A12 Chelmsford to A120 widening scheme

PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

Statutory Consultation 2021

CONTENTS

LIST OF PLATES

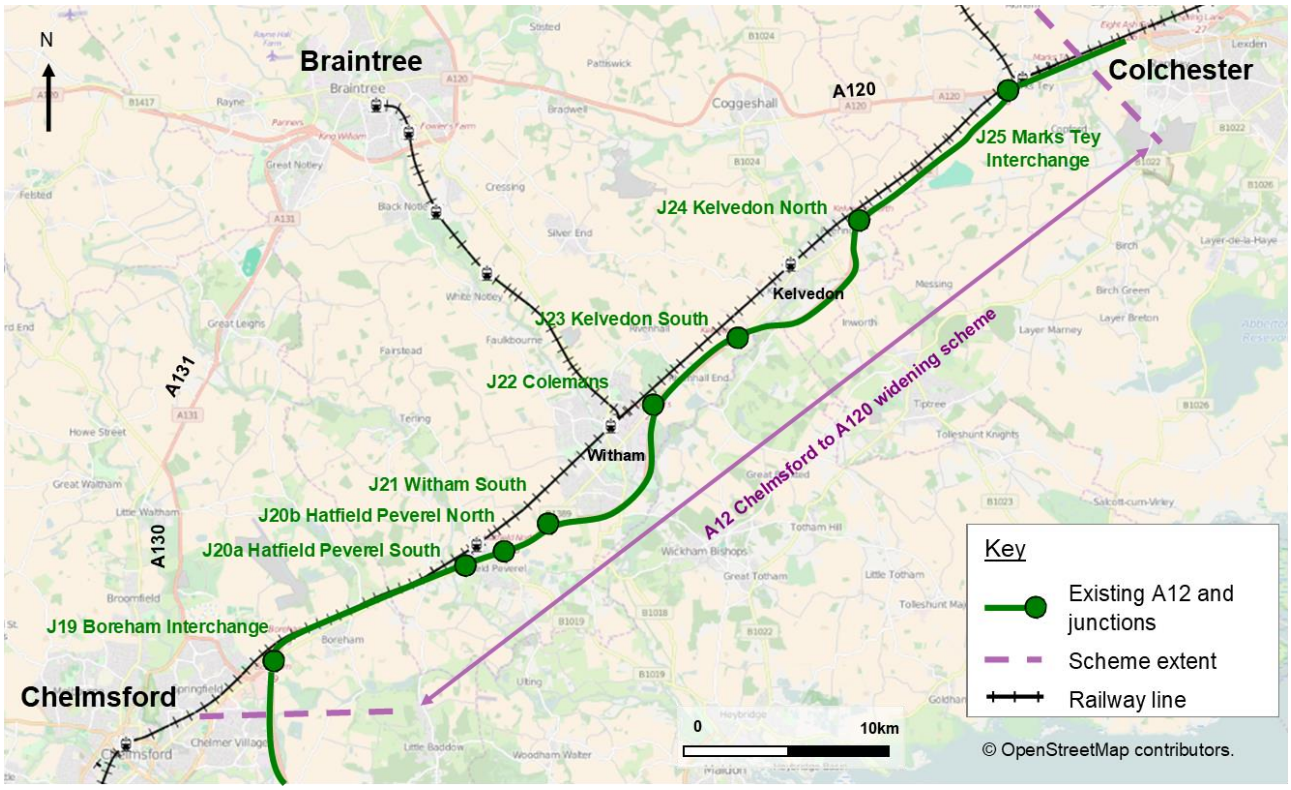
LIST OF TABLES

1 Introduction

1.1 Scheme overview

1.1.1 The A12 Chelmsford to A120 widening scheme (the 'proposed scheme') comprises improvements to the A12 between junction 19 (Boreham interchange) and junction 25 (Marks Tey interchange), a distance of approximately 24km, or 15 miles (Plate 1.1). The proposed scheme involves widening the A12 to three lanes throughout (where it is not already three lanes) with a bypass between junctions 22 and 23 and a second bypass between junctions 24 and 25. It also includes safety improvements, including closing off existing private and local direct accesses onto the main carriageway, and providing alternative provision for walkers, cyclists and horse rides (WCH) to existing routes along the A12, which would be removed. A location plan is included in Appendix A (Figure 1.1) which shows the proposed scheme extents.

