguilla*	UK BAP and NERC S41 IUCN Red List
		Gudgeon *Gobio gobio*	-
		Minnow *Phoxinus phoxinus*	-
		Perch *Perca fluviatilis*	-
		Pike *Esox lucius*	-
		River/brook lamprey *Lampetra fluviatilis*/ *Lampetra planeri* (Lamprey species was not confirmed)	Annex II of Habitats Regulations NERC S41 (*Lampetra fluviatilis*)
		Roach *Rutilus rutilus*	-
		Stone loach *Barbatula barbatula*	-
		Three-spined stickleback *Gasterosteus aculeatus*	-
Roman River	TL 93284 24400	Brown trout *Salmo trutta*	UK BAP and NERC S41
		Roach *Rutilus rutilus*	-
		Three-spined stickleback *Gasterosteus aculeatus*	-

Terrestrial invertebrates

9.8.114 Five sites identified as having good suitability for terrestrial invertebrates were surveyed and are shown on Figure 9.3 [TR010060/APP/6.2]. These were: Brockwell Meadows LNR; Little Braxted Fishing Lakes; site at Prested Hall; site west of Hatfield Peverel; and Whetmead LNR. Other sites were considered to either not provide suitable habitat to support notable species or only supported common and widespread species.

9.8.115 Results, including records of notable species, are shown in Table 9.20.

9.8.116 Most notable are records of small heath butterfly (IUCN near threatened, NERC S41) at Whetmead LNR, the site at Prested Hall, and the site west of Hatfield Peverel.

9.8.117 With the exception of Brockwell Meadows which is adjacent to the Order Limits, all other sites surveyed are located at least partially within the Order Limits. However, these are generally only small areas with the majority of the site areas sitting outside the Order Limits.

9.8.118 No legally protected invertebrate species were recorded.

9.8.119 Full details on the terrestrial invertebrate surveys are provided in Appendix 9.11: Terrestrial Invertebrate Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Table 9.20 Summary of terrestrial invertebrate survey results

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
Brockwell Meadows LNR	TL 86681 18658	Semi-improved grassland, wetland and plantation woodland habitats adjacent to the River Blackwater	320 species identified, 13 considered as species of conservation importance:	
			Spider *Ballus chalybeius*	Nationally scarce – least concern
			Spider *Rugathodes instabilis*	Nationally scarce – least concern
			Flea beetle *Podagrica fuscicornis*	Nationally scarce – least concern ERL
			Leaf beetle *Longitarsus lycopi*	Nationally scarce – least concern
			Rove beetle *Sepedophilus bipunctatus*	Nationally scarce – least concern ERL
			Tumbling flower beetle *Mordellistena neuwaldeggiana*	Nationally scarce – least concern ERL
			Weevil *Liparus coronatus*	Nationally scarce – least concern ERL
			Weevil *Polydrusus formosus*	Nationally scarce – least concern
			Weevil *Protapion filirostre*	Nationally scarce – least concern ERL

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
			True bug *Deraeocoris olivaceus*	Nationally scarce – least concern ERL
			True bug *Lygus pratensis*	Rare – Red Data Book (RDB3)
			True bug *Macrosteles sardus*	New to Britain
			Ruddy darter dragonfly *Sympetrum sanguineum*	ERL
Little Braxted Fishing Lakes	TL 83206 14938	Semi-natural and plantation woodland with fishing lake margins	144 species identified, five considered as species of conservation importance:	
			False flower beetle *Anaspis thoracica*	Nationally scarce – least concern ERL
			True bug *Lygus pratensis*	Rare – RDB3
			Dark blood bee *Sphecodes niger*	Rare – RDB3 ERL
			Ivy bee *Colletes hederae*	Not scarce or threatened, but a very large aggregation of nest worthy of note
			Lobe-spurred furrow bee *Lasioglossum pauxillum*	Nationally scarce

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
Prested Hall	TL 88198 19574	Parkland and associated semi-improved neutral grassland and mature broadleaved woodland margins	311 species identified, 14 considered as species of conservation importance:	
			Spider *Phylloneta impressa*	ERL
			Beetle *Involvulus cupreus*	Nationally scarce
			Beetle *Rhinocyllus conicus*	Nationally scarce
			Beetle *Tanymecus palliatus*	Nationally scarce – least concern ERL
			Beetle *Meligethes umbrosus*	Nationally scarce – least concern ERL
			Band-eyed brown horsefly *Tabanus bromius*	ERL
			Hornet mimic hoverfly *Volucella zonaria*	ERL
			True bug *Lygus pratensis*	Rare – RDB3
			Ant *Lasius brunneus*	Nationally scarce – least concern ERL
			Blue carpenter bee *Ceratina cyanea*	Rare – RDB3 ERL
			Lobe-spurred furrow bee *Lasioglossum pauxillum*	Nationally scarce

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
			Spider wasp *Anoplius nigerrimus*	ERL
			Welted lesser mason bee *Hoplitis claviventris*	ERL
			Small heath butterfly *Coenonympha pamphilus*	IUCN – near threatened NERC S41
West of Hatfield Peverel	TL 78241 11611	Semi-improved neutral grassland, with tall ruderal and scattered scrub, and river margin of mixed tall ruderal and mature broadleaved trees	358 species identified, 23 considered as species of conservation importance:	
			Jumping spider *Ballus chalybeius*	Nationally scarce ERL
			Spider *Phylloneta impressa*	ERL
			Beetle *Longitarsus lycopi*	Nationally scarce – least concern
			Beetle *Rhagonycha lutea*	Nationally scarce – least concern ERL
			Beetle *Rhinocyllus conicus*	Nationally scarce
			Beetle *Variimorda villosa*	ERL
			Bloody cranesbill weevil *Zacladus exiguus*	Nationally scarce – least concern ERL
			Chocolate Tipula cranefly *Nigrotipula nigra*	ERL

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
			Hoverfly *Pipizella virens*	ERL
			Hoverfly *Volucella inanis*	ERL
			Hoverfly *Volucella inflata*	ERL
			True hornet mimic hoverfly *Volucella zonaria*	ERL
			True bug *Deraeocoris olivaceus*	Nationally scarce ERL
			True bug *Iassus scutellaris*	Nationally scarce – least concern ERL
			True bug *Lygus pratensis*	Rare – RDB3
			True bug *Macrosteles sardus*	New to Britain
			True bug *Oxystoma cerdo*	Nationally scarce ERL
			Lobe-spurred furrow bee *Lasioglossum pauxillum*	Nationally scarce
			Ridge-cheeked furrow bee *Lasioglossum puncticolle*	Nationally scarce ERL

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
			Spider wasp *Auplopus carbonarius*	Nationally scarce ERL
			Small heath butterfly *Coenonympha pamphilus*	IUCN Near threatened NERC S41
			Dotted fan-foot moth *Macrochilo cribrumalis*	ERL
			White-legged damselfly *Platycnemis pennipes*	ERL
Whetmead LNR	TL 83071 13824	Rough grassland, scrub and semi-mature broadleaved woodland bound by the River Blackwater to the east	296 species identified, 12 considered as species of conservation importance:	
			Beetle *Anaspis thoracica*	Nationally scarce – least concern ERL
			Beetle *Larinus planus*	Nationally scarce
			Beetle *Mordellistena humeralis*	Nationally scarce – least concern ERL
			Beetle *Rhinocyllus conicus*	Nationally scarce
			Mallow flea beetle *Podagrica fuscipes*	Nationally scarce – least concern ERL
			True bug *Drymus latus*	Nationally scarce ERL

Site name	Approximate site midpoint (NGR)	Site description	Summary of notable species	Conservation status
			True bug *Lygus pratensis*	Rare – RDB3
			Lobe-spurred furrow bee *Lasioglossum pauxillum*	Nationally scarce
			Ridge-saddled carpenter bee *Heriades truncorum*	Rare – RDB3
			Spined hylaeus bee *Hylaeus cornutus*	Nationally scarce ERL
			Swollen-thighed blood bee *Sphecodes crassus*	Nationally scarce ERL
			Small heath butterfly *Coenonympha pamphilus*	IUCN Near threatened NERC S41

Freshwater macro-invertebrates

9.8.120 Across 2017 and 2020, 10 sites were surveyed from seven watercourses for freshwater macro-invertebrates. These were Boreham Brook, Domsey Brook, Rivenhall Brook, River Blackwater, River Brain, River Ter and Roman River (see Figure 9.3 [TR010060/APP/6.2]).

9.8.121 All sites, with the exception of the Boreham Brook in autumn 2017, were classified as 'good' or above under the WFD, indicating that the macro-invertebrate communities at these sites only deviate slightly from reference condition. The Boreham Brook achieved Moderate status in autumn 2017, driven by poor species richness, potentially linked to poor habitat.

9.8.122 For macro-invertebrate surveys, each species was assigned a Community Conservation Index score (Chadd and Extence, 2004). Any score above seven is considered to be a species of conservation importance. No species of conservation importance were recorded. Macro-invertebrates reported were typical of the watercourse types sampled.

9.8.123 Full details on the freshwater macro-invertebrate surveys are provided in Appendix 9.1: Aquatic Ecology Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Notable plants

9.8.124 Notable vascular plants were identified during botanical surveys (see Figure 9.3 [TR010060/APP/6.2]). Twenty-eight notable plants were recorded within the survey area, of which 18 species were identified within 50m of the Order Limits and 15 species were identified within the Order Limits. Notable plant species are presented in Table 9.21.

Table 9.21 Summary of notable plants recorded from desk study and field survey within 50m of the Order Limits

Scientific name	Common name	Legal or conservation status	Record source(s)	Nearest distance (m)	Importance for biodiversity
Anacamptis pyramidalis	Pyramidal orchid	Essex Scarce, ERL – Rare	Desk study	0 (within Order Limits)	Local
Bromus secalinus	Rye brome	Nationally Scarce, Great Britain Vulnerable, England Near Threatened, Essex Scarce, ERL – Rare	Field survey	0 (within Order Limits)	County
Campanula rotundifolia	Harebell	England Near Threatened, Essex Scarce, ERL – Rare	Field survey	0 (within Order Limits)	County
Clinopodium calamintha	Lesser calamint	Nationally Scarce, Great Britain Vulnerable, ERL	Field survey	0 (within Order Limits)	County
Dipsacus pilosus	Small teasel	Essex Scarce, ERL – Rare	Field survey / desk study	0 (within Order Limits)	County
Euphorbia exigua	Dwarf spurge	Great Britain Near Threatened, England Vulnerable	Desk study	0 (within Order Limits)	Local
Filago vulgaris	Common cudweed	Great Britain Near Threatened, England Near Threatened	Field survey / desk study	0 (within Order Limits)	Local
Galium parisiense	Wall bedstraw	Nationally Scarce, Great Britain Vulnerable, England Vulnerable, ERL	Field survey	0 (within Order Limits)	County
Hyoscyamus niger	Henbane	Great Britain Vulnerable, England Vulnerable, Essex Scarce, ERL	Field survey / desk study	0 (within Order Limits)	County

Scientific name	Common name	Legal or conservation status	Record source(s)	Nearest distance (m)	Importance for biodiversity
Knautia arvensis	Field scabious	England Near Threatened	Field survey / desk study	0 (within Order Limits)	Local
Mentha arvensis	Corn mint	England Near Threatened	Field survey / desk study	0 (within Order Limits)	Local
Oenanthe fluviatilis	River water-dropwort	Essex Scarce, ERL	Field survey / desk study	0 (within Order Limits)	County
Polygonum rurivagum	Cornfield knotgrass	ERL	Field survey	11	County
Populus nigra subsp. Betulifolia	Black poplar	Essex Scarce, ERL – Rare	Field survey / desk study	0 (within Order Limits)	County
Rosa obtusifolia x tomentosa	Rose species	Essex Notable Other	Field survey	8	County
Spergula arvensis	Corn spurrey	Great Britain Vulnerable, England Vulnerable	Field survey	11	Local
Valeriana officinalis	Common valerian	England Near Threatened, Essex Scarce, ERL	Field survey	0 (within Order Limits)	County
Veronica officinalis	Heath speedwell	England Near Threatened	Field survey	0 (within Order Limits)	Local

9.8.125 Of particular note, several populations of the nationally scarce (also Great Britain Vulnerable, ERL) lesser calamint were recorded on poor semi-improved grassland along road verges of the A12 and edges of nearby fields between junction 22 (Colemans interchange) and junction 23 (Kelvedon South interchange).

9.8.126 Wall bedstraw (nationally scarce, Great Britain vulnerable, England vulnerable, ERL) was recorded in one location close to junction 22.

9.8.127 The nationally near threatened field scabious and common cudweed were recorded in numerous locations within arable field margins and open, disturbed vegetation between junction 21 (Witham South interchange) and junction 25 (Marks Tey interchange).

9.8.128 Despite its nationally scarce status, rye brome is not considered of national importance in this instance. The species is not considered a conservation priority due to it being classified as a colonist archaeophyte, a non-native species that has long been established in Britain (pre-1500 AD) and often turns up on disturbed land. It has been noted that the overall population has been recently increasing as grass-seed contamination (Stace, 2019), which may imply an alternative origin for the single plant found during field surveys. Furthermore, a single plant would not be considered to qualify as a population of national significance.

9.8.129 No legally protected plant species were recorded.

9.8.130 Full details on the notable plants recorded during field surveys are provided in Appendix 9.8: Phase 1 Habitat Survey Report, of the Environmental Statement [TR010060/APP/6.3]. The species and distances presented in Table 9.21 differ slightly from those presented in Appendix 9.8 as the notable plant species have been re-reviewed against the latest available Order Limits.

Freshwater macrophytes

9.8.131 The notable plant, river water-dropwort (Essex scarce, ERL) was recorded from the River Blackwater in proximity to the existing A12 (see Table 9.21).

9.8.132 No other notable macrophyte species or protected macrophyte species were recorded.

9.8.133 Full details on the freshwater macrophytes surveys are provided in Appendix 9.1: Aquatic Ecology Survey Report, of the Environmental Statement [TR010060/APP/6.3].

Invasive non-native species

9.8.134 A total of 38 invasive non-native plant species were identified through desk studies and field surveys. Of these, six invasive plant species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) were recorded within 50m of the Order Limits:

- Giant rhubarb, *Gunnera tinctoria*
- Giant hogweed, *Heracleum mantegazzianum*

- Himalayan cotoneaster, *Cotoneaster simonsii*
- Japanese knotweed, *Fallopia japonica*
- Montbretia, *Crocosmia x crocosmiiflora*
- Three-cornered garlic, *Allium triquetrum*

9.8.135 There were also five plant species considered invasive but not currently on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) recorded within 50m of the Order Limits:

- Alexanders, *Smyrnium olusatrum*
- Butterfly-bush, *Buddleja davidii*
- Himalayan balsalm, *Impatiens glandulifera*
- Least duckweed, *Lemna minuta*
- Snowberry, *Symphoricarpos albus*

9.8.136 Invasive animal species identified through desk studies and field surveys that are likely within 50m of the Order Limits include American mink and Turkish crayfish.

9.8.137 The legal status of INNS will be documented in the ISMP and included within the first iteration EMP [TR010060/APP/6.5]). This will be updated and included within the second iteration EMP.

Future baseline

9.8.138 The landscape is predominantly arable, and the quality of the agricultural land is good to very good (in relation to the Agricultural Land Classification, see Chapter 10: Geology and soils, of the Environmental Statement [TR010060/APP/6.1]). Further developments in the study area could reduce the areas of agricultural habitats. Increasing development and housing in the area is likely to put more pressure on the remaining natural habitats which may affect the local population and distribution of flora and fauna. Any effect from climate change is unlikely to materially alter the land use, and therefore the habitats, prior to construction of the proposed scheme.

9.8.139 Long-term impacts from climate change could alter the species composition and types of habitats in and around the site, and therefore the types and diversity of fauna. However, it is not anticipated that the combined impact of the proposed scheme and climate change would be any different to the impact of climate change in isolation (for example, without the proposed scheme) as the habitats that would be created as part of mitigation proposals would be the same types as those found currently in the local area.

9.8.140 Planning consent has been granted for development at Colemans Farm Quarry, which includes restoration of the site. For the purpose of the Environmental Statement, the restored site has been considered in the baseline (as per the restoration plans approved by the local authority at the time of DCO

submission). It is recognised that Colemans Farm Quarry is a flagship biodiversity site within the Essex Minerals Local Plan 2014 and the proposed scheme should therefore provide habitats of a similar size and context in order to deliver at least an equivalent level of compensation to that already permitted. Section 9.10 of this chapter describes the habitat creation proposals for the proposed scheme, with reference to Colemans Farm Quarry. Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3] demonstrates that the proposed scheme aspires to maximise biodiversity delivery during construction.

9.8.141 Proposed developments surrounding the proposed scheme are considered in Chapter 16: Cumulative effects assessment, of the Environmental Statement [TR010060/APP/6.1]. Developments included for consideration within Chapter 16: Cumulative effects assessment, that fall outside, as well as within, the biodiversity study areas were considered during the process of identifying cumulative effects on biodiversity receptors. However, only developments that would lead to cumulative effects are presented within Chapter 16: Cumulative effects assessment.

9.8.142 The shortlist of developments with the potential to result in cumulative impacts with the proposed scheme has been reviewed from a biodiversity perspective and there are not considered to be any significant effects.

Importance and sensitivity of receptors

9.8.143 All receptors within the baseline have been assigned an importance based on criteria in DMRB LA 108 Biodiversity (Highways England, 2020c) and using professional judgement. Table 9.22 summarises the importance of receptors identified within the study area.

Table 9.22 Importance of receptors in the study area for biodiversity

Importance	Description	Examples within the study area
Designated sites		
International or European	Sites including: 1) European sites: a. Sites of community importance b. SPAs c. Potential SPAs d. SACs e. Candidate or possible SACs f. Ramsar sites 2) Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves 3) areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such	• Abberton Reservoir SPA and Ramsar site • Alde-Ore SPA and Ramsar site • Blackwater Estuary SPA and Ramsar site • Colne Estuary SPA and Ramsar site • Crouch and Roach Estuaries SPA and Ramsar site • Dengie SPA and Ramsar site • Outer Thames Estuary SPA • Stour and Orwell Estuaries SPA and Ramsar site • Essex Estuaries SAC

Importance	Description	Examples within the study area
UK or national (England)	Sites including: 1) SSSIs or areas of special scientific interest 2) NNRs 3) National Parks 4) marine protected areas including marine conservation zones 5) areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such	• Tiptree Heath SSSI • River Ter SSSI
Regional (East)	Designated sites (non-statutory) including heritage coasts	No features present within the study area at this level of importance.
County (Essex)	Wildlife and nature conservation sites designated at a county (or equivalent) level including: 1) LWSs 2) Local nature conservation sites (LNCSs) 3) LNRs 4) sites of importance for nature conservation (SINCs) 5) sites of nature conservation importance (SNCIs) 6) county wildlife sites	• Whetmead LNR • Brockwell Meadows LNR • Spring Lane Meadows LNR • Hilly Fields LNR • Galleywood Common LNR • 37 LWS designated sites within 1km of the proposed scheme • 11 LWS within 200m of the construction ARN and 27 LWS within the operational ARN
Local (Chelmsford to Colchester)	Wildlife and nature conservation sites designated at a local level including: 1) LWSs 2) LNCSs 3) LNRs 4) SINCs 5) SNCIs 6) sites of local nature conservation importance	No features present within the study area at this level of importance
Habitats		
International or European	There are no habitats which are assigned this relative importance	N/A

Importance	Description	Examples within the study area
UK or national (England)	Habitats including: 1) areas of UK BAP priority habitats 2) habitats included in the relevant statutory list of priority species and habitats 3) areas of irreplaceable habitats including: a. ancient woodland b. ancient or veteran trees c. blanket bog d. limestone pavement e. sand dunes f. salt marsh g. lowland fen 4) areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such	• Ancient Woodland Inventory sites and additional ancient woodland habitats identified through field survey • Ancient and veteran trees and potential veteran and ancient trees • Priority habitats – arable field margins, lowland mixed deciduous woodland, eutrophic standing waters, wet woodland, hedgerows, open mosaic habitats on formerly developed land, ponds, rivers, wood pasture and parkland
Regional (East)	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable)	No features present within the study area at this level of importance
County (Essex)	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable)	• Annex I habitat: wet woodland
Local (Chelmsford to Colchester)	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange	No features present within the study area at this level of importance
Species		
International or European	Resident, or regularly occurring, populations of species which can be considered at an international or European level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale 2) the population forms a critical part of a wider population at this scale 3) the species is at a critical phase of its life cycle at an international or European scale	No features present within the study area at this level of importance

Importance	Description	Examples within the study area
UK or national (England)	Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale 2) the population forms a critical part of a wider population at this scale 3) the species is at a critical phase of its life cycle at a UK or national scale	No features present within the study area at this level of importance
Regional (East)	Species identified in regional plans or strategies	No features present within the study area at this level of importance
County (Essex)	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a. the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale b. the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations c. the species is at a critical phase of its life cycle 2) species identified in county or equivalent authority area plans or strategies	• Bat assemblage including barbastelle bat • Barn owl • Notable breeding birds; hobby, turtle dove and sand martin • Otter • Water vole • Species of principal importance; brown hare, hedgehog and polecat • Great crested newt • Species of principal importance; common toad • Freshwater fish communities • Freshwater macrophyte communities • Terrestrial invertebrate assemblages • Notable plants: black poplar, common valerian, cornfield knotgrass, harebell, henbane, lesser calamint, river water-dropwort, Rosa obtusifolia x *tomentosa*, rye brome, small teasel and wall bedstraw

Importance	Description	Examples within the study area
Local (Chelmsford to Colchester)	Populations and communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange	• Badger • Breeding bird assemblage • Wintering bird assemblage • Common reptiles: common lizard, grass snake and slow worm • Freshwater macro-invertebrate communities • Notable plants: common cudweed, corn mint, corn spurrey, dwarf spurge, field scabious, heath speedwell and pyramidal orchid

9.9 Potential impacts

9.9.1 Potential impacts relating to construction and operational phases of the proposed scheme are described below.

Construction

9.9.2 There are a number of ways in which the proposed scheme could have temporary or permanent impacts on biodiversity during construction. The main pathways to impacts are listed below.

9.9.3 The proposed scheme would require the temporary and permanent loss of terrestrial and aquatic habitats, including those located within designated sites. There would also be temporary habitat losses associated with the gas main diversion. This would include priority habitats (including those located at Colemans Farm Quarry), and habitats likely to be used by or to support protected and notable species including notable vascular plants.

9.9.4 Construction would result in the loss of features directly used by protected and notable species for shelter, including badger setts and bat roosts.

9.9.5 Habitat fragmentation would potentially result from the severance of linear habitat features such as hedgerows, lines of trees and riparian corridors. This could potentially affect protected or notable species that rely upon such habitats for foraging, commuting or dispersing.

9.9.6 The proposed scheme would require two new crossings of Main Rivers (the Rivenhall Brook and Domsey Brook (east crossing)) on proposed offline sections of road, and alterations to four existing culvert and bridge crossings. Two Main River crossings (Boreham Brook and the River Ter) would require no works to the existing structures. Four of the crossings would require minor realignments of the watercourse at the crossing points (Rivenhall Brook, Domsey Brook (east), Domsey Brook (west), and Roman River). Main river crossings are shown on the General Arrangement Plans [TR010060/APP/2.9]

and further detail is provided within Chapter 2: The proposed scheme, of the Environmental Statement [TR010060/APP/6.1].

9.9.7 In addition to the Main River crossings, there would be 30 new culvert structures for Ordinary Watercourses, and improvements or extensions to 10 existing culvert structures. There would also be additional new culverts for drainage channels, which are shown on the Drainage and Surface Water Plans [TR010060/APP/2.13]. Construction of these new or modified watercourses could lead to habitat fragmentation for riparian or aquatic species.

9.9.8 During the construction phase, utilities and gas main diversion, site clearance, earthworks, excavations, watercourse realignments, extensions of existing culverts, creation of new culverts, and various other works could potentially result in mortality and injury of species. Significant effects could arise if protected or notable species are present within the Order Limits of the proposed scheme.

9.9.9 Disturbance to protected species could result from changes in noise, light, vibration or visual stimuli. During construction, disturbance could arise from fencing, earthworks, compound set-up, construction, reinstatement and other works. Chapter 8: Landscape and visual, and Chapter 12: Noise and vibration, of the Environmental Statement [TR010060/APP/6.1] provide additional details on these aspects.

9.9.10 Air quality changes could occur through changes in nitrogen oxide (NOx) and ammonia emissions caused by construction traffic, causing changes in N deposition and potential effects on sensitive designated sites and habitats within 200m of the construction ARN. The air quality assessment (Chapter 6: Air quality [TR010060/APP/6.1]) has shown that neither of the two LNR and 11 LWS and ancient woodland within 200m of the construction ARN would have potentially significant effects during construction as modelled transects do not exceed the 1% critical load or the 0.4kg N/ha/yr criteria outlined in DMRB LA 105 (Highways England, 2019) (see Chapter 6: Air quality [TR010060/APP/6.1]). However, one verified veteran (T685), one potential ancient tree (T624), and four potential veteran trees (T636, T439, T441, T443) may potentially be impacted by air quality changes during construction. These trees were scoped into further assessment in Appendix 9.15 of the Environmental Statement [TR010060/APP/6.3], the summary of which is provided in Section 9.11 of this chapter.

9.9.11 There is potential for hydrological change to cause significant effects during construction where works would directly or indirectly affect watercourses or groundwater. Hydrological changes are detailed in Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1] and include changes to both water quality and quantity within nearby watercourses through surface water runoff, and within GWDTEs through impacts to groundwater. Changes in hydrology, fluvial geomorphology and hydrogeology are important to terrestrial and freshwater ecology due to the following factors:

- Water quantity has an important role in structuring the flora and fauna communities in watercourses, ponds and wetlands

- Sediment and other pollutant releases have the potential to adversely affect sensitive ecological receptors
- Ecological receptors can be sensitive to alterations of runoff regimes changing the quality of surface water and groundwater

9.9.12 The gas main diversion has the potential to impact protected and notable species, including common reptiles (grass snakes, common lizard and slow worm), breeding birds, bats, badgers, otter and water vole and species of principal importance such as polecat, brown hare, common toad and hedgehog which may be present in habitats within the footprint of the construction area.