Plate 1.1 Scheme location



1.2 Purpose of this report

1.2.1 This is the Preliminary Environmental Information Report (PEIR) for the proposed scheme, which has been produced to support the statutory consultation. The PEIR includes environmental information to enable consultees to understand the likely significant environmental effects of the proposed scheme based on the preliminary environmental information available at the time, and measures proposed to mitigate such effects, to help inform their consultation responses.

1.2.2 This PEIR forms part of the consultation material provided for the statutory consultation process under the Planning Act 2008. Further details on the statutory consultation process are provided in Chapter 4: Consultation.

1.2.3 This PEIR has been prepared in line with guidance provided in the Planning Inspectorate's (2020) Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping.

1.3 The applicant

1.3.1 Highways England is the developer of the proposed scheme. Highways England is a government-owned company which plans, designs, builds, operates and maintains England's motorways and major A-roads, known as the strategic road network (SRN).

1.4 Legislative and policy overview

Development Consent Order

1.4.1 The proposed scheme would involve construction of a highway which is wholly in England, where Highways England is the highway authority and the speed limit for any class of vehicle is expected to be 50 miles per hour or greater and would have a footprint greater than 12.5ha. The proposed scheme is therefore classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008, triggering the need to apply for a Development Consent Order (DCO).

1.4.2 The proposed scheme is currently in the pre-application stage of the DCO process. This involves developing the design and undertaking all necessary assessment and consultation before submitting the DCO application. See Section 1.6 for more information on the next steps of the DCO process.

Environmental Impact Assessment

1.4.3 The proposed scheme falls under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations'), specifically Schedule 2, Section 10(f), infrastructure projects, construction of roads (unless included in Schedule 1 of the EIA Regulations). The selection criteria in Schedule 3 of the EIA Regulations have been used to screen the proposed scheme and identified the potential for significant effects. The proposed scheme therefore requires an Environmental Impact Assessment (EIA) to support the DCO application.

1.4.4 An Environmental Scoping Report was submitted to the Planning Inspectorate in October 2020, who in turn adopted a Scoping Opinion in December 2020 setting out the scope of the EIA (see Section 5.1 of Chapter 5: Environmental assessment methodology, for more information).

1.4.5 The results of the EIA will be documented in an Environmental Statement, which will be submitted as part of the DCO application.

1.4.6 This PEIR has been produced in advance of the Environmental Statement, for the statutory consultation, to provide preliminary information on the likely significant effects and proposed mitigation for the proposed scheme.

National Networks National Policy Statement

1.4.7 Section 104 of the Planning Act 2008 requires applications to be decided in accordance with the relevant National Policy Statement. The National Networks National Policy Statement (NNNPS) (Department for Transport (DfT), 2014) sets out principles by which applications for road and rail schemes should be assessed. Paragraph 4.3 of the NNNPS states:

'*In considering any proposed development and in particular when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:*

- *Its potential benefits including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits;*
- *Its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.*'

1.4.8 The proposed scheme will be assessed against the policies outlined in the NNNPS. Each environmental aspect chapter in the Environmental Statement will set out the key NNNPS policy relevant to the aspect and highlight the extent to which the proposed scheme meets these requirements.

Local planning policy

1.4.9 Local planning authorities are key consultees throughout the DCO process. They will typically produce Local Impact Reports during the DCO examination giving details of the likely impact of the proposed scheme on the authority's area (or any part of that area), which must be taken into account by the Examining Authority and Secretary of State.

1.4.10 The proposed scheme is located within the administrative boundaries of Essex County Council, Chelmsford City Council, Braintree District Council, Maldon District Council and Colchester Borough Council. Details of the local planning policy relevant to the proposed scheme are included in Appendix B.

1.4.11 Although local planning policy is considered, National Policy Statements (NPS) are the sole policy on which NSIPs are determined. If there is any conflict between a designated NPS and any local planning document, the policies in the NPS will prevail (Planning Inspectorate, 2015).

1.5 Structure of this PEIR

1.5.1 The environmental aspects covered in this PEIR include those within the EIA Regulations and the Design Manual for Roads and Bridges (DMRB). The relationship between DMRB and EIA is provided in Section 5.2 of Chapter 5: Environmental assessment methodology. The structure of the report is set out in Table 1.1.

1.5.2 A separate Non-Technical Summary (NTS) for the PEIR has been produced to support the statutory consultation. The NTS presents the information in the PEIR in non-technical language which can be understood by a wider audience.

Table 1.1 Structure of the PEIR

Chapter	Contents
1. Introduction	Provides an overview of the proposed scheme and the purpose of this report.
2. The scheme	Provides a statement on the need for the proposed scheme, sets out the objectives for the proposed scheme, and provides a description of the proposed scheme location and design.
3. Assessment of alternatives	Provides a summary of the development of the proposed scheme and the various options considered during the design process. Also includes consideration of how the environmental assessment has influenced the option selection process and design development.
4. Consultation	Provides a summary of the consultation with stakeholders undertaken to date in relation to the options selection, public engagement events, and the EIA, and consultation strategy going forward.
5. Environmental assessment methodology	Provides an overview of the environmental assessment methodology, including significance criteria and surveys and predictive techniques.
6-15. Aspect chapters	There is a chapter for each environmental aspect. Each sets out the assessment methodology, study area used, and baseline environmental conditions. Each chapter also describes the potential impacts, likely significant effects, and proposed mitigation. Aspect chapters are as follows: • Chapter 6: Air quality • Chapter 7: Cultural heritage • Chapter 8: Landscape and visual • Chapter 9: Biodiversity • Chapter 10: Geology and soils • Chapter 11: Material assets and waste • Chapter 12: Noise and vibration • Chapter 13: Population and health • Chapter 14: Road drainage and the water environment • Chapter 15: Climate
16. Cumulative effects assessment	Provides a summary of how the cumulative effects assessment will be undertaken, and the short list of other developments that will be included in the assessment.
17. Summary	Summarises the likely significant effects and proposed mitigation from the PEIR assessment.
Acronyms, glossary, references	Description of acronyms, definitions of technical terms, and a reference list of document sources.
Appendices	Figures and supporting information are provided in the appendices.

1.6 Next steps

1.6.1 An eight-week consultation runs between 22 June 2021 and 16 August 2021. Highways England welcomes comments from stakeholders on the proposed scheme and the environmental information provided in this PEIR. Consultation documents, including response forms, can be found on the Highways England webpage: https://highwaysengland.co.uk/A12

1.6.2 Once the consultation has closed, all suggestions and comments received during the consultation will be reviewed. All feedback will be considered when making further refinements to the proposed design and developing planned mitigation measures. A summary of the responses and how the proposed scheme has been informed and influenced by them will be provided in a consultation report. This will form part of the DCO application and will also be available to the public following submission of the application.

1.6.3 The DCO application will be made to the Planning Inspectorate, who will examine the application. The examination process is likely to involve public hearings. Following the examination, the Planning Inspectorate will make a recommendation to the Secretary of State for Transport, who will decide whether development consent should be granted or refused for the proposed scheme. The DCO application is planned to be submitted in spring 2022 and, if approved, construction is anticipated to start in 2023.

2 The scheme

2.1 Need for the scheme

2.1.1 The A12 is an important economic link in Essex and across the east of England. It provides the main south-west/north-east route through Essex and Suffolk, connecting Ipswich to London and to the M25.

2.1.2 The section between Chelmsford and Colchester (junction 19 Boreham interchange to junction 25 Marks Tey interchange) carries high volumes of traffic, with up to 90,000 vehicles every day. Heavy Goods Vehicles (HGV) account for between 9% and 12% of the traffic on this section due to its important freight connection, especially to Felixstowe and Harwich ports. This section of the A12 is also an important commuter route between Chelmsford and Colchester, and acts as a link, via the A120, to London Stansted Airport. The resulting congestion leads to delays and means that, during the morning commute, a driver's average speed can be particularly slow in both directions for an A-road.