9.9.13 Whetmead LNR/LWS is also known to support a diverse assemblage of terrestrial invertebrate species, including 12 species of conservation importance, such as the small heath butterfly *Coenonympha pamphilus*. The invertebrate interest is predominantly associated with open habitats such as the semi-improved neutral grassland.

9.9.14 The gas main diversion would impact areas of lowland mixed deciduous woodland (a priority habitat) south of Blue Mills Hill and broadleaved plantation woodland north of Whetmead LNR and LWS. There is also potential for impacts to arable field margins and hedgerows, both of which are also priority habitats.

9.9.15 The gas main diversion has the potential to impact on the aforementioned protected and notable species. In addition, there is potential for impacts on dormouse due to severance of connectivity of hedgerows between the gas main diversion and Chantry Wood, Mope Wood, Grove Wood and Sparkey Wood.

Operation

9.9.16 The offline sections of the proposed scheme would permanently fragment habitats south of the existing A12 between junction 22 and junction 23, and between junction 24 and junction 25. Given the predominantly arable landscape, the severance of existing wildlife corridors along the proposed scheme (such as watercourses, field margins, hedgerows and tree lines) could have significant effects on species in the area as the new section of road would act as a barrier across the landscape.

9.9.17 Severance can lead to isolation both within and between populations and from specific resources separated spatially and temporally. The effects of this include reduced foraging success, increased competition, genetic isolation, and inbreeding, which can lead to local extinctions.

9.9.18 Mortality in the operational phase would largely result from animals attempting to cross a wide road, used by fast-moving traffic, which bisects many miles of the landscape. Unlike the risk of mortality directly from construction works, which is of a temporary nature, the risk of direct mortality through operation of the proposed scheme would be permanent.

9.9.19 The main sources of habitat degradation in the operational phase would be as a result of road noise and lighting disturbance. Noise has the potential to impact upon local populations of breeding birds and bats, potentially reducing the suitability of habitat close to the road and therefore reducing the availability of habitat in the vicinity of the proposed scheme.

9.9.20 Impacts from operational road lighting are most likely to affect bat species along the proposed scheme (although it could also affect birds, invertebrates and certain mammals, such as otter and badger). The effects of road lighting are complex but include:

- roost disturbance and abandonment
- severance (for light-shy species such as the brown long-eared bat)
- loss of foraging habitats for light-shy species due to light-spill
- a decline in airborne invertebrate prey available to light-shy species (as many invertebrates are attracted to lights)
- increased traffic collisions for bat species such as common pipistrelle, that would actively forage on insects attracted to lighting

9.9.21 Habitats where the impact of lighting can be particularly severe include river corridors, woodland edges and hedgerows.

9.9.22 Air quality changes could occur through changes in NOx and ammonia emissions caused by traffic, causing changes in N deposition and potential effects on sensitive designated sites and habitats within 200m of the operational ARN. The air quality assessment (Chapter 6: Air quality [TR010060/APP/6.1]) has shown that of the three LNR and 27 LWS within 200m of the operational ARN, only one LNR (Whetmead), eight LWS (Braxted park, Brockwell Meadows, Boreham Road Gravel Pits, Cook's Lane Lexden, Perry's Wood, Smyth's Green, West House Wood and Whetmead) could have potentially significant effects. Similarly, the air quality modelling showed only one ancient woodland (Perry's Wood) and one potential ancient woodland (Porter's Grove), six verified veterans (T9226, T9259, T9238 T9346, T649 and T1013), one verified ancient tree (T9322), and 16 potential veteran trees (T124, T234, T308, T316, T422, T494, T506, T549, T562, T744, T792, T1124, T1131, G1018, G489, G543) may potentially be impacted by air quality changes during operation. These sites were scoped into further assessment in Appendix 9.15 of the Environmental Statement [TR010060/APP/6.3], the summary of which is provided in Section 9.11 of this chapter.

9.9.23 Operational effects on watercourses are possible in relation to pollution of surface water due to contamination (for example by fuel or exhaust deposits) and from unexpected pollution events due to accidental spillage. The drainage design includes measures for the treatment of surface water runoff. In some instances, these measures result in a betterment upon existing conditions (Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]).

9.9.24 Groundwater could also become polluted if drainage is discharged to the ground or groundwater (although the proposed scheme is designed with drainage by outfall to surface waters). Temporary drainage matters during construction would be covered by standard construction mitigation measures (Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]).

9.9.25 The presence of permanent below-ground structures within the shallow aquifer, most notably bridge abutments associated with junctions and side roads, and sheet piles, have the potential to locally alter groundwater levels and flows. This could lead to an impact at groundwater receptors where these are close to such structures.

9.10 Design, mitigation and enhancement measures

Embedded (design) mitigation

9.10.1 The environment team has worked in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the proposed scheme design. This is referred to as embedded (or design) mitigation and is shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. Chapter 3: Assessment of alternatives, of the Environmental Statement [TR010060/APP/6.1] details the design alternatives that have been considered, including the environmental factors which have influenced the decision-making process.

9.10.2 Where practicable, the proposed scheme has been designed to avoid the potential impacts described in Section 9.9 of this chapter. Where this has not been possible, mitigation has been developed to reduce these potential impacts. Mitigation measures would seek to avoid habitat loss, habitat fragmentation, disturbance and species mortality.

9.10.3 Embedded mitigation relevant to this aspect includes siting of temporary and permanent works areas away from designated sites, notable habitats and resting places of protected and notable species, including bat roosts, barn owl nests, otter holts and couches, water vole burrows, badger setts, great crested newt ponds and core terrestrial habitat, as well as areas of terrestrial invertebrate interest, and habitats likely to support reptiles and species of principal importance.

9.10.4 The design of the proposed scheme has sought to minimise the loss of habitat within designated sites, in particular Whetmead LNR/LWS.

9.10.5 In addition, the design of the proposed scheme has accounted for the locations of valuable and priority habitats, including important connective habitats (e.g. hedgerows, watercourses and tree lines), and the locations of protected species. Where practicable, the design has been modified to avoid impacts to these features.

9.10.6 The use of permanent lighting would be developed at the detailed design stage in accordance with best practice guidance (including Bats and artificial lighting in the UK, BCT Guidance Note 08/18 (BCT and Institution of Lighting Professionals, 2018)) to minimise impacts on wildlife including sensitive design of lighting to avoid creating a barrier to aquatic species or foraging bats on watercourses. Lighting would be limited to junctions, handrail lighting on the bridges for walkers, cyclists and horse riders (WCH), and side road approaches to junctions, and designed to best practice to reduce light spill. LED luminaires would be used, which use less energy than conventional luminaires, while reducing light spill into adjacent areas.

9.10.7 Mammal ledges (positioned at least 150mm above the 1 in 100 year flood level and with at least 600mm headroom) would be fitted within culverts along the Rivenhall Brook, Domsey Brook (east), Domsey Brook (west) and Roman River, headroom and health and safety risk assessment permitting. Mammal ledges would be at least 500mm wide and accessible from the bank by ramps. Mammal ledges are labelled on the following sheets of Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]: Rivenhall Brook Culvert (sheet 11), Domsey Brook Bridge (sheet 14), Domsey Brook East Culvert (sheet 17) and Roman River Culvert (sheet 19). In addition, the provision of numerous 600mm, 1200mm, and 1500mm culverts for minor ditches would enable mammals, reptiles and GCN to safely cross beneath the proposed scheme. Where practicable, landscape planting would be designed to guide mammals to these features.

9.10.8 In line with the requirements of the NPPF and NNNPS, the proposed scheme aspires to maximise biodiversity delivery. Where habitats are lost as a result of the proposed scheme, new habitats of equal or greater value would be created (see Section 9.13 of this chapter).

9.10.9 New road verges would support low-nutrient grassland habitats which are of high ecological value. No topsoil would be applied to these areas which would be sown with a commercial and locally native seed mix appropriate to the geology. The habitat would be managed in accordance with the LEMP, which is included within the first iteration EMP [TR010060/APP/6.5], to maximise ecological delivery. On the inherently linear road verges of the proposed scheme, the creation of low-nutrient grasslands would provide an important wildlife corridor, as under these conditions native wildflowers have space to germinate and thrive amid reduced competition.

9.10.10 Other parts of the landscape design would include the creation of wildflower and grassland areas, seeded from an appropriate species-rich seed mix, as well as the planting of new woodland, species-rich hedgerows and scrub comprising locally native tree, shrub and herbaceous species of local provenance. Based on preliminary biodiversity net gain outputs, it is anticipated that hedgerows would be planted at a ratio of 2.5:1 in relation to those lost, and planting would be designed to maintain and increase connectivity around the proposed scheme and within the wider landscape.

9.10.11 A maximum of eight ponds are being lost and 57 new wildlife ponds would be created, therefore the ratio of ponds created to lost would be at least seven ponds created for every one lost. New drainage features such as attenuation ponds and ditches would incorporate wildlife-friendly design such as varying depths including shallow margins, native wetland plant species and macrophytes, and surrounded by wildflower and grassland areas seeded from a species-rich seed mix, where practicable.

9.10.12 In general, removal of mature trees would be avoided, however, in areas where mature trees are within the proposed scheme footprint and loss cannot be avoided, replanting of trees of the same species has been incorporated into the proposed scheme designs. Where practicable, trees would be planted close to the trees they are replanting. This design will be refined at the detailed design stage. Larger stock would be used where practicable to replace trees

designated under a Tree Preservation Order (TPO) or amenity planting. To achieve quicker establishment or height within planting mixes, a higher proportion of faster-growing species such as birch, alder and poplar would be used.

9.10.13 Where woodland vegetation is lost and trees cannot be replaced *in situ* due to the restrictions of utility easements, native shrub planting would be used as a replacement. Where tree lines and tree belts are lost and cannot be replaced *in situ* due to the restrictions of utility easements, native hedgerow planting would be used as a replacement. Replanting along the easement of the Cadent gas main diversion would be carried out in accordance with Cadent's standards and specifications presented within Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees (The National Joint Utilities Group, 2007). As well as mitigating the loss of habitats themselves as part of construction of the proposed scheme, creation of new habitats would mitigate the loss of foraging, resting and commuting habitats for a variety of protected and notable species including bats, badger, brown hare, hedgehog, polecat, breeding and wintering birds, GCN, reptiles and terrestrial invertebrates.

9.10.14 The planting design would use native species of local origin. Landscape planting has been designed to support green infrastructure objectives (Chelmsford City Council, 2018; Essex County Council, 2020), through the use of planting to link to existing field boundary vegetation to provide screening and connectivity of existing wildlife corridors. Ecology mitigation areas have been located in areas with connectivity to existing habitats. These areas will be created in advance of construction where practicable.

9.10.15 Landscape planting would be designed to reduce visual and lighting impacts to habitats, species and designated sites, and provide guide planting to maintain connectivity and encourage use of new or existing crossing structures.

9.10.16 Landscape planting would be designed to maximise biodiversity delivery by improving the value of habitat throughout the proposed scheme and improving wildlife connectivity by incorporating linear habitats such as hedgerows and lines of trees, linking with retained woodland and hedgerows where feasible.

9.10.17 The design of habitats to mitigate direct loss of habitats at the flagship biodiversity site at Colemans Farm Quarry is shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2] and will be further developed at detailed design. Habitats to be created within ecology mitigation areas to the south and north-west of junction 22 (i.e. the closest mitigation areas) include orchard trees, open mosaic habitat on formerly developed land in the form of banks and bare earth, neutral grassland, and reedbed within wildlife and attenuation ponds. The location of the ecology mitigation area to the south of Little Braxted Road provides direct connectivity to the remaining areas of quarry to be restored by the landowner following mineral extraction. In addition, newly created linear landscapes along the verges of the new A12 would provide connectivity with the wider landscape.

9.10.18 River realignments have been designed in collaboration with a qualified geomorphologist to maximise environmental gain where practicable (see Appendix 9.14 of the Environmental Statement [TR010600/APP/6.3]).

Freshwater ecologists have worked closely with hydromorphologists so that beneficial features for wildlife, including natural banks, riffles, sinuosity and variation in depths, are included within the designs.

9.10.19 Seventy-one attenuation ponds have been provided throughout the proposed scheme to mitigate for flood risk and enable road runoff to be treated prior to discharge into receiving watercourses, mitigating pollution of surface water. These have been designed to mimic natural water bodies where practicable by providing varying depths including shallow margins. The design of the ponds will be refined at the detailed design stage and would incorporate native wetland plant species and macrophytes and be surrounded by wildflower and grassland areas seeded from an appropriate species-rich seed mix. As well as mitigating flood risk and pollution, these ponds would provide habitat for numerous species including invertebrates, grass snakes, amphibians and foraging bats.

9.10.20 The drainage development during the detailed design phase would continue to be aligned with the guidance Protect Groundwater and Prevent Groundwater Pollution (Environment Agency, 2017). This would ensure that ponds comply with legal requirements to mitigate groundwater pollution.

9.10.21 Dewatering of wet woodlands would be avoided with the exception of Wet Woodland 7, which is required to facilitate construction of the adjacent borrow pit (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1] for details).

9.10.22 Fencing would also be used where necessary (and where this would not conflict with requirements for other species and with road user safety) to minimise the risk of wildlife mortalities. Fencing would be erected along the eastern boundary of Whetmead LNR where the site meets with proposed scheme to prevent mortality of wildlife.

Standard mitigation

9.10.23 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. The following standard construction best practice techniques and methods would be employed to remove or reduce the risk of potential impacts, in particular disturbance, habitat loss and species mortality:

- An Ecological Clerk of Works (ECoW) would be available during the phase of site clearance to assess and advise on retention of habitats. The ECoW would assess each area prior to clearance commencing and would advise whether full ECoW supervision is required for the work. If full ECoW supervision is not required, the ECoW would ‘sign off’ clearance of that particular area.

- Existing vegetation within the proposed scheme boundary and within temporary works areas would be retained as far as practicable and in accordance with, as a minimum, the Retained and Removed Vegetation Plans [TR010060/APP/2.14]. Particular attention would be given to the retention and protection of mature vegetation including ancient, veteran and notable trees (both verified and potential) and trees subject to TPOs.

- Where it would be necessary to remove vegetation within temporary works areas, such as construction compounds, utility routes, haul roads and regrading areas, this would be replaced on completion of construction using the same or similar species to that removed where practicable (subject to restrictions to planting over and around pipeline easements and consideration of species with regards to climate change and resilience to pests and disease and landowner agreement). All land used temporarily would be restored and returned to an appropriate condition relevant to its previous use wherever practicable and appropriate, including the ripping, minor regrading and re-spreading of topsoil. Hedgerows, fences and walls would be reinstated to a similar style and quality to those that were removed with landowner agreement.

- No topsoil would be incorporated within grassland areas on new earthworks to create low-nutrient substrate suitable for species rich grassland establishment and increase local biodiversity where reasonably practicable, in accordance with Major Project Instructions (Highways England, 2020e). Low-nutrient grassland would be seeded along highway verges and at junctions.

- Replanting along the easement of the gas main diversion would be carried out in accordance with utility company's guidance and best practice standards. Where woodland vegetation is lost and trees cannot be replaced *in situ* due to the restrictions of utility easements, native shrub planting would be used in line with the relevant utility company's guidance. Where tree lines and tree belts are lost and cannot be replaced due to the restrictions of utility easements, native hedgerow planting would be used in line with the relevant utility company's guidance.

- Working width for the installation of the gas main diversion would be reduced as far as reasonably practicable through woodland and where the gas main diversion crosses through hedgerow field boundaries. All Main River crossing(s) for the gas main diversion would be installed using trenchless techniques, such as horizontal drilling. Directional drilling would be considered where practicable.

- Exclusion zones would be marked where appropriate around protected habitat areas such as trees, woodlands, hedgerows and watercourses to avoid accidental damage and retain vegetation in accordance with the Retained and Removed Vegetation Plans [TR010060/APP/2.14]. Marking of protected areas would be based on proximity and risk of encroachment and based on these factors, marking may include physical barriers or signage. Construction compounds would be fenced off.

- Exclusion zones would be marked around Brockwell Meadows LWS which is adjacent to the Order Limits, and around retained parts of Whetmead LNR/LWS and Riverview Meadows LWS, to retain vegetation in accordance with the Retained and Removed Vegetation Plans [TR010060/APP/2.14].

- Pollution of watercourses from surface water runoff during the construction stage would be prevented through standard mitigation such as the use of silt fencing, cut-off drains, and baffles at discharge locations (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]).

- To mitigate impacts associated with construction plant and equipment noise, standard measures would be undertaken as necessary during the construction phase of the works, including programming works to minimise work outside of normal work hours where practicable and specifying use of lower-noise emitting equipment where practicable (see Chapter 12: Noise and vibration [TR010060/APP/6.1]).

- Works would be timed to avoid sensitive periods for protected species where reasonably practicable and appropriate. Where this cannot be achieved this would be managed in accordance with advice, under supervision from an ECoW where required, and in accordance with any protected species licence requirements.

- Following inspection by the ECoW, clearance of habitats within the construction area would be conducted under appropriate supervision where there is potential for impacts to protected species. For example, where bird nesting habitat would be removed in the bird breeding season, a suitably competent person would check vegetation and habitats no more than 24 hours prior to work occurring. Any vegetation and habitats found to contain active nests would not be removed or disturbed until the nest is no longer active. What is considered ‘appropriate supervision’ in each scenario would be at the discretion of the ECoW and would be based on the works required and the ecological receptors present (e.g. in some instances the ECoW may consider themselves the most suitable supervisor, but in others with fewer risks they may deem it appropriate to delegate supervision to someone else on site with suitable briefing on the requirements of supervision).

- Creation of features which could attract wildlife into works areas would be avoided where practicable, this may include the maintenance of habitat in an unsuitable condition for species (to discourage species from using such areas). Where appropriate, the construction site boundary would be designed to discourage wildlife entering the site.

- Important commuting features such as mammal pathways and river channels would be left clear of obstruction. Where an ECoW deems it beneficial to local wildlife, temporary fencing would be raised slightly off the ground (150mm) where reasonably practicable; if not, gaps would be provided at regular intervals (as assessed on site) to allow wildlife to move freely throughout their normal territories where appropriate. Where wildlife travelling freely through fencing is considered likely to increase the risk of mortality (e.g. fencing between habitat and the existing A12), then fencing would be installed to reduce likelihood of wildlife moving freely through it where practicable, i.e. not leaving a gap beneath fencing or at regular intervals.

- Where practicable, trenches, trial pits and excavations would be covered overnight or fenced off in order to prevent animals falling in and becoming trapped within excavations. Where excavations cannot be fenced, closed or filled on a nightly basis, a means of escape would be provided. Examples of 'means of escape' include:
  - making one edge/section of each excavation sloped at such an angle such that any animal which may fall into an excavation could leave of their own accord
  - placing a plank of wood (or similar) of a suitable width and angle that both touches the bottom of the excavation and overlaps with the top lip of the excavation such that an animal could use it as a ramp to walk out of an excavation should they fall in
  - borrow pits would be fenced to prevent animals falling in, and where appropriate, a gradually sloping access track would be used as a safe means of escape for wildlife
  - pre-works checks would be undertaken to ensure that wildlife has not become trapped overnight/while works have paused
- Buffer zones around sensitive features such as confirmed bat roosts, badger setts, otter holts, water vole burrows, birds' nests and watercourses would be implemented as directed by the ECoW. Appropriate buffers would be implemented around watercourses where suitable, using physical barriers during construction works to protect aquatic species from destruction and disturbance. Where appropriate, professional judgement would be exercised by the ECoW to amend buffer zones to accommodate works, with the option of introducing additional control measures such as a watching brief to ensure risks to habitats and wildlife are appropriately managed. Buffer zones would be suitably demarcated to prevent encroachment of works.
- Temporary lighting would be provided to ensure safe working conditions and to maintain security within construction compounds and working areas. Best practice measures would be implemented where practicable to ensure temporary lighting is avoided or directed away from ecological receptors such as watercourses, woodland, badger setts, bat roosts and important commuting habitats.
- The Invasive Species Management Plan (ISMP) would be developed and implemented based on the measures and approaches detailed within the ISMP in the first iteration EMP [TR010060/APP/6.5]. The ISMP would describe how non-native plant and animal species would be managed or removed where required in order to prevent their spread in the terrestrial and aquatic environment during construction of the proposed scheme. The ISMP will be secured through the REAC, which is included in the first iteration EMP [TR010060/APP/6.5]. The ISMP in outline format is also in the first iteration EMP and would be updated by the Principal Contractor into the second iteration EMP, as appropriate and necessary, prior to commencement of works. The ISMP will follow Defra guidance (How to stop

invasive non-native plants from spreading, Defra 2022), stating any risks associated with removal of INNS.

- Landscape and ecology mitigation would be delivered in accordance with the LEMP, which is included in the first iteration of the EMP [TR010060/APP/6.5].
- Relevant CIRIA guidance, including C741 – Environmental Good Practice on Site (4th Edition) (2015) and C961 – Working with Wildlife: Guidance for the Construction Industry (2011) would be adopted as good practice on how to work with biodiversity considerations in the construction industry.
- As the construction of the proposed scheme progresses, pre-construction surveys using current best practice guidance would be undertaken for bats, barn owl, badger, otter, water vole and reptiles to update baseline surveys prior to construction.
- ECoWs would be employed where relevant to the works being undertaken.
- With regard to air quality, the second iteration of the EMP would adopt best practice measures to control fugitive dust (and hence avoid or reduce potential impacts) in compliance with DMRB LA 105. The Principal Contactor would enter into pre-works discussions with affected local authorities to agree appropriate dust mitigation measures outlined within the first iteration of the EMP [TR010060/APP/6.5]. Mitigation measures would include the dampening down of surfaces, planning the site layout so that machinery and dust-causing activities occur as far from receptors as practicable, and cover, seed or fence stockpiles to prevent wind whipping, where practicable.
- Grass seeded bunds at least 2m high would be provided around the southern and western sides of junction 20b main compound and around the perimeter of junction 22 north main compound in order to provide noise and visual screening for birds. Breaks in the bunds would be required for utilities.

9.10.24 Standard mitigation is included in the REAC, within the first iteration of the EMP [TR010060/APP/6.5] which forms part of the DCO submission (see Chapter 5: Environmental assessment methodology [TR010060/APP/6.1]). The LEMP, which is included in the first iteration of the EMP [TR010060/APP/6.5], presents how the landscape and ecological mitigation would be reinstated and maintained, although this is separate to the landscape design. The LEMP will be further developed prior to construction by the Principal Contractor.

Additional mitigation

9.10.25 Additional mitigation for each biodiversity matter is described below and, where appropriate, shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].

Whetmead LNR/LWS

9.10.26 Impacts to Whetmead LNR and LWS would be offset through creation of habitats within the proposed scheme. Due to ground conditions, there is limited scope for additional planting to improve the existing LNR/LWS or to restore or improve the condition of formerly wet habitats within the site. Habitats would be created south of the River Brain. The newly created habitats would include scrub to offset the loss in the Whetmead LNR/LWS and ecologically valuable habitats, namely species-rich grassland, hedgerows with trees, and a pond and ditch complex designed specifically for the benefit of water voles (with additional benefits to other species such as amphibians, grass snakes and bats).

9.10.27 Stockproof fencing would be erected along the western boundary of Whetmead LNR/LWS to prevent animals from crossing the A12 and thereby reducing mortality risks. Types of fencing would be considered further during detailed design.

9.10.28 As per mitigation in Chapter 12: Noise and vibration [TR010060/APP/6.1], a road surface influence of -6.5dB or better (i.e. a surface with greater noise-reducing properties than a conventional low noise surface) would be installed between Witham Bypass and the new Rivenhall End bypass between the existing junction 21 and junction 23, which also includes all road surface alongside Whetmead LNR/LWS. This is considered to offset any impacts from the change in alignment, speed and increase in traffic flow which would otherwise lead to an increase in noise levels.

9.10.29 In addition to habitat creation, further mitigation would include the creation of reptile hibernacula and log piles within Whetmead LNR/LWS and the new mitigation areas to the south of the River Brain. The number of hibernacula and log piles would be determined at detailed design.

9.10.30 Bird boxes would be installed within Whetmead LNR/LWS, the nearby Shelley's Meadow and the River Walk to be used by nesting birds and as mitigation for loss of mature scrub habitat while new habitats mature. Quantities and species suitability will be agreed in advance through consultation with Witham Town Council. This would include one bird box fitted with a camera linked to the visitor centre at Witham Town Hall.

9.10.31 Mitigation for Whetmead LNR/LWS will be secured through the REAC within the first iteration of the EMP [TR010060/APP/6.5].

Ancient woodland – Perry's Wood

9.10.32 As detailed in Section 9.11 of this chapter, modelling predicts an increase in N deposition of 2.82kg N/ha/yr (28.2% of the lower critical load) over more than 20% of this site. There is no feasible mitigation for the impact (see Appendix 6.6: Project air quality action plan [TR010060/APP/6.3]). Offsetting would therefore be provided through the creation of an area of broadleaved woodland habitat (7.4ha) as part of the restoration of borrow pit F as shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. The design of this woodland would be developed at detailed design into the final landscape design. Indicative species lists are detailed in the LEMP in the first iteration EMP [TR010060/APP/6.5]. The proposed species composition would reflect the species typical of Perry's Wood and other ancient woodlands in the local area,

although not ash due to the prevalence of ash dieback in the area. The maintenance and management of this area of habitat would be the responsibility of National Highways. The location falls outside the 200m buffer around the operational and construction ARN and so would not be subject to air quality impacts and is immediately adjacent to an area of existing broadleaved woodland, providing continuity of habitat and maximising the functional value of the new woodland.

Habitats

9.10.33 As detailed in Section 9.11 of this chapter and Appendix 14.4: Groundwater Assessment [TR010060/APP/6.3], potential impacts on groundwater flows and levels to GWDTEs at Marshy Grassland 1, Wet Woodland 1, Wet Woodland 8, and Wet Woodland 9, have been assessed as of slight, or neutral significance. No additional mitigation measures are therefore required.

9.10.34 Appendix 14.4: Groundwater Assessment [TR010060/APP/6.3] has determined the potential for construction impacts on groundwater flows and levels to GWDTEs in Wet Woodland 7.

9.10.35 Pre-construction surveys would be undertaken to further understand the functioning of Wet Woodland 7. Groundwater level monitoring using dataloggers would continue at boreholes BH2058, BH2059 and BH2060 within Wet Woodland 7, and beside borrow pit I and the A12. This would be complemented by a National Vegetation Classification (NVC) survey to refine baseline habitat at Wet Woodland 7 and surface water monitoring to provide an understanding of the proportion of surface water which supports Wet Woodland 7 prior to excavation of borrow pit I.

9.10.36 Additional ground investigation would include pumping tests at borrow pit I to support a more detailed dewatering impact assessment. BH2058, BH2059 and BH2060 would continue to be monitored during the pumping tests and during construction if necessary.

9.10.37 A Water Balance Compensation strategy would be put in place to compensate the loss of natural groundwater recharge to Wet Woodland 7 by diverting extracted groundwater from borrow pit I towards Wet Woodland 7. The volume of water to be diverted would be based on the detailed design and dewatering impact assessment and long-term groundwater monitoring around Wet Woodland 7. The Water Balance Compensation strategy would determine whether monitoring of boreholes BH2058, BH2059 and BH2060 would continue during construction of borrow pit I and up until groundwater has rebounded. A post-construction NVC survey would be undertaken by the Principal Contractor to verify that no significant change in vegetation has taken place during construction.

9.10.38 Where potential ancient and veteran trees are unavoidably removed to accommodate the proposed scheme, their loss would be partially compensated (acknowledging that features such as ancient and veteran trees are considered irreplaceable and therefore cannot be fully compensated) as per the latest guidance from Natural England and the Forestry Commission (2022):

- Young trees of the same species as that which is removed would be planted with sufficient space around them to encourage development of an open crown.
- Where practicable, trees would be planted close to the trees they are replacing, taking into account post construction air quality levels.
- Where practicable and safe to do so, the intact hulk of the potential ancient or veteran tree would be left where it is (preferably standing) to benefit invertebrates and fungi. Where this is not possible, the hulk would be moved near to other unimpacted potential ancient or veteran trees or parkland in the area.

Protected species

9.10.39 Through the application of embedded, standard, and additional mitigation the proposed scheme would comply with legal requirements for protected species that may be impacted but that would not be significantly affected in EIA terms. Legal requirements for protected species are detailed in Section 9.4 of this chapter. Where the proposed scheme requires a Natural England EPSM licence, this is discussed in the relevant section below.

Bats

9.10.40 Owing to their legal status, a Natural England EPSM licence would be required to destroy or disturb any bat roost. The proposed scheme would aim to secure a 'Letter of No Impediment' (LONI) from Natural England with the draft bat licence application (Appendix 9.16: Draft bat licence [TR010060/APP/6.3]), prior to or during examination. Following grant of the DCO, an EPSM licence would be developed based on the draft bat licence application and outcomes of the pre-construction surveys and applied to Natural England.

9.10.41 Following DCO consent, pre-construction bat surveys would be undertaken and the EPSM licence application would be updated accordingly. Pre-works surveys would include internal inspections, climbing surveys and/or emergence and re-entry surveys as appropriate to the feature.

9.10.42 Four confirmed bat roosts (one building and three trees) would be lost or damaged as part of construction of the proposed scheme. These are as follows:

- B1463, a commercial building containing a common pipistrelle non-breeding summer day roost located at NGR TL 87664 18932
- T1149, an aspen containing a common pipistrelle transitional roost at NGR TL 82979 14183
- T79, a white willow tree containing a brown long-eared transitional roost at NGR TL 83977 16366
- T733, an oak tree containing a soprano pipistrelle day roost at NGR TL 78048 11380

9.10.43 Pre-construction surveys of B1463, T1149, T79 and T733 are to be carried out to determine the current use of these features by bats. The three trees (T1149, T79 and T733) are in areas of vegetation currently due to be cleared. Now that the roosts are known, every effort will be made to reduce clearance in these areas to an absolute minimum in order to retain these trees, so the roosts may not be lost. However, as they are in areas currently due to be cleared, they are included as roosts to be lost.

9.10.44 Impacts to bats would be mitigated through the following steps:

- Felling of T33, T79 and T1149 and demolition of B1463 would be conducted in accordance with a method statement (which would be licensed to ensure legal compliance) and under supervision of a licensed bat ecologist. Bats would be excluded before demolition or felling, for example using one-way excluders and internal lighting, and T133, T79 and T1149 would be soft felled.

- Timing of works would avoid sensitive times of year for the bat roosts. Works are currently due to be carried out between April and September for T1149, T733 and T79 to avoid the risk of encountering hibernating bats. Works are currently due to be carried out between May and August for B1463 as the building is suitable for hibernating bats and no evidence of use by bats in the maternity period (May-August) has yet been found (bat was found roosting in September).

9.10.45 The loss of these roosts would be mitigated through the provision of suitable roosting boxes at a ratio of 3:1 for every roost lost.

9.10.46 The locations of all replacement roosts and bat boxes are shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2] and are detailed in the LEMP, which is included in the first iteration of the EMP [TR010060/APP/6.5].

9.10.47 Pre-construction bat surveys would be undertaken to support the EPSM licence application following DCO consent. Surveys would include internal inspections, climbing surveys and/or emergence and re-entry surveys as appropriate to the feature. If new roosts are identified during pre-construction surveys, the following general principles would be applied to any future iterations of the bat licence:

- Exclusion of bats from roosting features ahead of demolition works, for example using one-way excluders and internal lighting.

- Avoidance of mortality, injury or disturbance to bats, through timing of demolition or felling works for when bats are least vulnerable to harm (i.e. when bats are not hibernating in winter or in maternity roosts in summer). March, April and October are typically the preferred times for works in relation to bats, although this may be deviated from depending on a number of factors (e.g. the type of roost).

- Pre-demolition inspection by a licensed bat ecologist including supervised removal of roosting features by hand (i.e. roof tiles in the case of buildings ahead of demolition, or soft felling of trees) as practicable.

- The provision of alternative roosting habitat. A number and variety of bat boxes would be erected in nearby trees (on a ratio of at least three bat boxes erected per roost removed), prior to works taking place which would impact a roost. An updated plan, detailing the location of all replacement roosts/bat boxes, would be included in the second iteration EMP for reference during construction.

- The size and style of the box would be suitable for the species in the existing roost. Boxes would be positioned within retained habitat (either attached to retained trees or a free-standing post) in proximity to the roosts to be lost. These would be positioned to avoid any impacts from construction or operation of the proposed scheme, e.g. away from sources of noise or lighting disturbance.

9.10.48 In addition to the mitigation required as part of the licence application (i.e. where there is a risk of a legal offence in the absence of mitigation), further mitigation to offset impacts of the proposed scheme are proposed.

9.10.49 Additional bat boxes would be provided for every tree, building and structure assessed as having moderate to high suitability in the bat report that would be lost as a result of construction of the proposed scheme. This would mitigate for the loss of potential roost features with suitability to support roosting bats in the future. Boxes would be provided at a ratio of 2:1 for every tree, building or structure lost to account for variance in bat roosting preferences. Boxes would comprise a range of types to also account for variance in bat roosting preferences. The locations in which these boxes would be installed are shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].

9.10.50 Landscaping and habitat planting have been designed to increase connectivity across the landscape and avoid fragmentation of foraging and commuting habitats (see Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]). The detail of landscaping proposals would be further developed at the detailed design stage to include linear woody planting on the embankments of Braxted Road Overbridge, Highfields Overbridge replacement, Ewells Overbridge replacement, Prested Hall Overbridge, Easthorpe Road Overbridge and Wishingwell Overbridge. The linear planting at these locations would include larger stock and faster-growing native trees at strategic locations on the new embankments and existing A12 where practicable, to act as hop-overs and to guide bats over the new road. Where possible, linear planting would tie in with culverts to guide bats through these as opposed to over nearby side roads.

9.10.51 Creation of new habitat within landscaping and mitigation areas has been designed to enhance bat foraging habitat, for example through the provision of native flowering trees and shrubs, and ponds and ditches which would attract invertebrate prey species (see Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]).

Badger

9.10.52 Owing to badgers' legal status, a development licence would be required to damage or interfere with a sett. Construction of the proposed scheme would result in damage to, destruction of or disturbance to a total of 26 of the 36 active setts (outliers/subsidiary/annex/main) within the Order Limits. All 26 setts would require closure under licence, of which 23 setts would be permanently closed and three would be temporarily closed. No action would be required for the remaining 10 active setts which are unaffected by construction.

9.10.53 The proposed scheme would aim to secure a LONI from Natural England with the draft badger licence application (Appendix 9.17: Draft Badger Licence, of the Environmental Statement [TR010060/APP/6.3]). Following grant of the DCO, an EPSM licence would be developed based on the draft badger licence application and outcomes of the pre-construction surveys and applied to Natural England.

9.10.54 In accordance with the draft badger licence application which would be updated following pre-construction survey, it is anticipated closure to the following setts would be undertaken:

- two main setts
- 21 outlier setts (18 permanent closures and three temporary closures)
- two subsidiary setts
- one annex sett

9.10.55 This would be reviewed and updated following pre-construction badger surveys and any changes to the baseline survey results.

9.10.56 Use of setts can be highly changeable, and badgers are able to quickly colonise new areas. Pre-construction surveys would be undertaken to confirm the status of all setts and also identify any new setts prior to the start of works. These data would be used to inform the final licence application and to amend mitigation proposals accordingly.

9.10.57 At the time of assessment, destruction of 13 setts which have been determined as disused, could be undertaken without licensing. No action would be required for the remaining two disused setts which are unaffected by construction.

9.10.58 Closure of the 21 outlier setts (18 permanent closures and three temporary closures), two subsidiary setts and one annex sett would be undertaken using standard techniques (detailed below). No artificial setts would be provided to mitigate the loss of these lower status setts.

9.10.59 Closure of two main setts would also be undertaken using standard techniques. Two artificial setts would be provided to mitigate for the loss of main setts, as outlined in the draft badger licence (Appendix 9.17 [TR010060/APP/6.3]). The artificial setts would be created at least six months prior to the exclusion phase (governed by the licence). The total number of artificial setts to be created is based on the current assessment of setts in relation to the proposed scheme and may be subject to change depending on the findings of pre-construction surveys and the granted licence. Due to sensitivities around badgers, the

locations of these setts have not been shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2], however, this information has been made available for stakeholders. The locations of the artificial setts have been discussed and agreed with Natural England (see Table 9.1). Evidence of use of the artificial setts would be obtained and provided to Natural England prior to closure of the main setts.

9.10.60 As required by Natural England, badger exclusion works would be from 1 July and would be completed by the end of November the same year so as to avoid impacts to pregnant badgers or cubs.

9.10.61 Exclusion of badger setts would follow standard procedures under licence, as supervised by a suitably experienced ecologist. One-way badger gates would be fitted to any entrances exhibiting current use by badgers. All other entrances would be hard stopped using wooden stakes or a similarly robust material. Heavy duty chain link, stock or weld mesh fencing, secured to the ground using metal pegs or wooden stakes and staples, would be installed around the entire sett to prevent badgers from re-entering. Exclusion would take place over a minimum period of 21 days after the last date when badgers were recorded leaving the sett. Monitoring visits would take place at least once every three days during the exclusion to determine whether badgers are still active in the sett.

9.10.62 Once badgers have been excluded, setts requiring temporary closure would be securely closed (i.e. the fencing would remain in place and wooden stakes or metal pins would be inserted in front of the gates so they cannot be opened again). These setts would be monitored by the ECoW for signs of badgers attempting to regain entry. If evidence of digging around was identified during a check, additional exclusion fencing would be installed over that area. If evidence suggested that a badger may have fully re-entered the sett, then construction works would need to cease until the full exclusion method had been re-applied. Upon completion of works in the area, the sett would be re-opened and all proofing removed on completion of construction at that location.

9.10.63 Any setts requiring destruction would be dismantled mechanically as per the specifics of the licence and under the direction of the licence holder or appointed accredited agent as soon as practicable after the successful completion of badger exclusion. Once each tunnel has been excavated, the excavation would be backfilled and the entire sett area covered over with chain link, stock-proof or weld mesh fencing to prevent badgers from re-excavating the sett until construction activity in the area is completed.

9.10.64 Typically, exclusion zones of 30m would be implemented around any retained active setts within the Order Limits to avoid disturbance. The exact distance of exclusion zones may be altered based on assessment by an ECoW, who would look at the type and condition of the sett(s) present and the works planned for the area. Exclusion zones may be reduced or increased based on these assessments.

9.10.65 Main sett 80 would be retained but would be located between the existing and new A12. In order to prevent fragmentation impacts from habitats and other setts to the south, linear planting would be installed to guide badgers to a culvert formed of a 1200m diameter pipe. Headroom and health and safety risk

permitting, mammal ledges at least 500mm wide and 150mm above the 1 in 100 year flood level and with at least 600mm headroom would be fitted to either side of the culvert to ensure the usage of badgers even during times of flooding. In addition, habitats around the sett would be enhanced to increase their value to foraging badgers. Existing arable habitats north of the sett would be landscaped as species-rich grassland and woodland. To the south of the sett would be further areas of grassland, and 0.4ha of orchard, as well as additional areas of woodland habitat. This includes habitats within an ecology mitigation area which would be created in advance of the works in the affected area. This would increase the availability of food resources in proximity to the sett.

9.10.66 Fragmentation impacts across the wider proposed scheme would be mitigated through the provision of mammal ledges where practicable as described in the embedded mitigation section. Where practicable, landscape planting would be designed to guide badgers to these features.

Dormouse

9.10.67 Should the surveys to the east of the River Blackwater identify dormouse presence within the footprint of the proposed gas main diversion, additional mitigation for dormice would include the following measures.

9.10.68 An EPSM licence would be obtained from Natural England which would agree the specific mitigation approach.

9.10.69 Timing of clearance of vegetation with the potential to support dormice (e.g. vegetation which is suitable in terms of quality and is connected to habitats to the east of the River Blackwater known to support dormice) to avoid sensitive periods, for example removal of the roots and stumps of trees within hedgerows would not be undertaken during the hibernation season.

9.10.70 Removal of vegetation would be undertaken under the supervision of a licensed ecologist.

9.10.71 Where removal of hedgerows cannot be avoided (see standard mitigation), dead hedging would be installed upon completion of works in each section of hedgerow in order to maximise connectivity, and replacement hedgerow shrubs would be planted in the next planting season. Dead hedging would be left *in situ* until new planting had sufficiently matured.

Otter

9.10.72 Based on the current baseline, no otter resting places would be disturbed, damaged or destroyed as a result of the proposed scheme and therefore a Natural England EPSM licence is not required. However, pre-construction surveys would be conducted to identify any newly created holts or couches. Should any new resting places be identified and should they be located in a place that would be disturbed, damaged or destroyed as a result of the proposed scheme, an EPSM licence would be obtained from Natural England to agree the specific mitigation approach.

9.10.73 During construction, mitigation measures such as the avoidance of works within 10m of the tops of riverbanks without an Environment Agency Flood Risk Activity Permit would be implemented. Within the permit, protection of otter

commuting routes will be required, which would be achieved through the avoidance of excessive noise and artificial lighting, particularly at night where night-time working cannot be avoided.

9.10.74 Fragmentation impacts across the wider proposed scheme would be mitigated through the provision of mammal ledges where practicable, as described in the embedded mitigation section.

9.10.75 Whilst otters are most likely to utilise the larger watercourses along the proposed scheme, it is also feasible they may traverse ditches to commute across the landscape. The provision of numerous 600mm, 1,200mm, and 1,500mm diameter culverts for minor ditches would enable otters to safely cross under the proposed scheme. Where practicable, landscape planting would be designed to guide otters to these features.

9.10.76 Fencing would be installed in the vicinity of areas where the A12 crosses the main watercourses to direct otter to safe crossing points under the road.

Water vole

9.10.77 Pre-construction surveys would be undertaken within 50m of the Order Limits to update the baseline for water voles and to assess the locations of any active burrows.

9.10.78 Should any new water vole burrows be impacted by construction works, it may be possible to modify the design of the proposed scheme to avoid impacts, for example through micro-siting drainage ditches or outfalls to avoid burrows, or by altering the alignment of the permanent and temporary access tracks within the horizontal limits of deviation. It is considered that a licence to disturb, damage or destroy water voles and their burrows is unlikely to be needed on this basis, however, ecology mitigation areas incorporating pond and ditch complexes have been included within the vicinities of junction 19 and the River Brain (areas most likely to have water vole presence) as shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. These mitigation areas have been designed to provide water vole habitat as well as to mitigate for the species and habitats for which they are primarily required, should avoidance of impacts not be possible.

9.10.79 Works on ditches south of junction 19 are more than 5m from known water vole burrows and works on Domsey Brook to the south of existing junction 24 are over 150m from a water vole burrow and are considered to be sufficiently far from this feature that no impacts are anticipated.

9.10.80 Where water vole burrows are present, bankside habitat would be fenced off and a buffer of 5m from works maintained where practicable and as directed by the ECoW to prevent unnecessary damage to water vole burrows and disturbance to water voles. Site control measures are detailed within the LEMP in the first iteration EMP [TR010060/APP/6.5]. Where this is not practicable, a licence would be obtained from Natural England.

9.10.81 Fragmentation impacts across the wider proposed scheme would be mitigated through the provision of mammal ledges where practicable, as described in the embedded mitigation section.

9.10.82 Where practicable, mitigation would include the creation of new habitat suitable for water voles through the selection of wildlife ponds and open drainage ditches with vegetated earth banks, as opposed to closed (culverted or buried) drainage options that would not support water voles.

9.10.83 At the detailed design stage, the proposals for new ditches and ponds would be developed to include planting schedules. Ditches and wildlife ponds would be planted or seeded with suitable water vole food plants to provide cover and foraging resource.

Other mammals

9.10.84 Habitat creation would be suitable for other mammals, such as hedgehogs, and therefore no additional mitigation for other mammals is proposed.

Birds

9.10.85 Bird nesting boxes would be provided to mitigate for the temporary loss of nesting habitat whilst newly planted habitats mature. Bird nesting boxes would be installed in retained vegetation within the Order Limits during the pre-construction phase on new or existing structures, or on free-standing posts as appropriate. Boxes would be suitable for a variety of species, including cavity-nesting species with entrance holes of different sizes, open-fronted boxes, and larger boxes to accommodate birds of prey. The boxes would be constructed of hardwearing materials such as exterior grade plywood, recycled plastic or woodcrete.

9.10.86 Creation of new habitats such as woodland, trees, scrub, grassland and water bodies, as shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2], would benefit birds through provision of new foraging and nesting opportunities, as well as mitigating the loss of other habitats. Habitats would be established well ahead of any works in the affected area, as assessed by a suitably experienced ecologist.

Barn owl

9.10.87 No barn owl roosting or nesting sites would be lost or altered as a result of the proposed scheme, so at the time of assessment there is no proposal to provide barn owl nest boxes as mitigation.

9.10.88 Pre-construction surveys of all trees and buildings that would be impacted by the proposed scheme would be undertaken in order to determine their use by barn owls ahead of works. The implementation of protection zones would be as directed by the ECoW and would be determined by the type of activity and associated risks. Protection zones could be altered where appropriate, based on professional judgement of the risks present by the ECoW.

9.10.89 Should any new barn owl roosting or nest sites be identified and determined to be lost as part of the proposed scheme, barn owl boxes at a ratio of 2:1 for each nest site lost would be installed at least 1.5km from the Order Limits to increase nesting opportunities and avoid increased barn owl road casualties. Barn owl boxes would be made from hard wearing materials such as exterior grade plywood or recycled plastic and locations of boxes would be identified through consultation with Essex Wildlife Trust. Planting of high roadside vegetation

along the new road verges to reduce the likelihood of increased barn owl road casualties has been considered. However, feedback from consultees (Essex Wildlife Trust) is that they would prefer to see provision of grassland habitats and that the overall benefit provided to other species (invertebrates, birds, small mammals, bats) offsets the potential risk to barn owls through mortality due to collision with vehicles.

Reptiles

9.10.90 Surveys indicated that low to good populations of three common reptile species (common lizards, grass snakes and slow worms) are present in a number of areas of suitable habitat, including tall grassland and scrub around the proposed scheme.

9.10.91 Pre-construction surveys would be undertaken to establish the presence and extent of reptile populations prior to the start of works.

9.10.92 For localised areas of impact to reptiles, habitat manipulation would be used to displace reptiles into suitable adjacent habitats to avoid killing or injury.

9.10.93 For the majority of suitable habitats where clearance of vegetation is required, a translocation exercise would be undertaken by suitably experienced ecologists to move reptiles to receptor sites ahead of works and avoid direct mortality of animals.

9.10.94 Reptile receptor sites suitable for translocated reptile populations are shown as ecological mitigation areas on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]. Receptor sites would be established well ahead of any translocation, as assessed by a suitably experienced ecologist, to allow newly created and enhanced habitats to become sufficiently established prior to introducing the animals. There would be 20 reptile receptor sites across the proposed scheme, totalling 46ha.

9.10.95 The receptor sites are in close proximity to the donor sites and are not currently considered to support a population of reptiles (or where they do, additional features would be added to increase the carrying capacity of the site). Receptor sites would be well connected to other suitable reptile habitats and would be able to support the translocated populations. Preparation of these sites would include habitat planting of grassland, scrub and woodland, provision of ponds and ditches, and the creation of basking sites, egg-laying habitat for grass snakes, hibernation sites (hibernacula) and log piles to be undertaken in advance of any translocation works.

9.10.96 Multiple sites would be utilised to ensure that animals are not transported long distances from the donor site and that sufficient habitats are available to support new reptile populations.

9.10.97 Receptor sites would be designed to link up with the wider environment to prevent fragmentation of populations, including providing connectivity with proposed scheme road verges so that populations are able to expand naturally across the study area. Further details on the maintenance and protection of receptor sites are provided in the LEMP (which is included in the first iteration of the EMP [TR010060/APP/6.5]) and will be further developed during detailed design.

9.10.98 The provision of numerous 600mm, 1,200mm, and 1,500mm culverts for minor ditches would enable reptiles to safely cross under the proposed scheme and would mitigate fragmentation impacts. There would be the creation of 30 new culverts and extensions to 10 existing culverts. Where practicable, landscape planting would be designed to guide reptiles to these features.

Great crested newt

9.10.99 None of the 21 confirmed GCN breeding ponds identified would be lost as a result of the proposed scheme, and only one is within the Order Limits. There is potential for partial impacts to P345 during earthworks and drainage works, however any impacts would be short term and sufficiently mitigated for by standard measures. There is also the potential for water drain from P99 as a result of borrow pit excavation. However, this is not considered to have any adverse impacts on GCN. There would be a loss of terrestrial habitat during construction of the proposed scheme. However, once the landscape planting has been implemented and has matured there would be a net gain of habitats, as shown in Table 9.28 (in Section 9.11 of this chapter).

9.10.100 GCN mitigation to alleviate these impacts would be delivered via Natural England's DLL process. This process moves mitigation from a site-based focus to a wider county or district-level. The proposed scheme would fund the creation of breeding ponds and terrestrial habitats for GCN to mitigate the loss of habitats with the aim of connecting and expanding existing GCN populations at a landscape scale rather than just within the proposed scheme. These compensatory habitats for GCN would be delivered offsite so that the conservation status of GCN in the region is maintained. Pond and habitat creation would be delivered by Natural England and its delivery partners. Mitigation ponds would be created in advance of construction of the proposed scheme.

9.10.101 No pre-construction surveys for GCN are required as the DLL is agreed with Natural England on the basis of existing data.

9.10.102 Mitigation approaches to protect reptiles during works would also benefit GCN. Where GCN are observed during vegetation clearance, they would be removed to suitable terrestrial habitat outside the working area by a GCN licensed ecologist. Areas of suitable habitat would be identified and confirmed ahead of works.

9.10.103 The provision of numerous 600mm, 1,200mm, and 1,500mm culverts for minor ditches would enable GCN to safely cross under the proposed scheme and would mitigate fragmentation impacts. Where practicable, landscape planting would be designed to guide GCN to these features.

Other amphibians

9.10.104 Other amphibians, including common toad, would be protected through the same mitigation processes as reptiles and GCN. Should these species be discovered during vegetation clearance, they would be removed to suitable terrestrial habitat (i.e. one of the ecological mitigation areas created in advance of construction) outside the working area by a suitably experienced ecologist.

9.10.105 New ponds would be created around the proposed scheme within mitigation and landscape areas which would benefit common toads and widespread amphibians by mitigating the loss of any ponds which they may use.

Freshwater fish

9.10.106 Where sections of watercourses are to be isolated as part of construction work, fluming would be used to protect any fish species present, preventing direct mortality of fish. Barriers would be installed upstream and downstream of the construction work to keep the area dry. A gravity-fed flume (or pipe) would connect the sections of the watercourse upstream and downstream of the construction works, positioned on the bed of the watercourse within the construction work area, and would allow for the migration of freshwater fish species. Where fluming is not practicable, over pumping may be required. Utilised pumps would be appropriately screened (2mm screens) to avoid fish entrainment and the duration of use minimised.

9.10.107 The period for in river working is 15 June to 1 October. The period for in river works will be agreed with the Environment Agency and Flood Risk Activity Permits would be in place for all works within 10m of the bank top of river. Measures to protect freshwater fish during works will be agreed as part of the Flood Risk Activity Permits, including timings of works.