2.1.3 Previous studies, including the East of England Route Strategy (Highways England, 2015), the A12/A120 Route Based Strategy (Highways Agency, 2013) and the Essex Local Transport Plan (Essex County Council, 2011), indicate several problems between junction 19 and junction 25 of the A12. The key problems and issues from these studies are documented in an Options Assessment Report (OAR) (Highways England, 2016) and summarised in Table 2.1. The OAR can be viewed on the Highways England webpage: https://highwaysengland.co.uk/A12

Table 2.1 Current issues along the A12

Strategic issue	Locations
Traffic flows and congestion	Congestion is experienced routinely on all links along the length of the A12. The busiest link is between J20b and J21 and is linked to the commuter route between Braintree and Maldon. These routes put pressure on traffic through Witham at J21 and affect the performance of the A12 between Boreham and Marks Tey.
Consistency in standard	The A12 has been improved in a piecemeal way which has resulted in a route with little consistency in terms of provision. It varies between dual two-lane and dual three-lane all-purpose carriageways and has numerous variations of junction types, surfacing, geometry, access, asset condition, lighting and lay-by provision. There is also limited technology along the whole route.
Resilience	There are limited suitable diversion routes for the A12, which can lead to significant disruption when incidents occur. The lack of diversion routes also makes it more difficult to undertake maintenance to the route.

Strategic issue	Locations
Safety	There were approximately 132 collisions in the section of A12 between J19 and J25 between 2015 and 2017. Up to date collision analysis will be available for the Environmental Statement. Motorcyclists and pedestrians have been identified as 'vulnerable' road user groups; however, this is based on low numbers and as such are more vulnerable to fluctuation. There are elements of the existing A12 with substandard design, including slip roads with inadequate length, and poor visibility at junctions and bends. There are also several direct accesses onto the A12 from residential, commercial and agricultural properties, particularly on the section between J24 and J25.
Walkers, cyclists and horse riders (WCH) and public transport provision	As the A12 becomes busier, there is an aspiration to move WCH provision and bus stops onto safer alternative routes. There are also issues regarding existing rights of way that were severed during the construction of the current A12 alignment.

2.1.4 The proposed scheme was included within the first Road Investment Strategy (RIS) as one of the projects to be delivered in Road Period 1 between 2015 and 2020. RIS1 (DfT, 2015) identified a phased approach to major improvement works to the A12 corridor. The proposed scheme was identified as phase 1 of a programme of major upgrades to the A12. It was described as 'widening the A12 to three lanes between junction 19 (north of Chelmsford) and junction 25 (A120 interchange)' and was allocated funding within RIS1.

2.1.5 In 2017, following the initial consultation on four route options, Highways England was asked to consider alternative options that sought to avoid the proposed Colchester Braintree Borders Garden Community (CBBGC) between junctions 24 (Kelvedon North interchange) and 25 (Marks Tey interchange). CBBGC (also referred to as the Marks Tey Garden Community) was one of three garden communities being proposed within Essex, included in the North Essex Authorities'[1] draft Local Plan. There was a commitment to 2,500 homes within the local plan period (as part of an overall total of between 15,000 and 24,000 homes). Alternative alignments for the proposed scheme were considered between junctions 24 and 25 to account for the potential footprint of this development, and a further consultation was held in October 2019. Although the CBBGC has now been removed from the draft Local Plan (see Chapter 3: Assessment of alternatives, for more details), the extended options stage means that the proposed scheme would commence construction within Road Period 2 between 2020 and 2025 rather than Road Period 1. The proposed scheme is a committed scheme in RIS2: 2020-2025 (DfT, 2020a).

[1] The North Essex Authorities consist of the Braintree, Colchester and Tendring local authorities.

2.1.6 Excluding the CBBGC, there are over 40,000 dwellings and 20,000 jobs planned within the region over the coming years (NTEM version 7.2). In addition, the investment in the Haven Ports is likely to increase heavy vehicles along the route. As such, an increase in overall traffic volume during peak periods is expected on the A12.

2.2 Scheme objectives

2.2.1 The overall aim of the proposed scheme is to solve strategic traffic problems and congestion, and associated safety issues, along the SRN between junctions 19 (Boreham interchange) and 25 (Marks Tey interchange).