9.10.108 While there are records of lamprey species in the River Ter, there are no SACs where lamprey are designated that are connected via the River Ter. Mitigation in the form of seasonal timing of works to avoid sensitive periods would avoid any impacts to lamprey and no additional measures are required.

9.10.109 Fish rescues would be required and authorised by the Environment Agency.

Terrestrial invertebrates

9.10.110 Measures to mitigate impacts on invertebrate assemblages would comprise the following:

- Habitat piles (e.g. hibernacula and log piles) would be created from some of the felled vegetation and dead timber (including felled potential veteran trees) within retained habitat and ecological mitigation areas where practicable and as directed by the ECoW.
- Mitigation areas, as well as broader landscaping, have been designed with benefits to invertebrates in mind. Designs include the creation of new wildflower and grassland areas seeded from a species-rich seed mix, new ponds and ditches, trees and woodland, species-rich hedgerows and scrub comprising native tree, shrub and herbaceous species of local provenance.
- At detailed design, areas of south-facing sandy banks and earth ‘cliffs’ would be included within ecology mitigation areas to benefit terrestrial invertebrate species.
- Species planting lists for new habitats would be developed during detailed design and would include food plants of notable invertebrate species, for example grasses such as fescues *Festuca sp*., meadow-grasses *Poa sp.,* and bents *Agrostis sp.* which are the favoured food plants of small heath

butterfly caterpillars. Ivy would be planted in areas where there are currently mature trees (and therefore sufficient shade for this species to establish) and in areas away from highway structures (for example around the artificial badgers setts) in order to benefit the ivy bee which is an important local pollinator.

Freshwater macro-invertebrates

9.10.111 No additional mitigation for freshwater macro-invertebrates is proposed.

Notable plants

9.10.112 Areas where notable plants have been recorded would be avoided where practicable and suitable buffers maintained to prevent encroachment of working areas. Key areas within the Order Limits where notable plants have been identified are poor semi-improved grassland along road verges of the A12 and edges of nearby fields between junction 22 (Colemans interchange) and junction 23 (Kelvedon South interchange), and open, disturbed vegetation between junction 21 (Witham South interchange) and junction 25 (Marks Tey interchange). These areas and measures are included in the REAC, which is within the first iteration EMP [TR010060/APP/6.5].

9.10.113 Habitat creation has been designed to include native species of local provenance in keeping with the landscape character of the proposed scheme and surrounds.

9.10.114 Notable plant species (as identified in Phase 1 Habitat Survey) that would be directly lost as a result of clearance of vegetation during construction of the proposed scheme would be translocated as directed by an ECoW into the ecological mitigation areas where practicable.

Freshwater macrophytes

9.10.115 No in-channel works are anticipated within the River Blackwater where the notable freshwater macrophyte river water-dropwort is present, and this species would therefore not be subject to direct damage or removal. Standard mitigation measures would offset impacts to river water-dropwort and no additional mitigation is proposed for this species.

Enhancement

9.10.116 Construction of the proposed scheme would provide the following enhancements for biodiversity:

- Provision of bat roosting boxes (over and above the numbers required for mitigating confirmed bat roosts and losses of trees with bat roost potential) suitable for supporting roosts of various species. These would range from summer roosts for low numbers of non-breeding male crevice-dwelling species (e.g. common pipistrelle) to larger boxes suitable for maternity roosts, and hibernation boxes. Bat boxes would be made of hard-wearing materials such as woodcrete. These would be installed within retained vegetation, for example attached to tall trees, or to new or existing buildings or structures, or installed on free-standing posts as appropriate.

- Creation of a bat hibernacula within an advanced ecology mitigation area to provide new hibernation habitat for the local bat population.
- Working in conjunction with Witham Town Council, the proposed scheme would aspire to create an improved area(s) for education within Whetmead LNR/LWS. Logs from vegetation clearance would be used to create seating areas for educational purposes (i.e. school visits) within land immediately west of the proposed scheme, north of the River Brain close to Whetmead LNR/LWS (see Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]).
- Educational signage would be provided throughout Whetmead LNR/LWS and the southern extension, and National Highways would aspire to create improved areas for education within the nature reserve to attract and inspire children, for example wildlife spotting games.
- Provision of bird nesting boxes (over and above the numbers required for mitigating habitat losses) suitable for a variety of species including cavity-nesting species, with entrance holes of different sizes, open-fronted boxes, and larger boxes to accommodate birds of prey.
- Installation of bird boxes within Whetmead LNR/LWS, the nearby Shelly's Meadow and the River Walk would be left indefinitely after newly planted habitats have matured, as per agreement with Witham Town Council.

9.10.117 The following measures would be implemented along Boreham Brook between the A12 and main road, where practicable:

- planting of trees and saplings along both banks
- creating a 10m buffer zone, either through fencing, where practicable, or landscaping (leaving the area to rewild) to allow for a natural riparian zone and habitat creation
- placing large wood along both bank tops and bank faces to improve habitat potential
- placing some large wood along the channel bed (fixing them to the bank toe for support) to allow for more variation in flow
- placing gravels and cobbles along the channel in the form of a pool-riffle sequence

9.10.118 The following measures would be implemented along the Domsey Brook, where practicable along all of subreach 1:

- planting saplings along both banks (tops)
- creating a 10m buffer zone, either through fencing, where practicable, or landscaping (leaving the area to rewild) to allow for a natural riparian zone and habitat creation
- planting reeds and emergent plants along both banks (ideally using coir rolls for stability)

- placing gravels and cobbles in the form of a pool-riffle sequence

9.10.119 The following measures would be implemented along the Domsey Brook, where practicable along all of subreach 2:

- planting saplings along both banks (tops and faces)
- creating a 10m buffer zone, either through fencing, where practicable, or landscaping (leaving the area to rewild) to allow for a natural riparian zone and habitat creation
- placing large wood along both bank tops to improve habitat potential
- planting reeds and emergent plants along booth banks (ideally using coir rolls for stability)
- during excavation of the sinuous channel, create low lying berms on the inside bends
- placing gravels and cobbles in the form of a pool-riffle sequence

9.10.120 The following measures would be implemented along the Rivenhall Brook (channel downstream of proposed culvert to the Order Limits boundary), where practicable:

- planting of trees and saplings along both banks (faces)
- creating a 10m buffer zone through either fencing, where practicable, or landscaping (leaving the area to rewild), to improve habitat variability
- placing large wood, where practicable, along both bank tops and bank faces to improve habitat potential
- planting reeds and emergent plants along both banks (ideally using coir rolls for stability)
- during excavation of the sinuous channel create low lying berms on the inside bends
- placing gravels and cobbles in the form of a pool-riffle sequence

9.10.121 In addition, a detailed assessment showed that 45 hedgerows across the proposed scheme have potential for enhancement at detailed design. The aim would be to increase their overall condition for Biodiversity Net Gain purposes, with the added benefit of improving diversity for the species they support, and connectivity across the landscape. Proposed enhancements include tree planting where there are gaps in the canopy to improve continuity of vegetation, and removal of invasive and neophyte species.

9.10.122 Enhancements have been discussed with stakeholders (see Section 9.3 of this chapter).

9.11 Assessment of likely significant effects

Construction

National Sites Network

9.11.1 The proposed scheme crosses the River Blackwater, the River Brain, the River Ter, Domsey Brook, Rivenhall Brook, the Roman River and the Boreham Tributary (Boreham Brook). These watercourses have downstream hydrological connectivity with the Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar, the Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar, and the Essex Estuaries SAC. No other SPA, Ramsar or SAC is hydrologically connected to the proposed scheme (see Figure 9.1 [TR010060/APP/6.2]).

9.11.2 The closest watercourse crossing is approximately 10.7km upstream from Blackwater Estuary (Mid-Essex Coast Phase 4) SPA/Ramsar and the Essex Estuaries SAC (as the designations coincide). The closest watercourse crossing is approximately 16km upstream of the Colne Estuary (Mid-Essex Coast Phase 2) SPA/Ramsar. Given the size of the estuaries (4,403ha and 2,701ha is designated as SPA for Blackwater Estuary and Colne Estuary respectively) and the distance downstream, any pollution would be diluted and very unlikely to affect any of the habitats or species which are criteria for Ramsar designation or the foraging habitats of the SPA qualifying features. The study area for groundwater impacts is 1km, as discussed in Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1], and therefore no beneficial or adverse impacts are predicted on GWDTE on sites within the national site network.

9.11.3 In addition, potential adverse impacts to the Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar, the Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar, and the Essex Estuaries SAC from hydrological and water quality changes to surface water would be avoided through standard mitigation outlined in Section 9.10 of this chapter, specifically, the use of silt fencing, cut-off drains, baffles at discharge locations, and adoption of CIRIA guidance (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]).

9.11.4 Due to their distance from the proposed scheme, no direct disturbance impacts on birds are likely to occur to these sites. During construction, some of the qualifying bird species (curlew, lapwing, golden plover and lesser black-backed gull) of Abberton Reservoir SPA and Ramsar, Alde-Ore Estuary SPA and Ramsar, Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar, Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar, and Stour and Orwell Estuaries SPA/Ramsar could potentially be present within arable habitats within the zone of influence. It is anticipated that the qualifying species would have the capacity to move away from sources of disturbance into adjacent undisturbed habitat, if needed. Any such avoidance behaviour is considered to be a negligible energetic burden (and thus no adverse effect to an individual bird's physical condition) given the propensity of these species to migrate or forage across large distances. Therefore, there is no likely significant effect as a result of disturbance on Stour and Orwell Estuaries SPA (curlew and lapwing), Blackwater Estuary (Mid-Essex Coast Phase 4) Ramsar (golden plover) or Alde-Ore Estuary SPA and Ramsar (lesser black-backed gull).

9.11.5 The waterfowl using Colemans Reservoir, including coot, tufted duck and cormorant are qualifying features of Abberton Reservoir SPA. Some species are also qualifying features of Stour and Orwell Estuaries SPA and Colne Estuary (Mid-Essex Coast Phase 2) SPA. Pochard, which was recorded in very low numbers, is a qualifying feature of Abberton Reservoir SPA and Ramsar as a non-breeding population. Breeding pochard is a qualifying feature of Colne Estuary SPA (Mid-Essex Coast Phase 2) and Blackwater Estuary (Mid-Essex Coast Phase 4) SPA/Ramsar.

9.11.6 The numbers of all qualifying species recorded on Colemans Reservoir and other waterbodies in the vicinity of the proposed scheme are small relative to the population estimates of these species for the SPA and Ramsar sites and are unlikely to form part of the SPA populations. Furthermore, these waterbodies are not directly affected by the proposed scheme. The road would be closer to Colemans Reservoir than it is at present, with the main carriageway of the proposed scheme approximately 200m to the north of the reservoir, and minor access road works along part of the eastern edge of the reservoir. A buffer of terrestrial habitats would persist between the proposed scheme and the reservoir, including a shelter belt of trees of approximately 15-20m depth, around the entire perimeter of the reservoir. Typically, for most waterfowl species in winter, noise and visual effects beyond 300m (less for many species) are considered to be of low magnitude and unlikely to elicit a reaction. Therefore, there is no likely significant adverse effect as a result of disturbance on Abberton Reservoir SPA and Ramsar, Blackwater Estuary (Mid-Essex Coast Phase 4) SPA or Colne Estuary SPA (Mid-Essex Coast Phase 2).

9.11.7 The HRA No Significant Effects Report [TR010060/APP/6.8] provides a detailed assessment of the potential impacts of the proposed scheme to these sites.

9.11.8 There would be no change in the level of impact on any internationally important receptors, and therefore the significance of effect is **neutral** (not significant).

Whetmead LNR and LWS

9.11.9 Whetmead LNR and LWS would be adversely impacted through permanent loss of 0.89ha of semi-natural broadleaved woodland habitats adjacent to the A12 on the western boundary of the LNR. This loss would occur during site clearance to enable widening of the existing A12 carriageway and construction of a retaining wall. This would be mitigated through provision of approximately 2ha of new habitats in an area immediately south of and outside the site as detailed in Section 9.10 of this chapter.

9.11.10 While there would be the construction of below-ground structures, including bridge abutments, retaining walls for which sheet piling is likely to be required, and piling associated with overbridges within the site, there would not be any adverse impacts on Whetmead LNR/LWS through changes in groundwater, as it has been determined that the site does not support GWDTE (see Appendix 14.4: Groundwater Assessment, of the Environmental Statement [TR010060/APP/6.3]).

9.11.11 Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1] has concluded that it is unlikely there would be significant adverse air quality effects resulting from construction dust with standard construction phase mitigation measures in place, and so Whetmead LNR/LWS would not be impacted through this pathway.

9.11.12 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.13 The introduction of INNS to this site during construction and their subsequent dominance could have a significant adverse effect on the habitats present by reducing habitat quality and species composition. Incidental sightings of 38 species of INNS were recorded during fieldwork and listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Of these, 11 were recorded within 50m of the Order Limits including three-cornered garlic, Himalayan cotoneaster, montbretia, Japanese knotweed, and Himalayan balsam. Introduction of INNS would be managed through standard mitigation including the implementation of the ISMP (to be produced by the Principal Contractor). This would ensure no adverse impacts to the site through this pathway.

9.11.14 Due to mitigation for Whetmead LNR/LWS being provided in advance of construction (it being an ecology receptor site) and considering that the habitats to be provided are relatively quick to mature, the short and long-term effects on the site are not discernible. There would be a moderate adverse level of impact on a County-level important receptor, and therefore the residual significance of effect is **slight adverse** (not significant).

River Ter SSSI

9.11.15 The River Ter SSSI is located approximately 8km upstream from the proposed scheme. It is therefore unlikely there would be impacts to this site from construction of the proposed scheme due to hydrological or water quality changes.

9.11.16 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Brockwell Meadows LNR and LWS

9.11.17 Brockwell Meadows LNR and LWS are located outside the Order Limits and would not be adversely impacted through direct loss of habitats.

9.11.18 The sites are located upstream of the proposed scheme along the River Blackwater. Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1] identifies the potential for adverse impacts to the River Blackwater through changes in surface water quality through sediment pollution, pollution from polluting substances and accidental spillages and pollution from pipe-jacking from the gas main diversion. However, Chapter 14 assesses these as of negligible magnitude resulting in a slight adverse significance of effect. Impacts to the River Blackwater could potentially cause impacts to Brockwell Meadows LNR and LWS, although pollution is likely to be very diluted and so the level of impact would be negligible.

9.11.19 The GWDTE assessment in Appendix 14.4 of the Environmental Statement [TR010060/APP/6.3] concludes that the majority of habitats within the site are not groundwater dependent, with the exception of an area of B5 marshy grassland which is identified as potentially having groundwater contributions. Dewatering of borrow pit J could result in moderate adverse impacts across the site, resulting in a slight adverse significance of effect. The sites would not be impacted via hydrological or hydrogeological pathways as no construction of below-ground structures is anticipated within a distance that could alter the groundwater resource of the sites. There could also be short-term adverse impacts on groundwater quality at the GWDTE due to mobilisation of suspended solids and associated solutes, leaks and spills of fuels and chemicals during construction (see Appendix 14.4 [TR010060/APP/6.3]).

9.11.20 As described in Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1] and Section 9.10 of this chapter, there are several best-practice mitigation measures which have been incorporated into the REAC, which is within the first iteration EMP [TR010060/APP/6.5], for pollution prevention including managing silt pollution (for suspended solids transport). These measures would reduce the likelihood of contaminating groundwater during construction. Considering best-practice mitigation measures, the magnitude of change on existing groundwater quality in the site is expected to be negligible (see Appendix 14.4 [TR010060/APP/6.3]). Impacts to groundwater flows are assessed as of slight adverse significance.

9.11.21 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1] summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Brockwell Meadows LNR is within the 50-100m distance band and Brockwell Meadows LWS is within the 0-50m distance band so the sites are assessed as being at high risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there would be air quality effects resulting from construction dust and so Brockwell Meadows LNR/LWS would not be impacted through this pathway.

9.11.22 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.23 The introduction of INNS to this site during construction is not anticipated due to the intervening distance between Brockwell Meadows LNR and LWS and the proposed scheme.

9.11.24 Overall, there would be a minor adverse level impact on a County level importance receptor, and therefore the significance of effect is **slight adverse** (not significant).

Boreham Road Gravel Pits LWS

9.11.25 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105.

9.11.26 Boreham Road Gravel Pits LWS is within the 100-200m distance band and so is assessed as being at low risk of dust deposition. With standard construction phase mitigation measures in place, it is unlikely there would be significant air quality effects resulting from construction dust and so Boreham Road Gravel Pits LWS would not be impacted through this pathway.

9.11.27 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.28 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Inworth Wood LWS and ancient woodland

9.11.29 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Inworth Wood LWS is within the 50-100m distance band and so is assessed as being at high risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there would be significant air quality effects resulting from construction dust, and so Inworth Road LWS (which is also designated as ancient woodland) would not be impacted through this pathway.

9.11.30 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.31 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Mope Wood Complex LWS

9.11.32 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Mope Wood Complex LWS is within the 100-200m distance band and so is assessed as being at low risk of dust deposition. With standard construction phase mitigation measures in place, it is unlikely

there would be significant adverse air quality effects resulting from construction dust, and so Mope Wood Complex LWS would not be impacted through this pathway.

9.11.33 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.34 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Perry's Wood LWS

9.11.35 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Perry's Wood LWS is within the 0-50m distance band and so is assessed as being at high risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there would be significant adverse air quality effects resulting from construction dust, and so Perry's Wood LWS (which is also designated as ancient woodland) would not be impacted through this pathway.

9.11.36 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.37 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

River Chelmer LWS

9.11.38 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. River Chelmer LWS is within the 0-50m distance band and so is assessed as being at high risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there would be significant air quality effects resulting from construction dust, and so River Chelmer LWS would not be impacted through this pathway.

9.11.39 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.40 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Riverview Meadows LWS

9.11.41 A small part of Riverview Meadows LWS overlaps the Order Limits where diversion of utilities may be required. The works would cause a temporary loss of habitat, however with standard mitigation and restriction of the extent of works to the smallest area possible, the impact would be minimised. Habitats would naturally regenerate following construction. Due to the duration and extent of the impacts, it is assessed effects of habitat loss would not affect the integrity of the site.

9.11.42 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Riverview Meadows LWS is within the 0-50m distance band and so is assessed as being at high risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there would be significant air quality effects resulting from construction dust and so Riverview Meadows LWS would not be adversely impacted through this pathway.

9.11.43 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.44 The southern part of Riverview Meadows LWS lies within the dewatering zone of influence. A conservative minor adverse impact has been attributed across the south of the site adjacent to the River Brain in the absence of mitigation. During construction, in the absence of mitigation, there could also be short-term impacts on groundwater quality at the GWDTE due to mobilisation of suspended solids and associated solutes, leaks and spills of fuels and chemicals.

9.11.45 However, Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1] has concluded that with best-practice mitigation measures for pollution prevention in place, the likelihood of contaminating groundwater would be reduced. Mitigation measures have been incorporated in the REAC within the first iteration EMP [TR010060/APP/6.5], including managing silt pollution (for suspended solids transport). With mitigation measures, the magnitude of change on existing groundwater quality would be negligible.

9.11.46 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Sandon Riverside LWS

9.11.47 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological

receptors, as per DMRB LA 105. Sandon Riverside LWS is within the 100-200m distance band and so is assessed as being at low risk of dust deposition. With standard construction phase mitigation measures in place, it is unlikely there would be air quality effects resulting from construction dust and so Sandon Riverside LWS would not be adversely impacted through this pathway.

9.11.48 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.49 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

The Grove LWS

9.11.50 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. The Grove LWS is within the 100-200m distance band and so is assessed as being at low risk of dust deposition. With standard construction phase mitigation measures in place, it is unlikely there would be air quality effects resulting from construction dust and so The Grove LWS would not be adversely impacted through this pathway.

9.11.51 As discussed in Section 9.9 of this chapter, there would be no significant effect from N deposition on this site.

9.11.52 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Ancient woodland

9.11.53 There would be no direct loss of ancient woodlands or potential ancient woodland due to construction of the proposed scheme.

9.11.54 The 15 areas of ancient woodland identified within 1km of the Order Limits do not support GWDTE and so would not be adversely impacted through changes in groundwater (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]).

9.11.55 Construction activities can give rise to emissions of dust from within the Order Limits and through trackout, which could cause damage to vegetation. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1], summarises the construction dust assessment undertaken to determine the construction dust risk potential for ecological receptors, as per DMRB LA 105. Perry's Wood, Inworth Wood and Chantrey/Mope Wood are within the 0-50m, 50-100m and 100-200m distance bands respectively and so are assessed as being at high, high and low risk of dust deposition. Porters Wood potential ancient woodland is within the 100-200m distance band and so is at low risk of dust deposition. However, with standard construction phase mitigation measures in place, it is unlikely there

would be air quality effects resulting from construction dust and so ancient woodland would not be adversely impacted through this pathway.

9.11.56 There would be no adverse impacts to ancient woodland from changes in air quality changes due to NOx emissions from construction traffic, as modelled transects do not exceed the 1% critical load or the 0.4kg N/ha/yr criteria outlined in DMRB LA 105 (Highways England, 2019) (see Chapter 6: Air quality [TR010060/APP/6.1]).

9.11.57 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Ancient and veteran trees

9.11.58 There would be no loss of veteran trees due to construction of the proposed scheme, however five potential veteran trees (i.e. trees not listed on the Ancient Woodland Inventory but assessed to be of sufficient quality to be considered of veteran status) within the footprint of the proposed scheme would be felled during construction: T236, T316, T367, T452 and T542 (see the Retained and Removed Vegetation Plans [TR010060/APP/2.14]). Loss of veteran trees cannot be mitigated due to the time period over which a veteran tree matures.

9.11.59 Within the 0-100m distance band there are 73 verified and potential veteran trees at high risk of impacts from dust deposition during construction. Sixteen verified veterans and potential veterans are within 100-200m of the construction ARN and so are at low risk of dust deposition during construction. Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1] has concluded that with standard construction phase mitigation measures in place, it is unlikely there would be significant air quality effects resulting from construction dust, and so neither verified nor potential veteran trees would be impacted through this pathway.

9.11.60 Air quality modelling has shown that one of the verified veteran trees, four of the potential veteran trees and one of the potential ancient trees within 200m of the construction ARN have the potential to be adversely impacted during the construction period as the predicted change in NOx deposition exceeds the 1% exceedance levels and critical loads (see Chapter 6: Air quality [TR010060/APP/6.1]). However, the adverse impacts would be temporary for the duration of construction and the duration of the changes in N deposition would not adversely impact the integrity or characteristics of the individual trees.

9.11.61 In addition, none of the veteran/ancient trees potentially significantly affected by construction traffic were assessed as being significantly affected due to operational air quality changes. Lastly, the assessment has considered the construction traffic representative of the peak construction year as a worst-case scenario, when in reality, this would only occur over a short period of construction, with nitrogen levels fluctuating over the entire duration of the construction period. The assessment is therefore precautionary, with the final impact anticipated to be lower.

9.11.62 With respect to lost potential veteran trees, there would be a minor adverse magnitude impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant). The significance of effect is assessed as slight, as opposed to moderate given that the loss of five

trees would only account for 7% of all potential and verified veteran and ancient trees within 15m of the Order Limits.

9.11.63 With respect to N deposition, less than 10% of the total number (65) of verified veteran trees within 200m of the construction and operational ARN would be impacted, representing a negligible magnitude impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitat and GWDTEs – Wet Woodland 7

9.11.64 Part of Wet Woodland 7 lies just within/adjacent to the limit of the dewatering zone of influence for borrow pit I. Dewatering of borrow pit I would be temporary for the duration of construction (up to three years) and would result in a potential adverse impact on the habitat.

9.11.65 In addition, dewatering is predicted for the construction of a nearby attenuation pond, which could result in minor adverse impacts.

9.11.66 Even though no specific works are scheduled in the portions of Wet Woodland 7 falling within the Order Limits, direct compaction effects could locally disturb groundwater flows resulting in further adverse impacts.

9.11.67 Further assessment would be undertaken in the form of pre-construction surveys to further understand the functioning of Wet Woodland 7, the details of which are provided in Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1].

9.11.68 During construction, in the absence of mitigation, there could also be short-term adverse impacts on groundwater quality at the GWDTE due to mobilisation of suspended solids and associated solutes, leaks and spills of fuels and chemicals during construction. However, as per Section 9.10 of this chapter, best-practice mitigation measures have been incorporated into the REAC within the first iteration EMP [TR010060/APP/6.5], to prevent pollution of soils. These measures would reduce the likelihood of contaminating groundwater.

9.11.69 Wet Woodland 7 would be adversely impacted by changes in groundwater levels, albeit these impacts would be temporary and mitigated as described in Section 9.10 of this chapter.

9.11.70 There would be a negligible adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitat and GWDTEs – Wet Woodland 1 and Marshy Grassland 1

9.11.71 The south-eastern area of Wet Woodland 1 lies within the Order Limits and so direct compaction effects could locally disturb groundwater flows. In the absence of mitigation, these could result in a significant adverse impact. Wet Woodland 1 also lies partially within a dewatering zone which would result in potential minor adverse effects.

9.11.72 Marshy Grassland 1 is located immediately adjacent to the boundary north of the A12. A compound area is proposed adjacent to and upgradient of the western boundary of Marshy Grassland 1. The southern part of Marshy Grassland 1 lies within the estimated dewatering zone of influence for one of

the cuttings. This could result in a localised impact which is likely to propagate into the site from the south, gradually becoming more minor towards the edge of the zone of influence. The northern half of the site is located outside the dewatering zone of influence, therefore groundwater levels are not predicted to be impacted in that area.

9.11.73 During construction, there could also be short-term adverse impacts on groundwater quality at the GWDTEs due to mobilisation of suspended solids and associated solutes, leaks and spills of fuels and chemicals during construction. However, as per Section 9.10 of this chapter, best-practice mitigation measures have been incorporated in the REAC within the first iteration EMP [TR010060/APP/6.5], and these measures would prevent the pollution of groundwater.