2.2.2 Scheme-specific objectives have been used to develop the proposed scheme design (Table 2.2). The environmental objectives were developed based on the commitments within the Highways England Licence to reduce the environmental impacts of operating, maintaining and improving its network; protecting and enhancing the environment to achieve the best practicable environmental outcomes across its activities; and seeking to improve the well-being of road users and communities affected by the network.

Table 2.2 Scheme-specific objectives

How it aligns with strategic aims	Objective
Supporting economic growth	Proposed scheme supports the growth identified in Local Plans by reducing congestion related delay, improving journey time reliability and increasing the overall transport capacity of the A12
A safe and serviceable network	Private accesses to the strategic road network closed off and alternative access to local roads provided by the proposed scheme
	Proposed scheme improves road user safety
	Proposed scheme improves road worker safety during maintenance operation
A more free-flowing network	Proposed scheme reduces current and forecast congestion related delays and therefore increases journey time reliability
	Proposed scheme understands the impacts of other schemes and recognises other RIS schemes
An improved environment	Reduce the visual, air and noise quality impacts of the proposed scheme on affected communities on the route
A more accessible and integrated network	Proposed scheme reduces the impact of severance of communities along the route
	Proposed scheme improves accessibility for walkers, cyclists, horse riders, and public transport users
Customer satisfaction	Improve customer satisfaction, and reduce customer impact during construction

2.2.3 The RIS2, published by the DfT in 2020, has an ambition to develop a greener network, specifically through:

- *'The majority of all vehicles using the SRN, including almost all cars and vans, are zero emission at the tailpipe, transforming the impact of the SRN on air quality and carbon emissions.*
- *The SRN makes extensive and effective use of environmentally and visually sensitive 'green infrastructure', modern materials and careful planting, including trees. Together, these minimise and mitigate the air, light, noise, visual, and water quality impacts of the SRN on those living or working near to it, and sustain habitats and enhance biodiversity.*
- *Enhancements to the network create roads that fit with their surroundings and which keep negative consequences to a minimum. In particular they employ high standards of design, responding to place-specific issues and in keeping with the natural, built and historic environment.'*

2.2.4 The design will take into account Highways England's 10 principles of good design published in The Road to Good Design (Highways England, 2018) to support their aspirations for a network that responds better to both people and places through improved design processes. These promote environmentally sustainable design that fits in context, while making roads safe, useful and understandable. The 10 principles state that good design:

- makes roads safe and useful
- is inclusive
- makes roads understandable
- fits in context
- is restrained
- is environmentally sustainable
- is thorough
- is innovative
- is collaborative
- is long-lasting

2.2.5 The following scheme-specific design principles have been identified in relation to the environment:

- Retain as much existing vegetation as feasible where it provides important visual screening or forms part of the landscape structure. Where vegetation loss is unavoidable, and where practicable, replace and extend areas of proposed planting into the landscape to provide visual screening.
- Achieve no net loss of habitat throughout the proposed scheme and improve wildlife connectivity by incorporating linear habitats such as hedgerows and lines of trees, linking with retained woodland and hedgerows where possible.

- Reinforce the landscape character and biodiversity by planting native tree and hedge species typically found within the surrounding local landscape.
- Provide visual interest for local residents, and users of public rights of way (PRoW) and public open spaces, including incorporating intermittent planting to improve views out from the road for drivers using the A12.
- Filter, screen and contain views of major junctions and integrate them into the surrounding landscape with native planting.
- Aim to limit the overall area of the road design as much as possible when considering the design and location of drainage ponds and new floodplain compensation areas. Integrate drainage and earthworks sensitively into the surrounding landscape by using planting and not making them too visually intrusive. Carefully consider the design of structures over watercourses, aiming to minimise their visual impact whilst helping wildlife to thrive and maintaining the character of the landscape and views along valley floors.
- Within areas of floodplain, minimise the amount of land needed and loss of vegetation to retain the locally distinctive willow plantations. Ensure proposed planting improves the pattern and character of existing vegetation.
- Improve the quality and capacity of existing WCH infrastructure, and seek opportunities to create new routes. Maintain connectivity to and along open space from the main residential population of Witham, including Whetmead Local Nature Reserve, Witham River Walk and the Blackwater Rail Trail (which is a Country Park).