9.11.74 There would be a negligible adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitat and GWDTEs – Wet Woodland 8

9.11.75 The western area of Wet Woodland 8 lies immediately north of the Order Limits, with an adjacent haul road on the southern bank of Domsey Brook. The majority of the GWDTE lies within the zone of influence of borrow pit J, which may result in adverse impacts to the habitat.

9.11.76 Dewatering for the construction of an attenuation pond to the west of the site is likely to adversely impact the centre of Wet Woodland 8. Taking a precautionary approach, minor adverse impacts may result.

9.11.77 No adverse impacts are expected to groundwater flows and levels throughout the site from the construction of the proposed cuttings, embankments, or drainage assets, given their distance from the site and their position south/east.

9.11.78 Wet Woodland 8 is located on the opposite bank of Domsey Brook from the proposed haul road. Therefore, the magnitude of change on existing groundwater quality across the site, due to the mobilisation of suspended solids and/or accidental spills and leaks, is expected to be negligible.

9.11.79 Potential adverse impacts on groundwater flows and levels to Wet Woodland 8 have been assessed as of slight or neutral significance, and therefore no mitigation measures are required (see Appendix 14.4: Groundwater Assessment, of the Environmental Statement [TR010060/APP/6.3]).

9.11.80 There would be a minor adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitats – arable field margins

9.11.81 There are no arable field margins within the Order Limits and there would therefore be no loss of this habitat type directly as a result of construction.

9.11.82 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Priority habitats – eutrophic standing waters

9.11.83 There would be a loss of 10.28ha of eutrophic standing water within the Order Limits of the proposed scheme, which would be a permanent negative impact in the absence of mitigation.

9.11.84 Losses of eutrophic standing waters would be mitigated through the creation of habitats as part of the Colemans Farm Quarry restoration plan.

9.11.85 Changes in hydrology and water quality from construction could result in a temporary negative impact on this habitat (see Chapter 14: Road drainage and the water environment, of the Environmental Statement [TR010060/APP/6.1]). However, as per Section 9.10 of this chapter, best-practice mitigation measures have been incorporated in the REAC within the first iteration EMP [TR010060/APP/6.5], to prevent pollution of waterbodies.

9.11.86 There would be a minor adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitats – hedgerows

9.11.87 There would be a loss of 15.81km of hedgerow. Of these, 3.86km are species-rich, 0.43km are species-poor, and 10.76km are important. These numbers include losses of hedgerow associated with the gas main diversion.

9.11.88 Loss of hedgerows would be mitigated through the creation of 42.15km of new hedgerow, which once matured would qualify as BAP habitat.

9.11.89 For UK BAP hedgerows, there would be a temporary moderate adverse level of impact on a Nationally important receptor while newly planted hedgerows mature, and therefore the significance of effect is moderate adverse in the short term. Once planting has matured, the level of impact would reduce to minor adverse, and so the residual significance of effect is **slight adverse** (not significant).

9.11.90 For non-BAP hedgerows, which have a lower (County) value, the temporary moderate adverse level of impact while newly planted hedgerows mature would have a slight adverse significance of effect in the short term. Once planting has matured, the level of impact would reduce to negligible and so the residual significance of effect is **neutral** (not significant).

Priority habitats – lowland mixed deciduous woodland

9.11.91 There would be losses of 44.78ha of woodland and forest habitats within the footprint of the proposed scheme, including some lowland mixed deciduous woodland, which would be considered a permanent negative impact in the absence of any mitigation. However, replacement woodland would be planted at a ratio of 1.95:1, resulting in an overall net gain of 42.52ha of woodland and forest (see Table 9.23).

9.11.92 There would be a temporary moderate adverse level of impact on a Nationally important receptor while newly planted woodland matures, and therefore the significance of effect is moderate adverse in the short term. Once planting has matured, the level of impact would reduce to minor adverse and therefore the residual significance of effect is **slight adverse** (not significant).

Priority habitats – open mosaic habitats on formerly developed land

9.11.93 There would be a loss of 4.49ha of open mosaic habitat on formerly developed land within the footprint of the proposed scheme.

9.11.94 There would be a minor adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitats – ponds

9.11.95 One pond within the Order Limits qualifies as UK BAP habitat. This would be retained.

9.11.96 Changes in hydrology and water quality from construction could lead to impacts to these habitats (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]). However, as per Section 9.10 of this chapter, best-practice mitigation measures have been incorporated in the REAC within the first iteration EMP [TR010060/APP/6.5], to prevent pollution of ponds.

9.11.97 There would be a temporary minor adverse level of impact on a Nationally important receptor due to the potential for water drain during excavation of borrow pit E and therefore the significance of effect is slight adverse in the short term. Following the completion of excavation, the level of impact would reduce to negligible adverse, and therefore the residual significance of effect is **slight adverse** (not significant).

Priority habitats – reedbed

9.11.98 There are two areas of reedbed habitat within the Order Limits, one of which forms part of the Colemans Farm Quarry restoration plan and the second as identified by Essex Wildlife Trust along the River Blackwater near Ishams Chase.

9.11.99 Impacts to the reedbed along the River Blackwater would be avoided as the Cadent gas main diversion would be directly drilled beneath the River Blackwater. Construction of the proposed scheme would prevent implementation of the Colemans Farm Quarry restoration plan effectively resulting in a loss of reedbed habitat.

9.11.100 However, with implementation of the landscape planting proposals shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2], which includes reedbed habitat, impacts would be mitigated.

9.11.101 There would be a negligible adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Wood pasture and parkland

9.11.102 There would be no loss of wood pasture and parkland habitats as a result of construction of the proposed scheme.

9.11.103 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Other habitats

9.11.104 There would be habitat losses as a result of construction of the proposed scheme, as shown in Table 9.23 and on the Retained and Removed Vegetation Plans [TR010060/APP/2.14]. For the Cadent gas main diversion, vegetation loss has been assumed within the 30m working width (as described in Section 2.6 of Chapter 2: The proposed scheme [TR010060/APP/6.1]). It is assumed there would be limitations on replanting trees within the gas main easement after construction is complete.

9.11.105 Temporary habitat losses would occur as a result of utilities diversions including the gas main diversion, vehicle haul roads, soil storage areas, borrow pits and construction compounds.

9.11.106 Permanent habitat losses would occur as a result of earthworks, excavations, side roads, carriageway widening, creation of new structures and widening of existing structures and emergency areas.

9.11.107 As detailed in the REAC within the first iteration EMP [TR010060/APP/6.5], any vegetation that is shown as retained on the Retained and Removed Vegetation Plans [TR010060/APP/2.14] which falls within the horizontal limits of deviation would be retained and not removed.

9.11.108 There would be total loss of habitats of 787.59ha during construction. However, as shown in Table 9.23, landscaping proposals for the proposed scheme would mitigate the impacts for most habitats.

Table 9.23 Summary of habitat loss and gain

Habitat group	Existing area (ha/km)	Post-development proposed area (ha/km)	Area change (gain/loss) (ha/km)
Arable	473.44ha	225.43ha	-248.00ha
Grassland	100.19ha	300.31ha	+200.11ha
Heathland and scrub	29.86ha	16.34ha	-13.52ha
Lakes	10.76ha	4.92ha	-5.84ha
Open mosaic habitats on previously developed land	4.74ha	0.48ha	-4.49ha
Eutrophic standing waters	10.36	13.74ha	+3.38ha
Sparsely vegetated land	2.32ha	0.72ha	-1.60ha
Urban	154.78ha	182.57ha	+27.78ha
Wetland	0.00ha	0.05ha	+0.05ha
Woodland and forest	61.55ha	104.07ha	+42.52ha
Hedgerows	39.24km	65.58km	+26.34km

9.11.109 Much of the land within the footprint of the proposed scheme (approximately 56%) is cultivated arable land of negligible ecological value, therefore, loss of this habitat type would not result in any significant adverse effects.

9.11.110 Areas of the proposed scheme would be set aside for mitigating the loss of semi-natural habitats, as well as for specific species mitigation such as receptor sites for reptiles. Landscaping of these areas, as well as within discrete areas around the proposed scheme, would also comprise the creation of new wildflower and grassland areas seeded from an appropriate species-rich seed mix, the creation of new ponds and ditches, as well as planting of trees and woodland, species-rich hedgerows, and scrub comprising native tree, shrub and herbaceous species of local provenance. The array of habitats created would generally be more diverse than the majority of the largely arable habitat present along the existing A12 corridor.

9.11.111 The LEMP, which is included in the first iteration of the EMP [TR010060/APP/6.5], includes details of how the soft estate of the proposed scheme would be managed in an ecologically sensitive manner to be beneficial to wildlife, so that the conservation status provided by the landscaping and mitigation areas is maintained in the long term.

9.11.112 In addition to the one UK BAP pond, there are a further 10 ponds within the Order Limits. Of these, there would be the loss of eight ponds (P43, P63, P64, P68, P69, P70, P87 and P354), which is 73% of the total available pond habitat within the Order Limits. However, landscaping proposals make provision for the creation of a total of 57 new wildlife ponds (in additional to the 71 new attenuation ponds). Therefore, there would be at least seven ponds gained for each lost, excluding attenuation ponds.

9.11.113 Changes in hydrology and water quality from construction could lead to impacts to these habitats (Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]). This would be a temporary negative impact.

9.11.114 There would be a temporary moderate adverse level of impact on a County level important receptor while newly created habitats mature, and therefore the significance of effect is moderate adverse in the short term.

9.11.115 Once habitats have become established and given the permanent loss of broadly lower-status arable habitats, and the creation of new more diverse habitats, including BAP habitats mentioned in the sections above and non-BAP habitats such as grassland and ponds, it is considered that the level of impact would reduce to minor beneficial, and therefore the residual significance of effect is **slight beneficial** (not significant).

Rivers

9.11.116 Construction of the proposed scheme would require realignments of the Domsey Brook east and west crossings, Roman River and Rivenhall Brook. It also requires the extension of existing culverts at Domsey Brook (west) and Roman River, and widening of bridges over the River Brain and River Blackwater. In addition, a new crossing would be constructed at Rivenhall Brook and Domsey Brook (east). These activities have the potential to result in impacts to watercourses and freshwater fish populations.

9.11.117 There would be habitat fragmentation during construction for the realigned watercourses. In addition, changes in hydrology and flow dynamics during in-channel works would have a temporary negative impact potentially affecting the species the watercourses support (Chapter 14: Road drainage and the water environment [TR010600/APP/6.1]). The river corridor may also become more fragmented due to the widening of culverts and bridges and the construction of a new crossing at Rivenhall Brook and Domsey Brook (east). Impacts to relevant species are discussed in the sections below.

9.11.118 There is potential for pollution through the release of sediments from earthworks. However, water pollution would be avoided through standard mitigation measures, and appropriate stand-off distances would be implemented around watercourses where practicable using physical barriers during construction works to protect aquatic species from disturbance.

9.11.119 Realignment of the Domsey Brook (east and west crossings), Roman River and Rivenhall Brook, and the extension or construction of existing or new culverts and bridges would result in loss of 230m of river through the creation of the new alignments. While this is an overall loss of river, the realigned sections would improve the condition and therefore, the score of each of the three rivers, and as such would have a permanent positive impact. Of the Domsey Brook, Roman River and Rivenhall Brook, 237m, 258m and 237m would be realigned respectively.

9.11.120 There would be a negligible level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Protected and notable species

Bats

9.11.121 Construction of the proposed scheme could result in direct mortality of bats if present within roosts at the time of demolition of structures or felling of trees. Any bats present within buildings, trees or structures could be affected by mortality if works (including destruction or modification of these features) are undertaken without mitigation. There are nine confirmed roosts within the Order Limits (some of which support multiple species), of which four would be lost as a result of construction (B1463, T1149, T733 and T79). All of the roosts are currently classified as non-breeding day roosts and are used infrequently by small numbers of common bat species (Table 9.24).

Table 9.24 Summary of bat roosts within the Order Limits

Roost ID	Species	Roost type	Likely impact
BE11	Common pipistrelle and soprano pipistrelle	Benton Bridge, a concrete overbridge containing a day roost (NGR TL 82482 13392)	Retained, noise disturbance
B1463	Common pipistrelle	Summer roost within a commercial building (NGR TL 87664 18932)	Demolished
T1149	Common pipistrelle	An aspen containing a day roost (NGR TL 82979 14183)	Felled

Roost ID	Species	Roost type	Likely impact
T733	Soprano pipistrelle	An oak tree containing a day roost (NGR TL 78051 11376)	Felled
T79	Brown long-eared bat	A white willow tree containing a day roost (NGR TL 83977 16366)	Felled
B3621	Common pipistrelle and soprano pipistrelle	Maternity roost within a workshop/outbuilding (NGR TL 86007 17944)	Retained
B118	Common pipistrelle and soprano pipistrelle	Day roost within a residential building (NGR TL 78742 11754)	Retained, noise disturbance
B923	Common pipistrelle	Day roost within a residential building (NGR TL 82446 13274)	Retained, noise disturbance
B1522	Common pipistrelle and soprano pipistrelle	Day roost within an outbuilding (NGR TL 88057 20430)	Retained, fragmentation

9.11.122 Three roosts in trees are currently due to be felled as a result of constructing the proposed scheme (T1149: soprano pipistrelle, T733: soprano pipistrelle and T79: brown long-eared bat).

9.11.123 One building (B1463) confirmed as supporting roosting soprano pipistrelle bats would likely be lost as a result of constructing the proposed scheme.

9.11.124 Impacts to bats would be mitigated through demolition or felling operations conducted in accordance with a method statement (which would be licensed to ensure legal compliance), exclusion of roosting features and soft felling, and timing of works to avoid sensitive seasons for bats.

9.11.125 These measures would be secured through a draft EPSM licence (Appendix 9.16: Draft bat licence [TR010060/APP/6.3]).

9.11.126 The loss of these roosts would be mitigated through the provision of suitable roosting boxes at a ratio of at least three bat boxes per roost loss (see Section 9.10 of this chapter).

9.11.127 There is also potential for direct mortality of bats which begin to use new roost features in the period between the surveys which were completed to inform this assessment and the start of construction. In particular, those structures and trees within the Order Limits identified as being of moderate or high suitability (two structures, 109 trees and 43 buildings) are most likely to support future roosts.

9.11.128 Analysis of bat commuting activity identified that high value foraging habitat (as defined by Wray *et al.,* 2010) present across the proposed scheme is well used by a variety of bat species. Of note are the records of the rare barbastelle bat, recorded across the study area but predominantly around junction 25 (Marks Tey interchange).

9.11.129 Linear features such as hedgerows and rivers present across the proposed scheme are considered important foraging habitat and commuting routes for bats across the landscape. Hedgerows at junction 25 (hedgerows 16, 17, 20 and 21) and south of junction 24 (hedgerows 58, 59 and 60-68), and woodland habitats around the River Blackwater and River Ter, as well as the rivers themselves, are commuting routes and foraging habitats for a variety of bat species, including Nathusius' pipistrelle.

9.11.130 The hedgerow and ditch network between arable fields in the Doggett's Lane area (Static Detector 8.1, Appendix 9.4: Bat Survey Report, [TR010060/APP/6.3]) is the most used area by barbastelle for commuting and foraging, although activity levels remain low. Barbastelle recordings on the static detectors were outside the emergence or re-entry times associated with this species, suggesting that it is unlikely this species is roosting nearby. There is also an absence of suitable roost resource (hollow and storm damaged trees, usually associated with ancient woodland or veteran trees) in the areas where this species was recorded, further supporting the absence of a nearby roost. Lastly, radio-tracking studies indicate that individuals can travel up to 20km to access suitable foraging sites (Zeale *et al.,* 2012). Barbastelle bats are therefore not considered to be roosting within the study area.

9.11.131 Hedgerows 20, 63 and 67 would be bisected by the proposed scheme; however, it is considered that there would be sufficient alternative linear resource available to bats. Landscape and habitat planting have been designed to increase connectivity across the landscape (see Figure 2.1 Environmental Masterplan [TR010060/APP/6.2]). The creation of ecological mitigation areas in advance of construction, directly to the east of hedgerow 20 and between hedgerows 63 and 67, would provide some benefit to foraging bats, albeit the diversity and abundance of invertebrate prey may not equate to existing habitats in the short term. Where practicable, linear planting would tie in with culverts to guide bats through these as opposed to over nearby side roads.

9.11.132 Prior to the start of main construction works, creation of a series of ecology mitigation areas would be undertaken to provide receptor sites for reptiles and badgers. Woody vegetation planted within these mitigation areas would take time to mature, however grasslands would be sufficiently mature to receive reptiles prior to site clearance and as such would provide some benefit to foraging bats, although the diversity and abundance of invertebrate prey may not equate to existing habitats in the short term.

9.11.133 Site clearance would then be undertaken to facilitate construction and would result in the temporary loss of habitats of value to foraging bats. Post-construction, the proposed scheme would be landscaped, and once mature the newly created habitats would be of equivalent or greater area to those lost during the construction phase. Changes in habitat area are shown in Table 9.25.

9.11.134 Construction would also result in the loss of hedgerows and woodland or scrub edge habitats which bats use as navigational features to commute. There would be permanent loss of current commuting routes within the construction footprint and temporary loss within temporary work areas during construction. Hedgerows have also been identified during baseline surveys as important for

commuting bats. Construction would result in the loss of 15.81km of hedgerow. Changes in the lengths of hedgerow and woodland/scrub edge habitats are detailed within Table 9.25.

9.11.135 Table 9.25 shows the areas of habitat to be lost during construction versus those to be created across the proposed scheme.

9.11.136 There would be an overall net gain of habitats of higher foraging value to bats as well as in the provision of bat boxes as mitigation and enhancement measures, resulting in an increase in the availability of foraging and roosting habitat for a diversity of bat species.

9.11.137 Bats also use watercourses within the Order Limits (namely the River Blackwater and River Ter) to navigate across the landscape. Construction of the proposed scheme would require the widening of bridges on the River Brain and River Blackwater. In addition, river diversions are proposed for the Domsey Brook (east and west crossings), Roman River and Rivenhall Brook, as well as the extension of existing culverts at Domsey Brook (west) and Roman River. In addition, a new crossing would be constructed at Rivenhall Brook and Domsey Brook (east). These activities have the potential to result in impacts to watercourses.

9.11.138 The impact is temporary loss of habitat with an overall increase in habitat in the long term.

9.11.139 There would also be the potential for disturbance impacts to bats navigating along or foraging over watercourses (in particular the River Blackwater and River Ter where bat activity levels were highest) from light, noise and vibration during any construction work being undertaken at night. Standard mitigation measures would minimise these impacts through the use of directional lighting to avoid sensitive receptors; and the use of lower-noise emitting equipment and works would be programmed to minimise work outside normal working hours (Chapter 12: Noise and vibration, of the Environmental Statement [TR010060/APP/6.1]).

9.11.140 Construction of the proposed scheme would result in temporary fragmentation impacts to three roosts: B1291, maternity; B1522, maternity; and B1679, occasional. Fragmentation impacts would be offset through landscape mitigation planting.

Table 9.25 Changes in the areas of bat foraging and commuting habitat

Habitat	Value to bats	Existing area (ha/km)	Post-development proposed area (ha/km)	Area change (gain/loss) (ha/km)
Woodland and forest	Foraging	61.55ha	104.07ha	+42.52ha
Hedgerow	Commuting/ foraging	39.24km	65.58km	+26.34km
Arable	Foraging	473.44ha	225.43ha	-248.00ha

Habitat	Value to bats	Existing area (ha/km)	Post-development proposed area (ha/km)	Area change (gain/loss) (ha/km)
Lakes	Foraging	10.76ha	4.92ha	-5.84ha
Grassland	Foraging	100.19ha	300.31ha	+200.11ha
Heathland and scrub	Foraging	29.86ha	16.34	-13.52ha

9.11.141 Low levels of light spillage from construction activities at night could temporarily negatively affect bat activity during the construction of the proposed scheme by fragmenting commuting routes, affecting access to foraging areas or affecting access to roosting sites. The main site compounds are likely to be in operation 24 hours a day with night-time working required across the scheme, so lighting impacts have been considered when locating compounds, and standard practices would be employed to minimise light spill.

9.11.142 Increased light levels could result in increased abundance of prey. Some species such as noctule, serotine, Leisler's and pipistrelle bats would benefit from increased lighting as they are able to forage prey which are attracted to it. Therefore, these species may be temporarily positively impacted by lighting (BCT and Institution of Lighting Professionals, Guidance Note 08/18, 2018).

9.11.143 However, slower-flying broad-winged species such as barbastelle bats, long-eared bats and *Myotis* species are less tolerant of light and are therefore less able to forage successfully and efficiently. Increased light levels would therefore have the potential to result in a temporary negative impact to these species (BCT and Institution of Lighting Professionals, 2018).

9.11.144 Construction activities would involve the use of heavy plant items with the potential to emit high levels of noise and vibration, such as excavators, dumper trucks, dozers and compaction equipment. Noisy activities also include demolition of existing features and piling for structures. A detailed list of the plant and equipment required for various construction activities, along with the assumed noise levels, is provided in Appendix 12.4 of the Environmental Statement [TR010060/APP/6.3]. These activities have the potential to negatively impact bats through disturbance via light spillage, noise and vibration, which could discourage commuting, foraging or accessing roosts. These impacts would be temporary.

9.11.145 Further details of the noise assessment are provided in Chapter 12: Noise and vibration, of the Environmental Statement [TR010060/APP/6.1].

9.11.146 Noise and vibration have the potential to impact on bats while roosting during the day by causing premature departure from the roost during daylight hours, potentially leading to increased mortality of bats as they would be more vulnerable to predation during the day. Bats may also be impacted through loss of roosts which may become temporarily unsuitable for use during the period over which disturbance occurs.

9.11.147 Construction of the proposed scheme would result in potential construction noise disturbance impacts to 11 currently identified roosts, as shown in Table 9.26 (roosts BE11 and B118 both contain roosts of two different bat species and are therefore considered as separate roosts within the same structure or building). These roost locations are those that within the construction noise models met the threshold criteria for disturbance set out in Section 9.5 of this chapter.

Table 9.26 Summary of potentially significant noise disturbance impacts on bat roosts

Roost ID	Species present	Roost category	Baseline noise (db)	Baseline noise + construction noise (db)	Noise increase due to construction noise (db)
BE11	Common pipistrelle	Day	78.8	80	1.2
	Soprano pipistrelle	Day			
B107	Soprano pipistrelle	Day	67.5	69.1	1.6
B118	Common pipistrelle	Day	73.4	77.7	4.3
	Soprano pipistrelle	Day			
B339	Common pipistrelle	Day	70.9	74.6	3.7
B631	Soprano pipistrelle	Day	67.9	68.1	0.2
B923	Common pipistrelle	Day	69.4	74.2	4.8
B1392	Soprano pipistrelle	Day	69.6	72.1	2.5
B1393	Soprano pipistrelle	Day	70.2	71.4	1.2
B1463	Common pipistrelle	Transitional	67.9	68.3	0.4

9.11.148 One structure (BE11) confirmed as supporting roosting common and soprano pipistrelle bats would likely be disturbed by noise and vibration impacts during demolition work on the deck above and is therefore due to be temporarily excluded for the duration of the demolition work. There would not be any physical impacts to the roosting features present on this structure and the exclusion would be removed once the works have concluded, thus reinstating the roosting features. These measures, in addition to embedded mitigation practices to minimise noise pollution, would reduce this impact.

9.11.149 Construction of the proposed scheme may result in the temporary reduction of roosting habitat through the removal of nine trees with high suitability and 43 with moderate suitability to support roosting bats, though this would be mitigated by provision of alternative roosting habitat such as bat roosting boxes, which is a commonly used and effective mitigation method.

9.11.150 Construction of the proposed scheme could result in negative impacts on foraging habitat and therefore on the conservation status of the local population of bats in the short term without mitigation. However, following implementation

and establishment of mitigation measures, the residual significance of effects on foraging bats within the footprint of the proposed scheme is not considered to be significant in the long term.

9.11.151 Bats would benefit from mitigation and enhancements in the long-term including the creation of new habitats within landscape and mitigation areas, such as new wildflower and grassland areas, planting of trees/woodland and species-rich hedgerows, creation of new wildlife-friendly ponds and provision of bat roosting boxes. These features would connect severed commuting routes and foraging routes and increase foraging and roosting resource for bats once habitats have had time to mature (Appendix 9.4: Bat survey report [TR010060/APP/6.3]).

9.11.152 Given the mitigation proposed, impacts on bats arising from mortality during construction are not significant.

9.11.153 There would be a minor adverse level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Badger

9.11.154 Badgers could be affected by construction activities through direct mortality, loss of setts, loss or fragmentation of habitats, and disturbance associated with noise and vibration.

9.11.155 There is the potential for direct mortality of injury of badger through collisions with construction traffic, through entrapment in excavations or through site clearance activities.

9.11.156 As badgers are nocturnal, there would be no risk of collision during the day. Off-peak working may include night work, however it is considered that the risk of collision with construction traffic is negligible, particularly as the speed of plant would be restricted and work areas would be well lit if used after dark.

9.11.157 Badgers could also be killed or injured if they were to fall into or become entrapped within trenches or excavations, including the borrow pits. Standard mitigation measures (Section 9.10 of this chapter) such as the use of ramps, where feasible, or appropriate contouring of earthworks within the borrow pits to provide a means of escape, would be implemented to prevent this impact from occurring.

9.11.158 Pre-construction surveys to establish the locations of active setts would be undertaken prior to the start of construction to prevent killing or injury of badgers during site clearance. These surveys provide up to date information on sett entrances and extents, and whether the sett is still active. Active setts which would be impacted by construction would be closed under licence from Natural England (see below).

9.11.159 Of the 128 setts within the study area, 90 were active at the time of survey. Of these, 23 setts would be directly impacted and would require permanent closure. The 23 setts comprise two mains, one annex, two subsidiary and 18 outliers. As detailed in Section 9.10 of this chapter, loss of the main setts would be mitigated through provision of two artificial setts. Artificial setts would not be provided for lower status setts as badgers would be able to create new setts within the wider landscape.

9.11.160 Of the 67 active setts which would not be permanently closed, three outlier setts would be impacted by disturbance as they are within 30m of construction activity and a buffer zone cannot be applied. These setts would therefore be temporarily closed under licence if required, on a case by case basis.

9.11.161 Construction would also result in the temporary and permanent loss of foraging and sett building habitat, as presented in Table 9.27. Around 90% of badger setts recorded were located within field margins, ditch embankments and in areas of woodland and scrub.

9.11.162 Creation of ecology mitigation areas prior to the start of main construction would provide a benefit to badgers in the form of additional foraging and sett building habitat prior to clearance of the main site.

Table 9.27 Changes in the areas of badger foraging and sett building habitat

Habitat group	Existing area (ha/km)	Post-development proposed area (ha/km)	Area change (gain/loss) (ha/km)
Woodland and forest	61.55ha	104.07ha	+42.52ha
Hedgerow	39.24km	65.58km	+26.34km
Arable	473.44ha	225.43ha	-248.00ha
Grassland	100.19ha	300.31ha	+200.11ha
Heathland and scrub	29.86ha	16.34ha	-13.52ha

9.11.163 While the habitats identified in Table 9.27 are commonly used by badgers for foraging, all habitats present within the proposed scheme (with the exception of tarmac and standing water) have the potential to support foraging badgers.

9.11.164 Impacts to badger foraging and commuting habitat would be temporary and badgers are highly resilient and adaptable as a species. These would therefore not present significant effects.

9.11.165 As well as habitat loss, badger foraging and sett-building habitats could become fragmented and isolated due to construction of the proposed scheme. Construction of the new A12 would lead to isolation of an area of land between it and the existing A12, between junction 22 and Rivenhall End, and Inworth Road and junction 25. Five active badger setts are within this area: main sett 80, and setts 115, 116, 130 and 133 (all outliers), locations of which will be provided to stakeholders within plans accompanying Appendix 9.2: Badger survey report [TR010060/APP/6.3]. Main sett 80 is most likely to be impacted by fragmentation as it is more heavily used by badgers. However, the linkage to a nearby culvert and provision of a mammal ledge (headroom and health and safety risk permitting) within that culvert (see Section 9.10 of this chapter) for this sett, would prevent fragmentation impacts.

9.11.166 The main temporary impacts to badgers from constructing the proposed scheme are likely to be a result of disturbance through increased vehicle and human activity, earthworks operations and the use of heavy plant, as well as temporary loss of foraging habitat to site compounds, borrow pits and laydown sites.

9.11.167 General impacts from construction, including impacts to most setts identified within the Order Limits and impacts to commuting and/or foraging badgers, would be avoided through the application of buffer zones around setts and the use of good practice regarding open excavations, storage of materials and demarcation of working areas which would prevent badgers from becoming harmed. Where this is not possible (outlier setts 51 and 133) they would be temporarily closed under licence. Due to the low status of these setts, this is assessed as of no significance.

9.11.168 Badgers are common and widespread and are not a species of conservation concern. Legal protection of badgers comes via legislation designed to protect badgers and their setts from persecution rather than because of any notable threat to the conservation of this species. Overall, the construction of the proposed scheme is unlikely to adversely affect the local conservation status of badgers; there would be a minor adverse level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Otter

9.11.169 Otters could be affected by construction activities through direct mortality, loss of resting places, loss or fragmentation of habitats, disturbance associated with noise and vibration, and through potential changes to water quality and hydrology in the absence of mitigation. Otter fencing would be installed in the vicinity of areas where the A12 crosses the main watercourses.

9.11.170 Construction activities have the potential to cause otter mortality while an otter is in a resting place (holt or couch), or to damage or modify the holt or couch. However, none of the couches or holts identified during field surveys are located within the Order Limits and therefore none would be directly impacted by construction.

9.11.171 Pre-construction surveys would be undertaken to ensure the baseline is up to date and to determine if any new holts or couches have started to be used by otters within 50m of the Order Limits. Where appropriate, an EPSM licence would be sought from Natural England.

9.11.172 During construction, widening or installation of new river crossings would result in the loss of 0.23km of riverine otter habitat, where otters or signs of otters have been recorded. River realignment works would result in the modification of 0.33km of river. Aquatic habitat is of paramount importance to otter populations and the loss of stretches of rivers through realignment, existing culvert expansion and new culverting has the potential to cause permanent negative impacts to populations within Rivenhall Brook, Domsey Brook and the Roman River.

9.11.173 Construction of the proposed scheme where it crosses watercourses (e.g. at Domsey Brook between junction 23 and junction 24) and where realignments of Main Rivers are required (e.g. at Rivenhall Brook between junction 22 and junction 23) could prevent otters from commuting, foraging and resting in these areas for the duration of construction, albeit unlikely that all watercourses would be affected at the same time. Given their large territories, otters would continue to attempt to use established commuting routes. If these routes are unavailable during construction and alternative routes not provided, this could force otters into using unsuitable routes, which would result in a temporary negative impact on this species.

9.11.174 Light, noise and vibration disturbance from construction activities have the potential to result in behavioural avoidance by otters, including otters being discouraged from commuting, resting and/or accessing foraging habitat. Noise data have been used to assess the change in noise levels during construction at the holt and couches along the River Blackwater. There would be an increase in noise of 1dB in the context of a baseline of 62dB which is not considered to be significant.

9.11.175 Lighting impacts would be minimised during construction through the use of directional lighting and avoidance of lighting of watercourses where possible. Impacts from construction lighting would be of a short duration and temporary.

9.11.176 Standard mitigation would be used to prevent changes to water quality and impacts to watercourses as detailed in the REAC, within the first iteration EMP [TR010060/APP/6.5].

9.11.177 With mitigation, it is considered that there would be no long-term or significant impacts on the conservation status of otter within the proposed scheme footprint or the wider Order Limits, and there would be a minor adverse magnitude impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Water vole

9.11.178 Construction of the proposed scheme would potentially lead to mortality of, or injury to, water voles. However, baseline surveys confirmed water vole burrows are limited to two areas within the Order Limits. The closest burrow to construction activity is located on ditch D136 (see Figure 9.3 [TR010060/APP/6.2]) and is 5m from an access track for an attenuation pond as shown on the current design. Best practice guidance (Dean *et al.*, 2016) recommends a buffer of 3-5m from the toe of the bank, the upper range of which could just be accommodated. There is also flexibility in the design as shown by the horizontal limits of deviation and so the design of the attenuation pond and access track can be modified at detailed design to maximise the distance from the burrow to the area of construction. No other burrows would be directly impacted by construction and standard mitigation (buffers around burrows, as described in Section 9.10 of this chapter) would prevent accidental damage to burrows during construction. Mortality or injury of water voles would therefore be prevented.

9.11.179 It is noted that the sizes of water vole populations can fluctuate significantly, particularly should management of American mink be undertaken within the river catchment, and therefore it is acknowledged that the baseline may change in the period up to construction. Pre-construction surveys would be undertaken for all watercourses and ditches with potential to support water vole within the Order Limits. Where practicable, the design of the proposed scheme would be modified to avoid impacts to any new burrows, for example through micro-siting of haul roads and access tracks. Where impacts could not be avoided, a licence would be sought from Natural England for the displacement or translocation of water voles as appropriate. Two ecology mitigation areas required for reptiles, and created in advance of construction, have been designed to include suitable water vole habitat in the event that water vole mitigation is required. Mortality and injury impacts could therefore be prevented in the event of water vole populations increasing within the Order Limits.

9.11.180 Water vole habitats (including those not in current use by water vole but of suitability for the species) including 230m of rivers and streams and 2.07km of ditches, would be lost as a result of any works which remove or alter these habitats including river realignments. However, the ditches within which water voles are present remain unaffected.

9.11.181 Ditch and pond complexes would be constructed within two ecology mitigation areas, one near junction 19 as mitigation for reptiles, the other immediately south of Whetmead LNR/LWS for that site's mitigation. These would provide benefits in the quality and area of water vole habitat available. The design of these areas would be developed at detailed design and so numbers for habitat gain are not currently included within the BNG calculations for the proposed scheme, however based on preliminary work these are anticipated to include 12 ponds and 1,800m of ditch (excluded from the habitat loss numbers above). The profile of banks and depths of water would specifically be designed to accommodate water vole, providing sufficient depth to escape predators, areas of steep bank in which to burrow, and shallow banks on which deep swathes of riparian vegetation could establish as a food source.

9.11.182 The current baseline shows water vole presence is limited to two ditches within one area within the Order Limits (south of junction 19), and one area within the study area but outside the Order Limits (Domsey Brook). Of the Main Rivers the proposed scheme would cross (see Chapter 2: The proposed scheme, of the Environmental Statement [TR010060/APP/6.1]), the following works to modify existing structures would be required: at the River Brain (an extension to the existing bridge by 7m to the east and 5m to the west); the River Blackwater (Ashman's Bridge) (an 10.1m extension to the south); widening and realignment of the existing structure at Domsey Brook (west crossing) by approximately 34.6m to the south-east; and extending the existing culvert crossing the Roman River by 12m to facilitate realignment of this watercourse south of the A12. In addition, two new structures are required at Rivenhall Brook (46m long culvert) and Domsey Brook (east crossing) (60m long culvert).

9.11.183 No widening is proposed for the nearest main watercourse crossing (Boreham Brook) to the water vole population at junction 19.

9.11.184 The new crossing at Domsey Brook (east crossing) would be approximately 2.7m wide and 2.7m high. The total length of the widened structure at Domsey Brook (west crossing) would be 85m. Data on the use of culverts by water vole are very limited, although observations have been made of them using culverts of 30m to 35m in length with headroom of 1m or more above normal water levels (Dean *et al*., 2016). The crossings would be fitted with two mammal ledges as mitigation for otter, and it is likely water vole would use these features (Dean *et al.,* 2016). However, severance has the potential to impact on the water vole population and their ability to explore and disperse. Water voles are faithful to their burrows and feeding areas but would, during certain times of the year, actively look to increase their range (Dean *et al.,* 2016). Due to the lack of evidence to support water voles using culverts of lengths comparable to that proposed, impacts are precautionarily assessed as slight adverse.

9.11.185 One burrow located on ditch D136 is within 5m of an access track for an attenuation pond, and within 12m of the attenuation pond. Noise and visual disturbance are, in most cases, unlikely to have a significant effect on water voles (Dean *et al*., 2016). As the burrow is at least 5m from the area of construction, it is assessed there would be no disturbance impact.

9.11.186 The second burrow is located within ditch D135 which falls within an advanced ecology mitigation area. An exclusion buffer can be placed around this burrow in order to ensure there are no disturbance impacts. Works within the vicinity of the ditch, which would include excavations of new ponds and ditches to provide ecological mitigation, would be undertaken under ecological supervision.

9.11.187 Lighting during construction could cause behavioural avoidance, however, as detailed in the REAC which forms an appendix to the first iteration EMP [TR010060/APP/6.5], the watercourses would not be lit and therefore impacts relating to lighting can be ruled out.

9.11.188 Standard mitigation would be used to avoid or alleviate effects to watercourses and has been included in the REAC, within the first iteration EMP [TR010060/APP/6.5].

9.11.189 Overall, there would be a major beneficial level of impact on a County level important receptor due to habitat creation south of junction 19 and south of the River Brain, and therefore the significance of effect is **moderate beneficial** (significant).

Dormouse

9.11.190 Dormice are likely absent within the Order Limits for the wider proposed scheme (i.e. the land excluding the gas main diversion, where surveys are pending). There would therefore be no impacts to dormice for the wider scheme.

9.11.191 Construction of the gas main diversion could result in mortality of dormice if present within hedgerows to the east of the River Blackwater. However, standard mitigation (as detailed in Section 9.10 of this chapter), such as timing of works and supervision by an ECoW, would avoid this impact.

9.11.192 If trenchless crossing techniques could not be used to lay the pipe under hedgerows, clearance of habitat would result in a loss of 0.79km of hedgerow and would result in temporary fragmentation impacts. However, the duration of the works would be short and with dead hedging instated whilst replacement hedgerow planting matures, this impact is not assessed as significant.

9.11.193 There would be a temporary negligible adverse level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Species of principal importance: brown hare, hedgehog and polecat

9.11.194 Movement of construction traffic could lead to increased mortality to mammals of principal importance. Hedgehogs seeking shelter in brush piles, hares resting in forms and polecats in dens may be particularly sensitive to activities which break ground as well as the movement of construction vehicles through their habitats. Standard mitigation measures detailed in the REAC, within the first iteration EMP [TR010060/APP/6.5], would avoid direct mortality of these species.

9.11.195 The following habitats which support mammals of principal importance would be lost as a result of construction of the proposed scheme: 466.53ha of arable fields, 86.66ha of grassland, 23.06ha of heathland and scrub and 15.81km of hedgerows. These species would benefit from habitat creation in mitigation and landscaping areas, including new woodland, grassland, hedgerow and pond habitats which would mitigate any loss of habitats and provide a net gain in resource for foraging and resting (see Table 9.23).

9.11.196 Construction of the proposed scheme would lead to temporary fragmentation of habitats of hares, hedgehogs and polecats. However, in the context of the available habitats in the wider landscape and considering the duration of impact, this is not considered to be significant.

9.11.197 Construction activities could cause temporary disturbance through lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat, however with standard mitigation measures to reduce the impacts, and considering animals would be able to temporarily disperse into adjacent habitats, it is considered there is no significant effect on these species from disturbance.

9.11.198 There would be a minor beneficial level of impact on a County important receptor due to the net gain in areas of habitat, and therefore the significance of effect is **slight beneficial** (not significant).

Barn owl

9.11.199 Site clearance could lead to direct mortality of barn owls through damage or destruction of a barn owl resting place while in use, and loss of roost sites. At the time of assessment, no nest sites or roosts would be lost as a result of construction of the proposed scheme. However, it is acknowledged that the baseline could change up to the period of construction should barn owls begin to roost or nest within construction areas. Pre-construction surveys would therefore be undertaken to update the baseline prior to the start of works. For the one nest site within the Order Limits, and if any new nest sites become

active within the Order Limits, standard mitigation (timing of works to avoid barn owl presence) would prevent mortality or injury of barn owls from occurring.

9.11.200 Should the baseline change such that nest sites would be lost, mitigation (provision of replacement boxes, see Section 9.10 of this chapter) would prevent impacts.

9.11.201 A total of 4.1ha of optimal foraging habitat and 9.7ha of sub-optimal foraging habitat would be lost as a result of the proposed scheme. The largely arable landscape with urban and suburban areas provides limited potential to support barn owl prey species such as field voles, therefore the loss of any optimal foraging habitat in particular would negatively impact barn owl.

9.11.202 However, barn owls would benefit in the long term from the net gain in habitats (see Table 9.23) including grasslands which may support a greater abundance of prey species than existing habitats, as well as the installation of barn owl nesting boxes outside the study area. In addition, landscaping has been designed to provide safe passage over the road for airborne species once it matures.

9.11.203 Stakeholders were consulted on whether the risk of providing grassland habitat along the new road verges (which could be used by foraging barn owl, encouraging them in proximity to traffic) outweighed the benefit to other species, and it was assessed that the net benefit outweighed the risk.

9.11.204 Construction activity could cause temporary disturbance to barn owls when in nests or roosts through additional construction noise, vibration or artificial lighting, particularly when within 30m of a barn owl nest or roost. There are no nests or roosts within 30m of the proposed scheme and therefore disturbance impacts are not predicted to occur. Protection zones would be implemented as directed by the ECoW, and there would be flexibility based on the type of activity and associated risks at the discretion of the ECoW. Should the baseline change as a result of pre-construction surveys, disturbance would be avoided through timing of works and provision of buffers around active roosts or nests.

9.11.205 There would be a minor beneficial level of impact on a County level important receptor due to the net gain in habitats providing foraging resource, and therefore the significance of effect is **slight beneficial** (not significant).

Breeding birds

9.11.206 Clearance of existing vegetation within the Order limits could lead to mortality of breeding birds, particularly dependent young and eggs. In addition, ground-nesting birds would be vulnerable to mortality through collisions with plant or through an activity such as earthworks which could damage or destroy a nest while in use. However, standard mitigation such as timing of works and supervision by an ECoW would avoid impacts.

9.11.207 There would be temporary losses of habitats which are important for breeding birds, including the numerous red and amber list species, ERL, and local BAP species recorded in the study area. Of particular concern would be:

- the loss of bare ground areas used by sand martins as feeding habitat

- the loss of intact hedgerows north of Hatfield Peverel, which were recorded as supporting small numbers of notable farmland birds
- any habitat losses at Colemans Reservoir which supported a diverse range of species
- any losses around Domsey Brook and any losses of scrub habitat at the River Blackwater which supported Cetti's warbler (see Appendix 9.5 of the Environmental Statement [TR010060/APP/6.3]).

9.11.208 As well as reducing the available habitat, this would increase the vulnerability of species to a range of external factors such as adverse weather conditions and predators. Habitat loss during construction would include 44.78ha of woodland and forest, 15.81km of hedgerows, 23.06ha of heathland and scrub and 86.66ha of grassland habitats. Once the landscape planting has been implemented and matured after main construction, there would be a permanent net gain of 42.52ha of woodland and forest, 26.34km of hedgerows and 200.11ha of grassland habitats, including the ecology mitigation areas created in advance of construction. Loss of nesting habitat would also be mitigated through provision of bird nesting boxes in retained habitats within or close to the Order Limits.

9.11.209 Construction activities have the potential to impact nesting birds though temporary increases in noise and vibration. This would constitute disturbance and could negatively impact the survival, range and abundance of certain species. Species such as hobby, that are sensitive and therefore prone to disturbance, could be displaced and prevented from breeding for the duration of works. Five species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) have been recorded during surveys (barn owl, Cetti's warbler, kingfisher, little ringed plover, red kite) and are confirmed/probable/possible breeders. It would be illegal to disturb these species whilst breeding, however standard mitigation for Schedule 1 species would avoid such impacts.

9.11.210 Transient, non-breeding and migrant species are not likely to be negatively impacted as a result of the proposed scheme.

9.11.211 The proposed scheme is unlikely to result in a significant negative impact on the conservation status of breeding birds and no permanent significant effects are anticipated.

9.11.212 There would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Wintering birds

9.11.213 There would be losses of habitats which are important for wintering birds during the construction period. These would be 466.53ha of arable, 10.59ha of lakes, 86.66ha of grassland, 44.78ha of woodland and forest, 23.06ha of heathland and scrub and 15.81km of hedgerows. Wintering birds are highly dependent on arable land sown with cover crops. For example, surveys showed land between Kelvedon and Marks Tey supported a diverse assemblage of birds including species listed as qualifying species of the nearby SPAs (see Appendix 9.12 of

the Environmental Statement [TR010060/APP/6.3]). Habitats for farmland birds, such as arable edges and stubble fields, are common and widespread within the wider landscape, meaning that any loss or alteration of these habitats would not be significant within a wider context. The HRA No Significant Effects Report [TR010060/APP/6.8] has demonstrated that there would be no significant effect on the integrity of the national site network due to impacts to wintering birds during construction or operation of the proposed scheme.

9.11.214 The net gain of new habitats including grasslands and ponds would be beneficial to wintering bird species in the long term through increased foraging and resting resource.

9.11.215 Construction activities have the potential to temporarily impact wintering birds though disturbance due to temporary increases in noise, vibration, and lighting. However, it is assessed that as highly mobile species, birds would move to other local habitats in the wider landscape and effects are assessed as not significant.

9.11.216 There would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Reptiles

9.11.217 There is potential for mortality or injury to reptiles during removal of vegetation for site clearance, groundworks, and movement of construction traffic around the site. In the absence of any mitigation this would be a permanent negative impact. Translocation of reptiles into newly created habitats would avoid mortality and injury to populations.

9.11.218 Within ecology mitigation areas created in advance of construction, 46.75ha of habitat would be created. These could be constructed in a phased process, and would be well established well ahead of any translocation, as assessed by a suitably experienced ecologist, before reptile translocation is undertaken and habitats within the works areas are cleared. The area of suitable reptile habitat to be cleared totals 123.5ha, comprising 86.66ha of grassland, 44.78ha of woodland and forest, and 23.06ha of heathland and scrub. Post-construction, the rest of the landscaping design would be implemented which would lead to a net gain of 200.11ha of grassland and 42.52ha of woodland and forest. There would be net gain of 49 wildlife ponds in addition to the 71 attenuation ponds, providing potential grass snake foraging habitat. Grass snakes would also benefit from the estimated 1,800m of ditch complex being created south of junction 19 and south of the River Brain.

9.11.219 Reptile habitats could also become fragmented and isolated during construction of the proposed scheme. New verges along the A12 would help improve connectivity across the landscape. There would also be provision of 30 new culverts for Ordinary Watercourses, which would provide connectivity for reptiles across the A12. Impacts are therefore assessed as not significant.

9.11.220 There would be a minor beneficial level of impact on a locally important receptor due to the net gain of habitats, and therefore the significance of effect is **slight beneficial** (not significant).

Great crested newt

9.11.221 There is the potential of mortality or injury to GCN in their terrestrial habitat during removal of vegetation for site clearance, groundworks, and movement of construction traffic around the site. If GCN are incidentally encountered during reptile translocations or other supervised site activities, they would be moved to the nearest appropriate receptor site. No specific GCN translocation programme is proposed as the legal offences with respect to GCN would be permitted under the proposed scheme DLL. Precautionary Working Methods for site clearance would be employed to protect reptiles and common toad and more widespread amphibians, and the funding provided by the proposed scheme to secure strategic habitat improvements within Essex would offset impacts.

9.11.222 None of the 21 confirmed GCN breeding ponds identified would be lost as a result of the proposed scheme. There is potential for partial impacts to P345 during earthworks and drainage works, however any impacts would be short term and sufficiently mitigated for by standard measures. There is also the potential for water drain from P099 as a result of borrow pit excavation. However, this is not considered to have any adverse impacts on GCN. Of the 21 ponds, 16 are within 500m of the proposed scheme, and only one (P099) is within the Order Limits, located within borrow pit E. Excavation of the borrow pit would be undertaken so as to retain the pond so that impacts to GCN aquatic habitat are avoided. This would also ensure there is no mortality of GCN within aquatic habitat.

9.11.223 Mitigation for GCN, delivered through the DLL process, would comprise the creation of a number of new ponds, designed to increase GCN habitats and connectivity between existing populations within and outside the study area. An Impact Assessment and Conservation Payment Certificate has been prepared by Natural England and signed by National Highways. Natural England would issue the DLL when the DCO is granted.

9.11.224 GCN populations retained in and around the proposed scheme would, however, also benefit from newly created ponds and habitat provided to mitigate the loss of pond habitats and impacts to other species.

9.11.225 GCN is a terrestrial species during most of its annual cycle. Loss of suitable habitats would reduce the species' ability to forage, shelter, avoid predators and hibernate, and would negatively impact gene flow within local related groups or metapopulations. There would be some temporary loss of suitable terrestrial habitats for GCN (including woodland, grass, scrub and hedgerows) during construction of the proposed scheme. However, once the landscape planting has been implemented and has matured there would be a net gain of habitats as shown in Table 9.28.

Table 9.28 Changes in the areas of terrestrial great crested newt habitat

Habitat group	Existing area (ha/km)	Post-development proposed area (ha/km)	Area change (gain/loss) (ha/km)
Woodland and forest	61.55ha	104.07ha	+42.52ha
Hedgerow	39.24km	65.58km	+26.34km
Arable	473.44ha	225.43ha	-248.00ha
Grassland	100.19ha	300.31ha	+200.11ha
Heathland and scrub	29.86ha	16.34ha	-13.52ha

9.11.226 During construction, fragmentation of metapopulations of GCN and isolation of GCN from breeding ponds and resting/foraging habitats would occur. Movement between water bodies is required for newt populations to function as coherent parts of the local metapopulation. Pond P014 forms part of a metapopulation with ponds P013, P007 and P005. Construction of the main alignment of the proposed scheme would result in fragmentation of this pond from others within the metapopulation. Construction of the road may also sever connectivity of breeding ponds from terrestrial habitat where offline sections are constructed. As previously described, the proposed scheme would be mitigated through DLL and so effects are assessed as neutral. In addition, it is likely connectivity across the landscape would be mitigated upon completion of construction, as new verges along the A12 would provide linear connectivity, and the 30 new culverts under the A12 would allow safe passage of GCN under the highway. The large number of new attenuation and wildlife ponds may also allow different metapopulations to become better connected.

9.11.227 Standard mitigation would be used to avoid or alleviate effects to waterbodies (and therefore GCN) and has been included within the REAC, within the first iteration EMP [TR010060/APP/6.5].

9.11.228 Proposed habitat creation in addition to mitigation delivered through DLL would provide a significant benefit to the local GCN population.

9.11.229 There would therefore be a moderate beneficial level of impact on a County level important receptor, and therefore the significance of effect is **slight beneficial** (not significant).

Species of principal importance: common toad

9.11.230 Mortality or injury to common toad could occur during removal of vegetation for site clearance, groundworks, and movement of construction traffic around the site. All waterbodies in which common toad were recorded lay outside the Order Limits and would be unaffected by construction, therefore there would be no mortality impacts to common toad within these waterbodies. There is a significant overlap in the types of habitat used by GCN, reptiles and common toad. Where trapping and translocation of reptiles would be undertaken, common toads would also be captured and moved to a nearby suitable receptor

area if encountered. An ECoW would supervise vegetation clearance and destructive searches of reptile habitats outside the hibernation season (October to March inclusive) and would also translocate common toads observed during works.

9.11.231 Of the five ponds and one ditch within which common toad were recorded, none would be lost as a result of construction. There would be a net gain of habitats which would benefit common toad: including woodland, ditches and wildlife ponds.