2.3 Scheme location

2.3.1 A location plan (Figure 1.1) is included in Appendix A. Key environmental constraints are included for each environmental aspect in respective constraints plans in Appendix A.

2.3.2 The proposed scheme lies within Essex, passing through mainly the Braintree and Colchester administrative areas, as well as the Chelmsford and Maldon administrative areas. Chelmsford is located to the south-west of the proposed scheme and Colchester to the north-east. The A12 lies adjacent to the smaller settlements of Boreham, Hatfield Peverel, Witham, Rivenhall End, Kelvedon, Feering and Marks Tey. There are also individual business and residential properties which front directly onto the A12.

2.3.3 The A12 runs in parallel and to the south of the Great Eastern Main Line (GEML) railway for most of its length between junctions 19 and 25. Major connecting roads include the A130 which joins the A12 at junction 19 (Boreham interchange) and the A120 which joins the A12 at junction 25 (Marks Tey interchange). The B1018 and the B1019 link Maldon to Witham and Hatfield Peverel respectively. The B1023 links Kelvedon and Tiptree.

2.3.4 Land use outside of built-up areas is generally broadacre arable cropping with pockets of other farming types. There are a number of large commercial plots (over 100ha in size) along the route. Soils are generally classed as ‘good’ or ‘very good’ according to provisional Agricultural Land Classification (ALC) data.

2.3.5 The A12 crosses seven main rivers between junctions 19 and 25. These are Boreham Brook, River Ter, River Brain, Rivenhall Brook, River Blackwater, Domsey Brook and Roman River.

2.3.6 Existing vegetation includes highway vegetation, the pattern of small woodland blocks and copses scattered throughout the wider surrounding landscape, hedgerow boundaries, watercourses lined with trees, and the woodland and locally distinctive plantations along the River Blackwater.

2.3.7 The network of ditches and streams, water bodies and rivers are key distinctive features of this flat and low-lying landscape. The winding routes of the rivers and smaller waterways influence field pattern, providing a strong sense of place and offering continuity throughout the landscape.

2.3.8 Key environmental designations and features along the route include the Blackwater Valley Landscape Character Area; Whetmead Local Nature Reserve to the east of the A12 at Witham; Boreham House and Braxted Park registered parks and gardens at junction 19 (Boreham interchange) and Great Braxted respectively; Rivenhall Long Mortuary Enclosure scheduled monument, located south of the A12 to the east of Rivenhall End; and a geological Site of Special Scientific Interest (SSSI) to the north of junction 25 (Marks Tey interchange).

2.3.9 Habitat capable of supporting various protected and notable species is located along the route of the proposed scheme. These include bats, badgers, great crested newt, breeding birds, barn owl, reptiles, water vole, otters and aquatic species.

2.3.10 There is one air quality management area (AQMA) located in proximity to roads affected by the proposed scheme (known as the affected road network, which is defined in Chapter 6: Air quality). This is the Lucy Lane North AQMA located in Colchester near junction 26 of the A12.

2.3.11 There are several noise important areas along the route, including at Boreham, Hatfield Peverel, Witham, Rivenhall End, junction 24 (Kelvedon North interchange) and Marks Tey.

2.3.12 Most of the study area is classed as a mineral safeguarding area (MSA) due to the underlying sand and gravel resources in the region. An MSA designation denotes where mineral capable of being an economic resource is considered to be present, and where prior extraction should take place if practicable to avoid its sterilisation by non-mineral development. There is also an active quarry at Colemans Farm, within the river valley at Rivenhall End.

2.3.13 There are several development proposals within the study area that have been considered during the proposed scheme's development. A full list of committed developments has been produced for the cumulative effects assessment, as set out in Chapter 16: Cumulative effects assessment. Key strategic developments include:

- Beaulieu Park development – this is a large development with planning permission to the north of junction 19. It includes 3,000 new homes, a 45,000m^2 office business park, a secondary school, two primary schools, four nurseries and a neighbourhood centre. It is currently being constructed and includes proposals to improve junction 19. Highways England is working with the developer to understand how the developer's proposals tie in with the proposed scheme. There is also planning permission approved for construction of a new railway station to serve the proposed Greater Beaulieu Park development.