9.11.232 Construction of the proposed scheme would also contribute to temporary fragmentation of habitats, negatively impacting connectivity to resting and foraging habitats for this species. However, it is likely that connectivity across the landscape would be mitigated upon completion of construction, as new verges along the A12 would provide linear connectivity, and the 30 new culverts under the A12 would allow safe passage of toads under the highway. The large number of new attenuation and wildlife ponds may also allow different populations to become better connected.

9.11.233 Standard mitigation would be used to avoid or alleviate effects to watercourses and has been included in the REAC, within the first iteration EMP [TR010060/APP/6.5].

9.11.234 There would be a minor beneficial level of impact on a locally important receptor due to the net gain of habitats, and therefore the significance of effect is **slight beneficial** (not significant).

Freshwater fish

9.11.235 Construction activities could potentially lead to direct mortality to fish species during in-channel works through interaction with construction plant. Prior to the commencement of construction activities, fish removal would be carried out and any fish moved to an unaffected part of the same watercourse, therefore avoiding this impact. This would be undertaken under authorisation from the Environment Agency.

9.11.236 Construction activities including river realignments and culvert and bridge creation or extensions, or modifications to habitats through changes to vegetation, bank profile, width, depth and shading would lead to direct loss of 230m of river habitat. However, this would be offset by the permanent beneficial impact to freshwater fish from improved river condition as part of proposed realignments of the Roman River and Domsey Brook.

9.11.237 Construction activities could impact freshwater fish through disturbance from lighting, noise and vibration which could discourage behaviours such as commuting, foraging and/or accessing foraging and breeding habitat. In-channel piling on the Domsey Brook, River Brain, River Blackwater, and Roman River has the potential to deter fish from sections of the watercourse where excessive noise and vibration transmits to the watercourse. However, these effects would be temporary for the duration of the works. If percussive piling is required, a soft start method would be used which would allow time for fish to move away from the noise and vibrations which may be harmful. Lighting of watercourses would be avoided where practicable during construction so as to prevent disturbance from lighting.

9.11.238 In-channel works to watercourses can create temporary barriers to fish passage by changing flow rates and reducing free movement. Preventing fish from being able to migrate reduces their ability to access suitable feeding and breeding locations and increases exploitation and predation. In the absence of mitigation, this would have a temporary negative impact. Where practicable, in-channel works would be avoided for Main Rivers during freshwater fish spawning and migration periods (October to May inclusive). This includes percussive works (piling) on land adjacent to the Main River during this period.

9.11.239 Changes in hydrology from construction could lead to impacts to fish which have species-specific flow regime requirements. A deterioration in water quality as a result of the release of pollutants and sediments during construction would directly impact fish and the prey species upon which they depend. Water pollution would be avoided through standard mitigation measures, and appropriate stand-off distances would be implemented around watercourses where suitable, using physical barriers during construction works to protect aquatic species from disturbance.

9.11.240 With mitigation, it is considered that construction would cause no long-term or significant impacts on the conservation status of freshwater fish within the proposed scheme footprint or in a wider context.

9.11.241 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Terrestrial invertebrates

9.11.242 Construction activities affecting habitats at the Brockwell Meadows terrestrial invertebrate survey area, would be limited to construction of an outfall pipe through an area of broadleaved woodland.

9.11.243 Construction activities at the Prested Hall terrestrial invertebrate survey area would be limited to planting of a short section of hedgerow at the northern end of the site.

9.11.244 Construction at the terrestrial invertebrate site West of Hatfield Peverel could result in loss of dense scrub and broadleaved woodland habitat which falls within the horizontal limits of deviation. This would amount to a maximum of 26% of broadleaved woodland and 100% of the dense scrub adjacent to the existing A12.

9.11.245 Impacts to the Little Braxted Fishing Lakes terrestrial survey areas would include loss of the open broad biotope habitat including sandy banks adjacent to the A12, in order to facilitate widening of the road. The sandy banks support populations of ivy bee in sufficient numbers to provide a significant pollination service for this site and the surrounds. The sandy banks and ‘cliff edges’ at this site also provide valuable nesting habitat for other ground-nesting invertebrates including two notable bees: the nationally scarce lobe-spurred furrow bee and dark blood bee.

9.11.246 Mitigation for loss of ivy bee habitat at Little Braxted Fishing Lakes would offset impacts to this species and the potential loss of pollinators (see Section 9.10 of this chapter).

9.11.247 Construction at Whetmead terrestrial invertebrate survey area would include the loss of scrub habitat adjacent to the A12 to facilitate widening of the road. The scrub edge and open habitat broad biotypes supporting this habitat were in favourable condition, with the open habitat biotope supporting nationally scarce thistle-associated weevils *Larinus planus* and *Rhinocyllus conicus* (as shown by field surveys) and potentially the lobe-spurred furrow bee and its nationally scarce and Essex Red Listed cleptoparasite, the swollen thighed blood bee (as shown by desktop records).

9.11.248 Impacts to Whetmead LNR, identified as an important site for invertebrates, would involve the loss of approximately 0.89ha of broadleaved semi-natural woodland. The invertebrate assemblage at this site was mostly associated with 'open habitats' i.e. grassland and scrub habitats, including the notable small heath butterfly.

9.11.249 Mitigation for loss of habitats at Whetmead LNR (see Section 9.10 of this chapter) would also mitigate impacts to the invertebrate assemblage of this site. In addition, creation of extensive areas of new habitats across the proposed scheme, such as woodland and grassland habitats and creation of habitat piles, including dead wood habitats, within landscape and mitigation areas would also benefit terrestrial invertebrates.

9.11.250 There would be a minor beneficial level of impact on a County level important receptor, and therefore the significance of effect is **slight beneficial** (not significant).

Freshwater macro-invertebrates

9.11.251 There would be a minor permanent loss of habitats within the footprint of new culverts and crossings which would become unsuitable for freshwater macro-invertebrates. However, this would be offset by a permanent beneficial impact to freshwater macro-invertebrates from habitat gains as part of proposed realignments.

9.11.252 Minor areas of watercourse could become isolated from the wider macro-invertebrate community during construction and prevent local migration. In the absence of mitigation, this would have a temporary negative impact. However, standard mitigation measures would be implemented, including pollution prevention and maintenance of hydrological connectivity between retained habitats, which would reduce impacts.

9.11.253 Construction activities could lead to changes in hydrology, an alternative flow regime, and a decline in water quality due to an increase in the release of sediments and pollutants to watercourses. This could deteriorate the habitat upon which freshwater macro-invertebrates depend. Water pollution would be avoided through standard mitigation measures as outlined in the REAC within the first iteration EMP [TR010060/APP/6.5].

9.11.254 With mitigation, there would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Notable plants

9.11.255 Site clearance works undertaken to facilitate construction of the proposed scheme could result in the damage or removal of the 15 notable plant species which have been identified within the Order Limits. Of the notable species recorded during field survey, of particular consideration are lesser calamint (nationally scarce), wall bedstraw (nationally scarce), field scabious (nationally near threatened) and common cudweed (nationally near threatened).

9.11.256 Loss of habitats in which these species have been recorded would result in direct damage or destruction of these species. Areas in which notable species were identified include various arable field margins and open disturbed vegetation between junction 21 and junction 25, which support species such as common cudweed, cornfield knotgrass, field scabious, harebell, henbane and lesser calamint; junction 22 which supports wall bedstraw; the banks of the River Brain that support small teasel; and lastly poor semi-improved grassland and field edges between junction 22 and junction 23 which support lesser calamint (see Appendix 9.8 of the Environmental Statement [TR010060/APP/6.3]).

9.11.257 Notable plants would be avoided in the first instance and working areas demarcated to prevent encroachment of site activities into these habitats. Where practicable, plants would be translocated into ecology mitigation areas created in advance of construction.

9.11.258 There would be a minor adverse level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Freshwater macrophytes

9.11.259 Freshwater macrophyte communities may be impacted as a result of construction activities (including culvert extensions and river realignments on the Domsey Brook, Rivenhall Brook and Roman River, as well as bridge widening on the River Brain and River Blackwater).

9.11.260 The only notable freshwater macrophyte recorded (river water-dropwort) was recorded from the River Blackwater which would not be subject to any new structures, only widening of an existing bridge. It is therefore considered that there would be no risk to this species from destruction or removal. The extension of culverts, bridges and realignments would lead to the removal of other native plant species from watercourses. However, these species would be able to recolonise areas close to the culverts and bridges, and newly created habitat within the realigned Roman River and Domsey Brook.

9.11.261 Construction activities would lead to permanent loss or temporary damage to habitats due to works affecting rivers where macrophyte species are present. This may result in a decline of species abundance or diversity. The extension of bridges and culverts would lead to increased shading of the channel leading to reduced macrophyte growth. However, there would be a permanent beneficial impact in terms of diversity of freshwater macrophytes from habitat gains as part of the proposed watercourse realignments.

9.11.262 Construction activities could lead to changes to the hydrological regime of watercourses impacting on the freshwater macrophyte communities present, which are adapted to specific environmental conditions. Construction activities could also lead to increased sedimentation and a decline in water quality as a result of increased pollutant runoff, which modifies the conditions required to support habitats upon which freshwater macrophytes depend. Water pollution would be avoided through standard mitigation measures as outlined in the REAC within the first iteration EMP [TR010060/APP/6.5] and Section 9.10 of this chapter.

9.11.263 There would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Summary of construction effects

9.11.264 Table 9.29 summarises the construction effects on biodiversity from the proposed scheme.

Table 9.29 Summary of construction effects on biodiversity receptors

Receptor	Significance of effect
National sites network	Neutral
River Ter SSSI	Neutral
Whetmead LNR/LWS	Slight adverse
Brockwell Meadows LNR/LWS	Slight adverse
Other LWS	Neutral
Ancient woodland	Neutral
Ancient and veteran trees	Slight adverse
Wet Woodland 7, 8, and 1 and Marshy Grassland 1	Slight adverse
Arable field margins	Neutral
Eutrophic standing waters	Slight adverse
Hedgerows	Slight adverse
Lowland mixed deciduous woodland	Slight adverse
Open mosaic habitat	Slight adverse
Ponds	Slight adverse
Reedbed	Slight adverse
Wood pasture and parkland	Neutral
Other habitats	Slight beneficial
Rivers	Neutral

Receptor	Significance of effect
Bats	Slight adverse
Badger	Neutral
Otters	Slight adverse
Water vole	Moderate beneficial
Dormouse	Slight adverse
Species of principal importance (brown hare, hedgehog, polecat, common toad)	Slight beneficial
Barn owl	Slight beneficial
Breeding birds	Neutral
Wintering birds	Neutral
Reptiles	Slight beneficial
GCN	Slight beneficial
Freshwater fish	Neutral
Terrestrial invertebrates	Slight beneficial
Freshwater macro-invertebrates	Neutral
Notable plants	Slight adverse
Freshwater macrophytes	Neutral

Operation

National site network

9.11.265 The HRA No Significant Effects Report [TR010060/APP/6.8] presents a detailed assessment of the potential for operational impacts of the proposed scheme on the SPA, SAC and Ramsar sites identified in Section 9.8 of this chapter. This includes impacts from disturbance arising from changes to noise, vibration, visual and light stimuli and by hydrological changes to surface water. The HRA No Significant Effects Report [TR010060/APP/6.8] concluded there would be no likely significant effects from operation of the proposed scheme on these designated sites.

9.11.266 Embedded mitigation measures, including approved drainage designs and water management, such as 71 attenuation ponds to store surface runoff (as shown on the General Arrangement Plans [TR010060/APP/2.9]), would prevent impacts to sites with hydrological connectivity to the proposed scheme (see 'Construction' section of Section 9.11), resulting in 'no change' to the above sites.

9.11.267 There would be no change in the level of impact on an Internationally important receptor, and therefore the significance of effect is **neutral** (not significant).

River Ter SSSI

9.11.268 The River Ter SSSI is located approximately 8km upstream from the proposed scheme (and outside the 200m buffer around the ARNs). It is therefore unlikely there would be impacts to this site from operation of the proposed scheme due to hydrological or water quality changes.

9.11.269 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Tiptree Heath SSSI

9.11.270 The air quality assessment (Chapter 6: Air quality [TR010060/APP/6.1]) has shown there would be no impact from changes in air quality at Tiptree Heath SSSI as a result of operation of the proposed scheme.

9.11.271 There are no other pathways to impacts due to the distance between Tiptree Heath SSSI and the Order Limits, and a lack of hydrological connectivity.

9.11.272 There would be no change in the level of impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

Whetmead LNR and LWS

9.11.273 Two transects were modelled for N deposition during operation of the proposed scheme at this site. The maximum predicted increase in N deposition (do minimum (DM) to do something (DS)) is 6.49kg N/ha/yr (32.5% of the lower critical load). A large proportion (5.25ha, 46%) of the LWS/LNR is affected by increased N deposition. The Phase 1 Habitat Map (Appendix 9.8 of the Environmental Statement [TR010060/APP/6.3]) indicates that the habitats affected are a strip of woodland along the western edge of the designation, but most of the area affected is semi-improved grassland. The affected area of woodland habitat along the western edge would be lost as a result of the proposed scheme.

9.11.274 Pyramidal orchid, which is sensitive to N deposition (Ellenberg N value of 3) has been recorded at the site and therefore an increase in N deposition could cause the loss of this species. However, on the whole, the grassland is species-poor, largely dominated by false oat-grass (Ellenberg N value of 7), which is indicative of fertile conditions.

9.11.275 Although the affected area includes the area of habitat loss, the extent of such an increase in N deposition could result in an adverse effect on site integrity. The proposed scheme impact is predicted to persist for 10 years, so is temporary and any changes as a result of increase N deposition could be reversible (but may require intervention through management). The impact level is considered moderate adverse, which is assessed as slight significance (not significant) in the absence of mitigation.

9.11.276 Given the habitat creation plans for Whetmead, which include compensatory habitat to the south of the River Brain, the impact level is reduced to a minor adverse level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Braxted Park LWS

9.11.277 The maximum predicted increase in N deposition (DM to DS) is 1.4kg N/ha/yr (14.0% of the lower critical load). The area affected by N deposition is a narrow strip at the north-western edge of the designation, which is occupied by broadleaved deciduous woodland with a lower critical load of 10kg N/ha/yr. The habitat is mapped as Priority Habitat (deciduous woodland) but is not listed on the Ancient Woodland Inventory. Given that the extent of area affected is less than 1% of the site, no effect on site integrity is predicted. However, the proposed scheme impact is predicted to persist for 15 or more years, so could result in permanent or irreversible effects.

9.11.278 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Brockwell Meadows LNR and LWS

9.11.279 There are no permanent below-ground structures or embankments proposed within the vicinity of the site to locally alter groundwater levels and flows supporting GWDTE. No impacts to the site from these assets are therefore predicted. Any long-term changes in recharge rates as a result of increased impermeable surface areas are not expected to impact the site, given the distance from the proposed scheme.

9.11.280 Borrow pit J would be left to fill with water, therefore groundwater levels should equilibrate within these ponds and return to pre-construction levels. No operational impacts to groundwater flows and levels at the site are therefore predicted.

9.11.281 Considering the distance of the proposed scheme from the GWDTE, no impacts from any accidental leaks/spills of fuels and chemicals and/or routine runoff associated with the road are expected at the site (see Appendix 14.4: Groundwater Assessment, of the Environmental Statement [TR010060/APP/6.3]).

9.11.282 The maximum predicted increase in N deposition (DM to DS) is 0.72kg N/ha/yr (3.6% of the lower critical load for grassland). Baseline N deposition at this site is 18.34kg N/ha/yr and the DS prediction at the transect point closest to the ARN is 20.56kg N/ha/yr. The area of increase above the 0.4kg N/ha/yr threshold is at the southern tip of the LWS and does not affect the overlapping LNR designation. The habitat in this area is a mixture of woodland and grassland, but because the main interest feature of the designation is grassland, it is this habitat, with a lower critical load of 20kg N/ha/yr, that has been modelled. Only 1.5% of the site is predicted to be affected by increased N deposition; the area affected is on the southern tip and does not support the habitats for which the site is designated (floodplain meadow). Therefore, no effect on site integrity is predicted. However, the proposed scheme impact is predicted to persist for 15 or more years, so could result in permanent or irreversible effects.

9.11.283 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Boreham Road Gravel Pits LWS

9.11.284 The maximum predicted increase in N deposition (DM to DS) is 0.6kg N/ha/yr (6% of the lower critical load). The designated site is not adjacent to the road. The area affected by N deposition is at the southern tip of the designation, which is occupied by broadleaved deciduous woodland with a lower critical load of 10kg N/ha/yr. Given that the extent of area affected is less than 1% of the site, no effect on site integrity is predicted. The proposed scheme impact is predicted to persist for seven years (see Appendix 9.15 of the Environmental Statement [TR010600/APP/6.3]), so would be temporary and any effects would likely be reversible.

9.11.285 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Cook's Lane Lexden LWS

9.11.286 The maximum predicted increase in N deposition (DM to DS) is 0.66kg N/ha/yr (6.6% of the lower critical load). Given that less than 3% of the site is affected by increased N deposition and that the proposed scheme impact is predicted to be very short-term and reversible (see Appendix 9.15 [TR010600/APP/6.3]), there is considered to be no effect on site integrity.

9.11.287 There would be a negligible adverse level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Perry’s Wood LWS

9.11.288 The maximum predicted increase in N deposition (DM to DS) is 2.82kg N/ha/yr (28.2% of the lower critical load), as detailed in Chapter 6: Air quality, of the Environmental Statement [TR010060/APP/6.1]. Given that more than 20% of the site is affected by increased N deposition and that the exceedance is predicted to persist for 11 years (although this is temporary and any effects could be theoretically reversible), there is considered to be an effect on site integrity. There would be a moderate adverse level of impact on a County level important receptor, and therefore the significance of effect is **large adverse** (significant).

9.11.289 Perry’s Wood is also designated as an ancient woodland, which is valued at a greater importance (national) than LWS (county), and therefore the impacts to this site have been concluded separately in the ancient woodland sub-section below. Mitigation measures are described in Section 9.10 of this chapter.

Smythe’s Green LWS

9.11.290 It is predicted that a narrow strip (maximum 10m width, 0.1ha in area) along the B1022 would be affected by a small increase in N deposition (0.59kg N/ha/yr, 2.96% of the lower critical load). Only the first point of the transect is predicted to have an increase in N deposition; beyond 10m, the prediction is for N deposition to decrease, resulting in an overall benefit for the site. The site is only 1ha in size, so this narrow strip constitutes approximately 9% of the site. However, the increase is extremely short-lived, with a duration of less than one

year. There is evidence of existing site degradation and therefore the increase in N deposition is not predicted to result in an adverse effect on site integrity.

9.11.291 As a result, there would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

West House Wood LWS

9.11.292 The maximum predicted increase in N deposition (DM to DS) is 0.65kg N/ha/yr (6.5% of the lower critical load). Although nearly 9% of the woodland is predicted to be affected by the proposed scheme impact, the duration of effect is temporary and reversible (see Appendix 9.15 [TR010600/APP/6.3]). The site is small (3ha) and adjacent to housing, with likely impacts from recreation (e.g. dog walking). Given the small increase in N deposition and that the critical load is already exceeded, no impact on site integrity is expected.

9.11.293 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Ancient woodland

9.11.294 Air quality modelling has shown that one of the seven ancient woodlands within 200m of the operational ARN (Perry's Wood) could be negatively impacted by changes in air quality as a result of operation of the proposed scheme, as the predicted increase in N deposition is more than 1% of the lower critical load and greater than 0.4kg N/ha/year. The maximum predicted increase in N deposition (DM to DS) is 2.82kg N/ha/yr (28.2% of the lower critical load). Site investigation found that there are no obvious features attributable to historic and ongoing N deposition, but also no species likely to be very sensitive to an increase in N deposition. The only species that is potentially sensitive to additional nitrogen is compact rush (*Juncus conglomeratus)*, of which there was only one plant in a disturbed area. However, given that more than 20% of this site is affected by increased N deposition and that the proposed scheme impact is predicted to persist for 11 years (although this is temporary and any effects could be theoretically reversible), there is considered to be an effect on site integrity. Therefore, the impact level is considered to be moderate adverse. Given the national importance of ancient woodland, the significance of this effect is **large adverse** (significant).

9.11.295 To offset the significant effect on Perry's Wood, it is proposed to plant woodland at borrow pit F, as shown on Figure 2.1 Environmental Masterplan [TR01600/APP/6.2] and as detailed in the LEMP within the first iteration of the EMP [TR010600/APP/6.5]. Indicative species mixes are described in the LEMP. The proposed species composition would reflect the species typical of Perry's Wood and other ancient woodlands in the local area, although not ash due to the prevalence of ash dieback in the area. The maintenance and management of this area of habitat would be the responsibility of National Highways.

9.11.296 Exceedance of the 0.4kg N/ha/year threshold would also occur at Porter's Grove, which overlaps with the southern end of Boreham Road Gravel Pits LWS. This small patch of woodland (0.45ha) is considered a potential ancient woodland but is not listed on the Ancient Woodland Inventory and does not

appear on mapping from 1799 (British Library, accessed 2022). However, it is indicated in mapping from 1874 (National Library of Scotland, accessed 2022).

9.11.297 The maximum predicted increase in N deposition (DM to DS) is 0.6kg N/ha/yr. A third of the area mapped as potential ancient woodland is predicted to be affected, which is considered a potential effect on site integrity. The exceedance is predicted to persist for seven years, so is temporary and any effects would be likely to be reversible. This woodland is not considered to be ancient and therefore of County level importance. There is justification for it to be assessed as part of Boreham Road Gravel Pits LWS (and not assessed as a separate woodland site) as it is wholly within the boundary of the LWS. The impact level is considered negligible, which is assessed as **slight adverse** significance (not a significant effect).

Veteran, potential veteran and ancient trees

9.11.298 Six verified veteran trees, 16 potential veteran trees and one verified ancient tree within 200m of the operational ARN could be negatively impacted by changes in air quality as a result of operation of the proposed scheme.

9.11.299 The predicted change in N deposition exceeds the 1% of the lower critical load for woodlands and is greater than 0.4kg N/ha/year. The duration of the proposed scheme impact is variable, but most trees are predicted to experience long-term elevated N deposition for 15 years or more.

9.11.300 The highest increase in N deposition is at a verified veteran elm tree (T649) where the increase (DM to DS) is predicted to be 7.26kg N/ha/yr. This tree is within the Order Limits, close to the offline section of the proposed scheme.

9.11.301 Given the lack of scientific evidence for direct effects of N deposition on individual trees and that the concept of integrity only applies to habitats and sites, the approach taken in the assessment is that veteran trees would remain *in situ* and processes of growth and senescence would continue even under high levels of N deposition. Therefore, there is no effect on 'integrity' as such. The baseline N deposition already exceeds the upper end of the critical load range for woodland and therefore there could already be effects on tree health that are not evident from survey (e.g. changes in the plant's nutrient balance or in the mycorrhizal assemblage associated with the tree).

9.11.302 For most receptors, the time taken for DS NOx emissions to reduce to DM levels is estimated at 15 or more years and therefore any non-visible additional impacts that have already been set in train by exceedance of the critical load are likely to be permanent. The impact level for these trees is therefore assessed as minor, which results in an effect of slight significance (not significant).

9.11.303 For those trees where the duration of impact is estimated at less than 15 years, it is considered that any impacts due to the proposed scheme could be reversible and therefore an impact level of negligible, which results in an effect of slight significance (not significant).

9.11.304 Considering the resource at the scale of the whole of the proposed scheme, approximately one third of the 65 veteran trees within 200m of the ARN are predicted to experience N deposition above the threshold.

9.11.305 There would be a minor adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Priority habitats

9.11.306 The following assessment of impacts applies to all priority habitats as defined in Table 9.13.

9.11.307 Operation of the proposed scheme could lead to negative impacts to water quality from surface runoff and groundwater in proximity to these habitats. During operation, embedded mitigation measures, including sustainable drainage designs and water management through the use of new attenuation ponds to store surface runoff, would be implemented (see Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]). It is therefore considered that there would be no likely impact to these habitats.

9.11.308 There would be a negligible impact on a Nationally important receptor, and therefore the significance of effect is **neutral** (not significant).

GWDTEs - Wet Woodland 1 and Marshy Grassland 1

9.11.309 There are no permanent below-ground structures or embankments proposed within the vicinity of the habitats to locally alter groundwater levels and flows supporting GWDTE. No impacts to the habitats are therefore predicted.

9.11.310 Dewatering impacts associated with road cuttings/widenings are expected to be long term and remain as assessed during construction. As the significance of effect has been assessed as slight adverse to neutral (within Chapter 14: Road drainage and the water environment [TR010600/APP/6.1]), no mitigation measures are required.

9.11.311 The spillage assessment indicates that the risk is well within the most stringently defined significance threshold of 0.5% Annual Exceedance Probability (1 in 200 probability of a natural hazard event such as rainfall or a flooding event), see Chapter 14: Road drainage and the water environment [TR010600/APP/6.1]. In addition, considering the distance of the proposed scheme from the GWDTE, any accidental leaks or spills of fuels and chemicals and routine runoff associated with the road are also expected to be negligible.

9.11.312 Overall, there would be a minor adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

GWDTEs - Wet Woodland 7

9.11.313 There would be no permanent below-ground structures or embankments proposed within the vicinity of Wet Woodland 7 to locally alter groundwater levels and flows supporting GWDTE.

9.11.314 The adjacent borrow pit I would be left to fill with water, therefore groundwater levels would equilibrate within these ponds and return to pre-construction levels. No operational impacts to groundwater flows and levels at the site are therefore predicted.

9.11.315 Considering the distance of the proposed scheme from the GWDTE, and likely groundwater flow directions in the area, any accidental leaks/spills of fuels and chemicals and/or routine runoff associated with the road are also expected to be negligible**.**

9.11.316 There would be a negligible adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

GWDTEs - Wet Woodland 8

9.11.317 Borrow pit J, which is close to Wet Woodland 8, would be left to fill with water, therefore groundwater levels should equilibrate within these ponds and return to pre-construction levels. No operational impacts to groundwater flows and levels at the site are therefore predicted.