- Chelmsford Garden Community – Strategic Growth Site 6 of the Adopted Chelmsford Local Plan (Chelmsford City Council, 2020a), located north of the Beaulieu Park development. A Masterplan is due to be approved in 2021, including 3,000 new homes, with planning applications expected in late 2021.

- Chelmsford North East Bypass – this is a new road scheme that Essex County Council is promoting. The route links with junction 19 (Boreham interchange) and is orientated north to join the A131 at Deres Bridge. The Chelmsford North East Bypass scheme will be delivered in phases and has secured funding from the Government's Housing Infrastructure Fund, as well as the South East Local Enterprise Partnership, and intends to submit a planning application for Phase 1 in 2021.

- Longfield Solar Farm – construction, operation and decommissioning of a solar photovoltaic electricity generating and storage facility with a capacity of up to 500 megawatts, on land approximately 6km north-east of Chelmsford. The DCO application for this development has not yet been submitted, but is expected in the second half of 2021. It is anticipated that construction of the solar farm will coincide with the construction phase of the proposed scheme.

- A120 Scheme between Braintree and the A12 – last year the government announced the inclusion of the A120 Scheme within the RIS3 pipeline (a group of schemes being considered for potential inclusion in the RIS3 programme for delivery in 2025-2030). Work is progressing to validate the recommended route made by Essex County Council which would include a link to the A12. The two project teams are working together to reduce customer impact where practicable should the A120 be included within a future RIS period.

2.3.14 Other committed developments included in the proposed scheme traffic model are shown in the Traffic Modelling Report for Consultation.

2.3.15 During the options selection stage of the proposed scheme the CBBGC was considered as a major future development along the A12 corridor, and options were developed to accommodate this (see Chapter 3: Assessment of alternatives). As the CBBGC was not taken forward in the North Essex Authorities Local Plan, it is no longer a committed development and is therefore no longer being considered as a future development for the purposes of cumulative assessment.