9.11.318 Considering the distance of the proposed scheme from the GWDTE, and likely groundwater flow directions in the area, any accidental leaks or spills of fuels and chemicals and routine runoff associated with the road are expected to be negligible in the western area.

9.11.319 There would be a negligible adverse level of impact on a Nationally important receptor, and therefore the significance of effect is **slight adverse** (not significant).

Protected and notable species

Bats

9.11.320 Operation of the proposed scheme could result in direct mortality of bats as a result of collisions with vehicles. The implementation of embedded mitigation measures would reduce this impact by maintaining connectivity under and over the road. These include the design of new and existing culverts of sufficient diameters to be permeable to commuting bats and linear planting to guide bats to culvert crossing points and overbridges. Baseline surveys also found that bats had a low unsafe crossing rate (3.13%) and therefore this impact is considered negligible.

9.11.321 There is potential for bats to be impacted by increased disturbance from noise and vibration during operation of the proposed scheme. Three roost sites are potentially due to be impacted by an increase in daytime noise level during operation of the proposed scheme (see Table 9.30). Two of these (T79 and B1463) are likely to be lost during construction (see Table 9.24) and therefore noise impacts are unlikely, but these roosts are included for completeness. These roost locations are the only ones within the operational noise models which met the threshold criteria for disturbance set out in Section 9.5 of this chapter.

Table 9.30 Summary of potentially significant operational noise disturbance impacts on bat roosts

Roost ID	Species present	Roost category	Baseline operational noise level (dB)	Post-development operational noise level (dB)	Operational noise increase due to the proposed scheme (dB)
T79	Brown long- eared bat	Day	66.8	69.1	2.3
B107	Soprano pipistrelle	Day	67.5	68.2	0.7
B1463	Common pipistrelle	Transitional	75.9	77.3	1.4

9.11.322 There is also the potential for operational noise to impact commuting bats, however, the use of embedded mitigation measures such as low-noise road surfacing and landscape design to provide noise screening would sufficiently reduce these impacts.

9.11.323 Road lighting has the potential to cause both positive and negative effects on bats as different species react differently to lighting. Some species such as noctule, serotine and pipistrelle bats would benefit from increased lighting as they are able to forage prey which are attracted to it. However, slower-flying broad-winged species such as barbastelle bats, brown long-eared bats and *Myotis* species are less tolerant of light which would affect their ability to forage successfully and efficiently. Should roost exits be lit, emergence is likely to be delayed, shortening the time available for foraging (BCT and Institution of Lighting Professionals, 2018). Of the roosts identified within the Order Limits, only one was found to contain a light-sensitive species (T79, a transitional roost for brown long-eared bats). It is considered that any impacts from lighting would be reduced given the periodic occupancy associated with transitional roosts.

9.11.324 Road lighting may act as a barrier to commuting and therefore prevent bats accessing important areas that are present beyond the road.

9.11.325 In addition, bats have the potential to be indirectly adversely affected by road lighting due to impacts on invertebrate prey as it is thought road lighting attracts invertebrates from further afield and therefore may cause a reduction in the availability of prey in adjacent habitats (BCT and Institution of Lighting Professionals, 2018).

9.11.326 Lighting would be limited to junctions, handrail lighting on the WCH bridges and side road approaches to junctions, and there would not be any lighting on the underside of bridges where the road is not expected to be lit. Where lighting is required, this has been designed in accordance with Guidance Note 8 Bats and Artificial Lighting (Bat Conservation Trust and Institution of Lighting Professionals, 2018). Embedded mitigation measures would minimise light spill beyond the footprint of the proposed scheme and therefore any impact is avoided (see Section 9.10 of this chapter).

9.11.327 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Badger

9.11.328 Operation of the proposed scheme could result in direct mortality of badgers as a result of collisions with vehicles. Collisions are most likely for badger populations within close proximity to the proposed scheme: 128 setts within 250m, of which 90 were active in recent surveys, comprising 18 mains, four annexes, 21 subsidiaries and 84 outliers and one undetermined, or for clans where the road bisects their territory (see Appendix 9.2 of the Environmental Statement [TR010060/APP/6.3]). The use of embedded mitigation measures such as fencing, culverts with sufficient diameters to be permeable to badgers, and mammal ledges, where practicable, would reduce this impact and provide suitable alternative crossing points to facilitate the movement of badgers, as detailed in Section 9.10 of this chapter and shown on Figure 2.1 Environmental Masterplan [TR010060/APP/6.2].

9.11.329 Operational noise has the potential to cause avoidance behaviour in badgers, which would negatively impact dispersal of this species. Operational noise levels are not anticipated to negatively impact badgers given the minor increase in noise levels compared to baseline levels. Also, it is anticipated that badgers would become habituated to the constant levels of noise close to the road (Neal and Cheeseman, 1996), and the implementation of embedded and standard mitigation practices would reduce this impact. Noise habituation for this species is further evidenced by the presence of a main badger sett at Whetmead.

9.11.330 There would be a negligible adverse level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Otter and water vole

9.11.331 Operation of the proposed scheme could result in direct mortality of otter and water vole as a result of collisions with vehicles. However, mortality risk for water vole is considered to be lower due to their limited distribution within the Order Limits and the avoidance this species exhibits towards areas of open ground (Carter and Bright, 2003; Dean *et al*., 2016). It is therefore considered unlikely that water vole would attempt to cross the live carriageway.

9.11.332 The provision of mammal ledges in culverts on the Roman River, Domsey Brook (east), Domsey Brook (west) and Rivenhall Brook as part of embedded mitigation would reduce impacts associated with direct mortality to both species (particularly otter) by allowing safe passage beneath the road (see Section 9.10 of this chapter). The provision of ledges includes retrofitting ledges to existing structures which is likely to provide a benefit to otters in particular.

9.11.333 Otter fencing (see Section 9.10 of this chapter) would also reduce the risk of mortality of otters. As there is currently no otter fencing along the A12 this would also provide a benefit.

9.11.334 Operation of the proposed scheme could lead to negative impacts on water quality due to surface runoff and pollution events. However, embedded mitigation measures including approved drainage designs, water management and attenuation ponds would be implemented. It is therefore considered that impacts to these species are unlikely as a result of changes in water quality.

9.11.335 Road lighting could negatively impact otters and water voles by causing avoidance behaviour, leading to reduced species dispersal and therefore reduced reproductive success. Embedded mitigation measures would reduce light spill beyond the footprint of the proposed scheme and therefore reduce this impact.

9.11.336 There would be a minor beneficial level of impact on otters, and no change in impact on water voles, both of which are County important receptors, and therefore the significance of effect is **slight beneficial** and **neutral** respectively (not significant).

Dormouse

9.11.337 No pathways to impacts for dormouse during operation have been identified. If dormice are present within hedgerows to the east of the River Blackwater, habitat fragmentation impacts would only occur for the duration of construction of the gas main diversion, and habitat connectivity would be restored through mitigation before the operational phase.

9.11.338 It is considered that there would be no long-term or significant impacts on the conservation status of dormouse within the proposed scheme footprint or the wider Order Limits.

9.11.339 There would therefore be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Species of principal importance: brown hare, hedgehog and polecat

9.11.340 Operation of the proposed scheme could result in direct mortality of brown hares, hedgehogs and polecats as a result of collisions with vehicles, and fragmentation of habitats. Embedded mitigation practices including the provision of mammal ledges in culverts on the Roman Rover, Domsey Brook (east), Domsey Brook (west) and Rivenhall Brook, and provision of multiple 600mm to 1,500mm culverts along the length of the proposed scheme would reduce this impact (see Section 9.10 of this chapter).

9.11.341 While operational noise and lighting could adversely impact these species, it is anticipated that these mammals would become habituated to the consistent levels of noise and lighting close to the road, and the implementation of embedded mitigation (i.e. landscape and lighting design) would reduce this impact (see Section 9.10 of this chapter).

9.11.342 There would be no change in the level of impact on a County level important receptor, and therefore the significance of effect is **neutral**.

Barn owl

9.11.343 Operation of the proposed scheme could result in direct mortality of barn owl as a result of collisions with vehicles, particularly in proximity to junction 21, junction 24 and junction 25 where there is suitable habitat for barn owls (see Figure 9.3 [TR010060/APP/6.2]). Stakeholders were consulted on whether the risk of providing grassland habitat along the new road verges (which could be used by foraging barn owl, encouraging them in proximity to traffic) outweighed the benefit to other species, and it was assessed that the net benefit outweighed the risk. As such, it is possible barn owls could be impacted by mortality. However, the landscape design provided as embedded mitigation also includes barn owl foraging habitats in areas further from the road (see Section 9.10 of this chapter). This is considered likely to offset any potential increase in direct mortality.

9.11.344 Barn owl could be negatively impacted by light and noise disturbance from operation of the proposed scheme, although there were no nests recorded within 30m of the road, which is the range within which disturbance impacts are perceived to be greatest. It is anticipated that barn owls using the site would have become habituated to the baseline disturbance levels and therefore would not be negatively impacted by disturbance resulting from operation of the proposed scheme. In addition, landscaping has been designed to provide safe passage over the road for airborne species once it matures.

9.11.345 There would be a negligible adverse level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Breeding and wintering birds

9.11.346 Operation of the proposed scheme could result in direct mortality of breeding and wintering birds as a result of collisions with vehicles. Certain species of birds are at particular risk of collision with vehicles as they cross active roads at low heights to reach different habitat areas. Vulnerable species typically include those of the thrush family, owls and game birds (see Appendix 9.5 and Appendix 9.12 of the Environmental Statement [TR010060/APP/6.3]). Collisions typically occur where verges or other adjacent areas of busy roads comprise woodland or scrub habitat.

9.11.347 Increases in noise and light levels during operation could permanently negatively impact birds and their dependent young due to stress, particularly those using habitat adjacent to the road. Breeding birds would be of particular concern regarding increased noise levels due to their reliance on song and calls as part of their mating behaviour. Artificial lighting along roads can alter natural behavioural patterns in both diurnal and nocturnal species of birds, affecting both breeding and foraging behaviour. Embedded mitigation would partially mitigate these impacts (see Section 9.10 of this chapter).

9.11.348 Habitat creation away from the road would increase carrying capacity for birds in alternative nearby habitats, reducing the impact on the local population. Similarly, retention of important habitats for birds including hedgerows north of Hatfield Peverel, the River Blackwater and Domsey Brook would continue to support breeding bird populations away from the proposed scheme (see Appendix 9.5 [TR010060/APP/6.3]). Retention of habitat surrounding Colemans

Reservoir which supports diverse assemblages of wintering birds would continue to support such populations away from the proposed scheme (see Appendix 9.12 [TR010060/APP/6.3]).

9.11.349 There would be a minor adverse level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Reptiles

9.11.350 Operation of the proposed scheme could result in direct mortality of reptiles as a result of collisions with vehicles. However, the likelihood of reptiles attempting to cross the road surface, which provides no natural cover and would be a source of noise and vibration, is considered low.

9.11.351 The proposed scheme could also cause fragmentation of habitats. However, embedded and standard mitigation practices such as the provision of mammal ledges in culverts on the Roman Rover, Domsey Brook (east), Domsey Brook (west) and Rivenhall Brook, and provision of multiple 600mm to 1,500mm culverts along the length of the proposed scheme would reduce both the likelihood of direct mortality and increase habitat connectivity (see Section 9.10 of this chapter).

9.11.352 There would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Great crested newt

9.11.353 There is the potential for the proposed scheme to restrict the dispersal of GCN metapopulation J, particularly west of junction 25. The creation of the new road at this location would bisect existing terrestrial habitat therefore creating a barrier for any GCN attempting to move south of Pond P014. In addition, the offline sections of the proposed scheme would permanently fragment terrestrial and aquatic habitats south of the existing A12 between junction 22 and junction 23, posing further restrictions on mobility of GCN across the landscape.

9.11.354 Operation of the proposed scheme could also result in mortality of GCN, particularly in spring as animals start to make their way to their breeding water bodies.

9.11.355 However, it is considered that the provision of culverts and drainage ditches as well as mammal ledges, where practicable, for otter and water vole would increase permeability of the landscape to GCN (see Section 9.10 of this chapter).

9.11.356 There would be a negligible level of impact on a County important receptor, and therefore the significance of effect is **neutral** (not significant).

Species of principal importance: common toad

9.11.357 There is potential for direct mortality of common toad during operation through collisions with vehicles, and fragmentation of habitats. Embedded mitigation, including the provision of multiple 600mm to 1,500mm culverts along the length of the proposed scheme, would reduce this impact (see Section 9.10 of this chapter).

9.11.358 Operation of the proposed scheme could lead to negative impacts to water quality from surface runoff and groundwater from operation of the proposed scheme. Embedded mitigation measures including approved drainage designs and water management, such as using new attenuation ponds to store surface runoff, would be implemented (see Section 9.10 of this chapter). It is therefore considered that impacts to this species are unlikely as a result of changes in water quality.

9.11.359 There would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Freshwater fish

9.11.360 Extended bridges and culverts could result in habitat fragmentation and create a barrier to the free movement of fish, and the modification of crossing structures would permanently alter the flow regime at watercourse crossings, which could lead to impacts to fish that have species-specific flow regime requirements.

9.11.361 Embedded mitigation includes the use of CIRIA culvert design best practice to minimise the length of newly constructed culverts, and to include natural substrate in culvert beds, thus ensuring no increase in flow velocity. It is therefore considered that in the presence of embedded mitigation, these impacts are negated.

9.11.362 Adaptations to the road drainage network would result in increased water quantity discharged to watercourses, which could cause a deterioration in water quality and ultimately directly impact fish and the prey species upon which they depend. Embedded mitigation measures including approved drainage designs and water management, such as using new attenuation ponds to store surface runoff, would be implemented (see Section 9.10 of this chapter). It is therefore considered that impacts to this community are unlikely as a result of changes in water quantity and quality.

9.11.363 Artificial lighting could alter the behaviour of migratory fish species and the movement of resident species between feeding and spawning grounds. Embedded mitigation measures would reduce light spill beyond the footprint of the proposed scheme and reduce this impact.

9.11.364 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Terrestrial invertebrates

9.11.365 In the absence of mitigation, there is potential for light disturbance to impact terrestrial invertebrates during operation, which could disrupt feeding, breeding and dispersal (Davies, *et al.,* 2012). Lighting would only be required at the junctions and not on the mainline, along with handrail lighting on the WCH bridges and side road approaches to junctions, and luminaires would be used and designed with zero tilt to produce no upward glare and minimal back light (as described in Chapter 2: The proposed scheme [TR010060/APP/6.1]). It is therefore considered that any likely impact to invertebrates as a result of lighting would be avoided.

9.11.366 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Freshwater macro-invertebrates and macrophytes

9.11.367 The extension of culverts could result in habitat fragmentation and impede local freshwater macro-invertebrate migration and could also impact the flow regime at watercourse crossings which could reduce habitat suitability for freshwater macro-invertebrates.

9.11.368 Embedded mitigation includes the use of CIRIA culvert design best practice to minimise the length of newly constructed culverts and extensions, and to include natural substrate to facilitate movement through the culvert to ensure no increase in flow velocity, thus reducing this impact to negligible.

9.11.369 Adaptations to the road drainage network would result in increased water quantity discharged to watercourses. Increased road surface water runoff discharged to watercourses can cause a deterioration in water quality as a result of the release of pollutants and fine sediments to watercourses. This can negatively impact freshwater macro-invertebrate and macrophyte communities by smothering invertebrates and reducing habitat suitability by altering flow features such as pool-riffle sequences. Embedded mitigation measures, including approved drainage designs and water management, and use of new attenuation ponds to store surface runoff, would be implemented (see Section 9.10 of this chapter). It is therefore considered that impacts to these communities are unlikely as a result of changes in water quantity and quality.

9.11.370 For freshwater macrophytes, there would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

9.11.371 For freshwater invertebrates, there would be a negligible level of impact on a locally important receptor, and therefore the significance of effect is **neutral** (not significant).

Notable plants

9.11.372 Notable plants have the potential to be impacted through pollution of habitats due to runoff from the road. However, embedded mitigation measures including approved drainage designs and water management using new attenuation ponds to store surface runoff, would be implemented (see Section 9.10 of this chapter). It is therefore considered that impacts to notable plants are unlikely as a result of changes in water quality.

9.11.373 There would be a negligible level of impact on a County level important receptor, and therefore the significance of effect is **neutral** (not significant).

Summary of operation effects

9.11.374 Table 9.31 summarises the operational effects on biodiversity from the proposed scheme.

Table 9.31 Summary of operational effects on biodiversity receptors

Receptor	Significance of effect
National site network	Neutral
River Ter SSSI	Neutral
Tiptree Heath SSSI	Neutral
Whetmead LNR and LWS	Slight adverse
Braxted Park LWS	Slight adverse
Brockwell Meadows LNR and LWS	Neutral
Boreham Road Gravel Pits LWS	Slight adverse
Cook's Lane Lexden LWS	Neutral
Perry's Wood LWS	Large adverse
Smythe's Green LWS	Neutral
West House Wood LWS	Neutral
Ancient woodland	Large adverse
Veteran, potential veteran and ancient trees	Slight adverse
Priority habitats	Neutral
GWDTEs – Wet Woodland 1 and Marshy Grassland 1	Slight adverse
GWDTEs – Wet Woodland 7	Slight adverse
GWDTEs – Wet Woodland 8	Slight adverse
Bats	Neutral
Badger	Neutral
Otter	Slight beneficial
Water vole	Neutral
Dormouse	Neutral
Species of principal importance: brown hare, hedgehog, and polecat	Neutral
Barn owl	Neutral
Breeding and wintering birds	Neutral
Reptiles	Neutral
Great crested newt	Neutral
Species of principal importance: common toad	Neutral

Receptor	Significance of effect
Freshwater fish	Neutral
Terrestrial invertebrates	Neutral
Freshwater macro-invertebrates	Neutral
Notable plants	Neutral
Freshwater macrophytes	Neutral

9.12 Monitoring

9.12.1 As the proposed scheme has been found to have significant adverse effects on biodiversity, proportionate monitoring of related mitigation measures would be undertaken, as described in DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020b). Additional monitoring, as required for legal compliance purposes, is also included within this section.

General

9.12.2 ECoWs would be employed where relevant to the works being undertaken to ensure all measures and method statements, including monitoring of important ecological features and biodiversity resources, are adhered to. This measure is secured in the REAC, which is included in the first iteration EMP [TR010060/APP/6.5].

Designated sites and habitats

9.12.3 Monitoring of the establishment of newly created habitat south of the River Brain, required to offset loss of habitat at Whetmead LNR/LWS, and newly created woodland to offset impacts to Perry's Wood ancient woodland, would be undertaken (as the latter would have likely significant effects). The purpose would be to ensure habitats are establishing as desired and to make recommendations for alterations to management regimes where required.

9.12.4 Habitats planted throughout the proposed scheme following construction, including those to address effects for habitats both within and outside impacted designated sites, would require detailed monitoring and management plans. Outline information on long-term commitments to aftercare, monitoring and maintenance activities relating to landscape and ecological features is provided within the LEMP, which is included in the first iteration of the EMP [TR010060/APP/6.5]. Further details on these commitments will be provided in an updated LEMP prior to construction, and in the third iteration of the EMP prepared for the handover stage once construction is complete.

9.12.5 To account for potential dewatering impacts to Wet Woodland 7 as a result of construction of the adjacent borrow pit I, a post-construction NVC survey would be undertaken alongside groundwater monitoring (Chapter 14: Road drainage and the water environment [TR010060/APP/6.1]). The purpose of the monitoring would be to verify that no significant change in vegetation has taken place during construction, and to confirm that following construction any minor changes in the vegetation on the site would return to its current condition. Further details of this monitoring will be developed during detailed design, including duration and triggers for remedial action which would be agreed with key stakeholders. This measure is secured by the REAC, which is included in the first iteration EMP [TR010060/APP/6.5].

Protected and notable species

9.12.6 Monitoring would be required under the licences for bats and badgers to ensure these species are correctly and fully excluded before demolition of currently used roosts and setts, respectively, and to determine whether replacement roosts and setts are being used during the post-construction period.

Bats

9.12.7 Monitoring would be conducted of the roosts to be retained and roosts supplied as compensation for loss of roost resource as part of the requirements of the EPSM licence. This would be undertaken during construction one year after they are installed, and post-construction as per the specifications of a granted EPSM licence. Monitoring would also be carried out during and post-construction at identified bat crossing points to allow for comparative analysis with previously completed baseline bat surveys. The objective would be to analyse the effectiveness of mitigation measures designed to guide bats safely under or over the proposed scheme (including planting to create hop-overs for bats or through other potential crossing options which are currently being investigated). This would be secured through the REAC, which is included in the first iteration EMP [TR010060/APP/6.5].

Badger

9.12.8 In accordance with the badger licence, any setts requiring closure (whether permanent or temporary) would be subject to monitoring to confirm the ‘active’ and ‘disused’ sett entrances at each sett, and all licensable activities would be undertaken between July to November inclusive.

9.12.9 During sett closure, each sett would be monitored by an ECoW at least once every three days during the exclusion period. Monitoring would be achieved using camera traps and by placing small sticks within tunnels and in front of the one-way gates and would also be used to ensure the gates are working as expected and to assess the condition of the wire mesh overlaying hard-blocked entrance holes.

9.12.10 Monitoring of the artificial setts would be undertaken during the construction period, and for year 1 post-construction of works in the relevant area of the proposed scheme to check for signs of use by badgers.

9.12.11 Full details of monitoring are outlined in Appendix 9.17: Draft Badger Licence [TR010060/APP/6.3].

Reptiles

9.12.12 Receptor sites for translocated reptiles would be created to limit impacts to these species through the provision of suitable habitats in appropriate locations. These sites would require management during the aftercare period to ensure/prolong habitat suitability and monitoring to determine success of the translocations. This is secured through the REAC, which is included in the first iteration EMP [TR010060/APP/6.5].

9.12.13 Following translocation for reptiles, monitoring would be conducted of receptor sites as defined in the LEMP in the first iteration EMP [TR010060/APP/6.5].

Notable plants

9.12.14 Notable plants may require translocation away from the construction footprint, where practicable (as secured in the REAC, within the first iteration EMP [TR010060/APP/6.5]). If such translocation is required, a suitably competent person would conduct ecological monitoring of the translocated plants in subsequent growing seasons to measure survivability of the translocated plants. Specific monitoring goals and targets would be defined in the second iteration EMP prior to construction.

9.12.15 Monitoring of Schedule 9 and non-native invasive plants would be undertaken to ensure that where required, species have been managed in accordance with the ISMP, as outlined in the first iteration EMP [TR010060/APP/6/5].

9.13 Biodiversity net gain

9.13.1 Appendix 9.14 of the Environmental Statement [TR010060/APP/6.3] provides full details on the habitat loss and gain calculations for the proposed scheme. BNG has been calculated using the Defra 3.0 metric calculator. The overall total percentages and units for habitats, hedgerows and rivers are presented in Table 9.32. These calculations exclude habitat creation within the borrow pits, with the exception of the 7.4ha of woodland provided to offset impacts to Perry's Wood.

Table 9.32 Summary of Biodiversity Net Gain

Habitat type	On-site net % change	Total net unit change
Habitat	25.01	633.58
Hedgerows	36.06	152.70
Rivers	156.73	147.10

9.14 Summary

9.14.1 The proposed scheme complies with the NNNPS for biodiversity, and relevant policies within EN-1 and EN-4 (including the draft updated versions) as detailed in Table 9.4, in that it describes significant effects on designated sites, protected and notable species. Iterations of the design have, where practicable, reduced and avoided to biodiversity features, and mitigation and enhancement measures are described within this chapter. The proposed scheme seeks to maximise biodiversity delivery. The proposed scheme avoids loss of ancient woodland and verified veteran trees, however five potential veteran trees would be removed during construction. The proposed scheme has been designed to retain trees where practicable, for example the alignment was adjusted between junction 24 and junction 25 to avoid a verified veteran tree. The loss of the five potential veteran trees is unavoidable as detailed within Chapter 3: Assessment of alternatives, of the Environmental Statement [TR010060/APP/6.1]. It may be possible to retain additional trees shown as 'at risk' on the Retained and Removed Vegetation Plans [TR010060/APP/2.14] and the construction team would seek to do this where feasible.

9.14.2 In addition, there would be some temporary changes in air quality due to N deposition for one veteran tree, four potential veteran trees and one potential ancient tree, however the duration of the changes in N deposition would not adversely impact the health of the trees and so this is not significant. During operation of the proposed scheme there would be some changes in N deposition in an area of Perry's Wood ancient woodland, where it is adjacent to Inworth Road. These changes would be significant due to the value assigned to the receptor. Offsetting measures are proposed for Perry's Wood as detailed in Section 9.10 of this chapter.

9.14.3 Table 9.33 summarises the significant residual effects for biodiversity during the construction and operational phases of the proposed scheme.

Table 9.33 Summary of likely significant biodiversity effects

Description of effect	Mitigation measures	Mitigation mechanism	Significance of effect
Construction			
Water vole – habitat gain	N/A	N/A	Moderate beneficial (significant)
Operation			
Perry's Wood LWS – air quality effects due to nitrogen deposition exceeding the relevant thresholds	Offsetting to be provided through planting of woodland habitat within an area of the Order Limits unaffected by changes in nitrogen emissions	LEMP, which is part of the first iteration EMP [TR010060/APP/6.5]	Large adverse (significant)

Description of effect	Mitigation measures	Mitigation mechanism	Significance of effect
Perry's Wood ancient woodland – air quality effects due to nitrogen deposition exceeding the relevant thresholds	Offsetting to be provided through planting of woodland habitat within an area of the Order Limits unaffected by changes in nitrogen emissions	LEMP, which is part of the first iteration EMP [TR010060/APP/6.5]	Large adverse (significant)

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