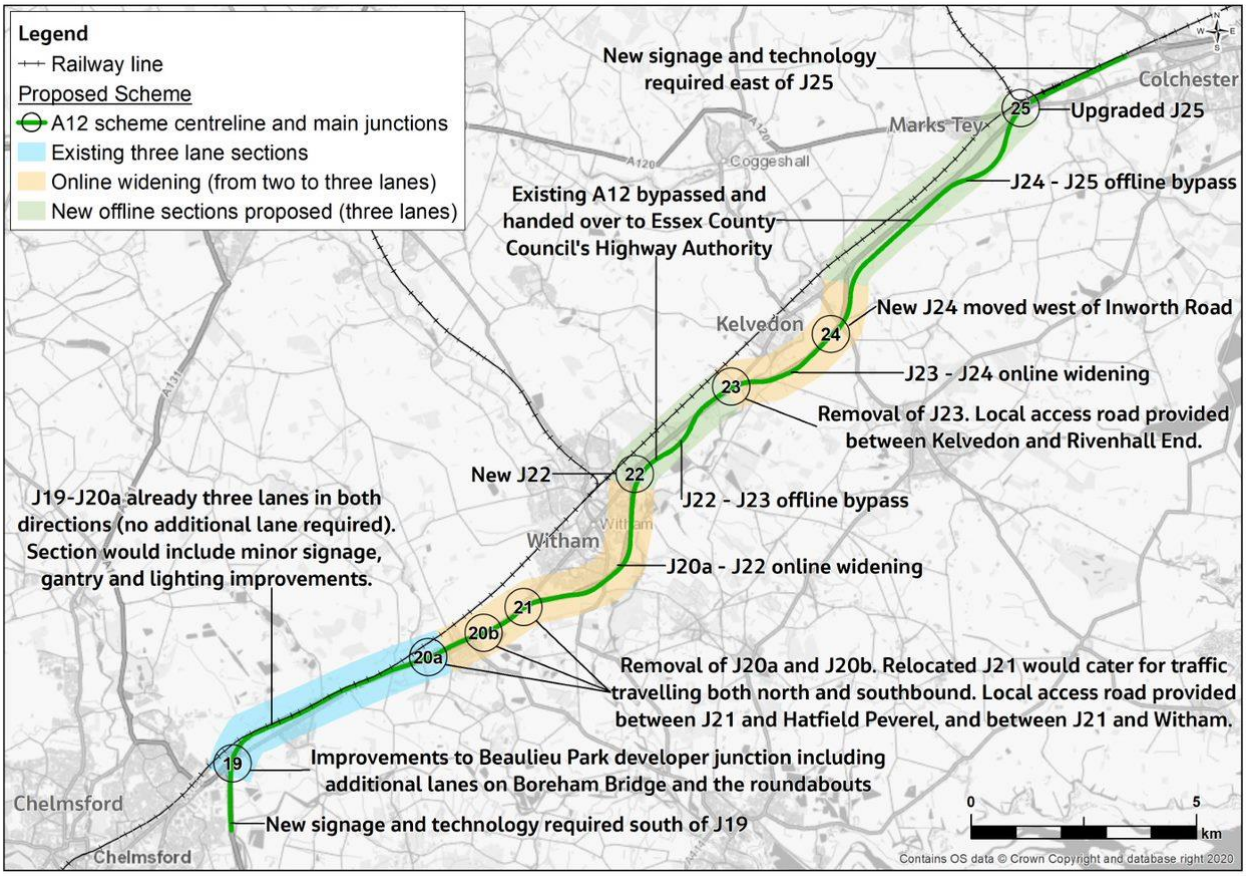
2.4 Scheme description

Main alignment and junction works

2.4.1 The existing A12 between junctions 19 and 25 is predominantly a dual two-lane carriageway, with a limited length of dual three-lane carriageway between junctions 19 (Boreham interchange) and 20a (Hatfield Peverel South interchange). There are a number of direct accesses onto the carriageways, particularly between junctions 22 (Colemans interchange) and 23 (Kelvedon South interchange) and between junctions 24 (Kelvedon North interchange) and 25 (Marks Tey interchange).

2.4.2 The proposed scheme involves widening the existing A12 to three lanes throughout in each direction (Plate 2.1), where it is not already three lanes. This would mainly involve online widening of the carriageway, with offline bypasses created between junctions 22 and 23 (Rivenhall End Bypass) and between junctions 24 and 25 (Kelvedon to Marks Tey). This would be accompanied by junction improvements (junctions 19 and 25), construction of new junctions catering for traffic movements both north and southbound (junctions 21, 22 and 24), and removal of existing junctions (junctions 20a, 20b and 23).

Plate 2.1 Overview of proposed scheme highway design



2.4.3 The proposed scheme is split into three design sections for ease of reference in this PEIR (note these do not represent construction phases):

- Section 1 – works between junction 19 and the existing junction 21
- Section 2 – works between the existing junction 21 and existing junction 23
- Section 3 – works between the existing junction 23 and junction 25

2.4.4 The following sub-sections provide more information on the proposed works at each design section.

2.4.5 The proposed scheme is shown on Figure 2.1 (Preliminary Environmental Masterplan) in Appendix A. Side roads and structures are shown on Figure 2.2 in Appendix A. Plate 2.2 to Plate 2.6 show the proposed junction works.

Design section 1

2.4.6 Design section 1 is a total length of 10.1km from junction 19 to the existing junction 21. The A12 as it passes through junction 19 is two-lanes in each direction and would not be widened, but carriageway improvements would be implemented for the junction slip roads. The 3.4km section between junctions 19 and 20a already consists of three lanes in each direction; works here would be confined to localised improvements to roadside infrastructure (such as signage). The remaining 6.7km section would be subject to online widening works to provide a dual three-lane carriageway. The scheme boundary extends to the south of junction 19 to allow for temporary traffic management and roadside works in the verges such as new signage and works associated with the junction 19 improvements. There are two junction upgrades within this design section (junctions 19 and 21).

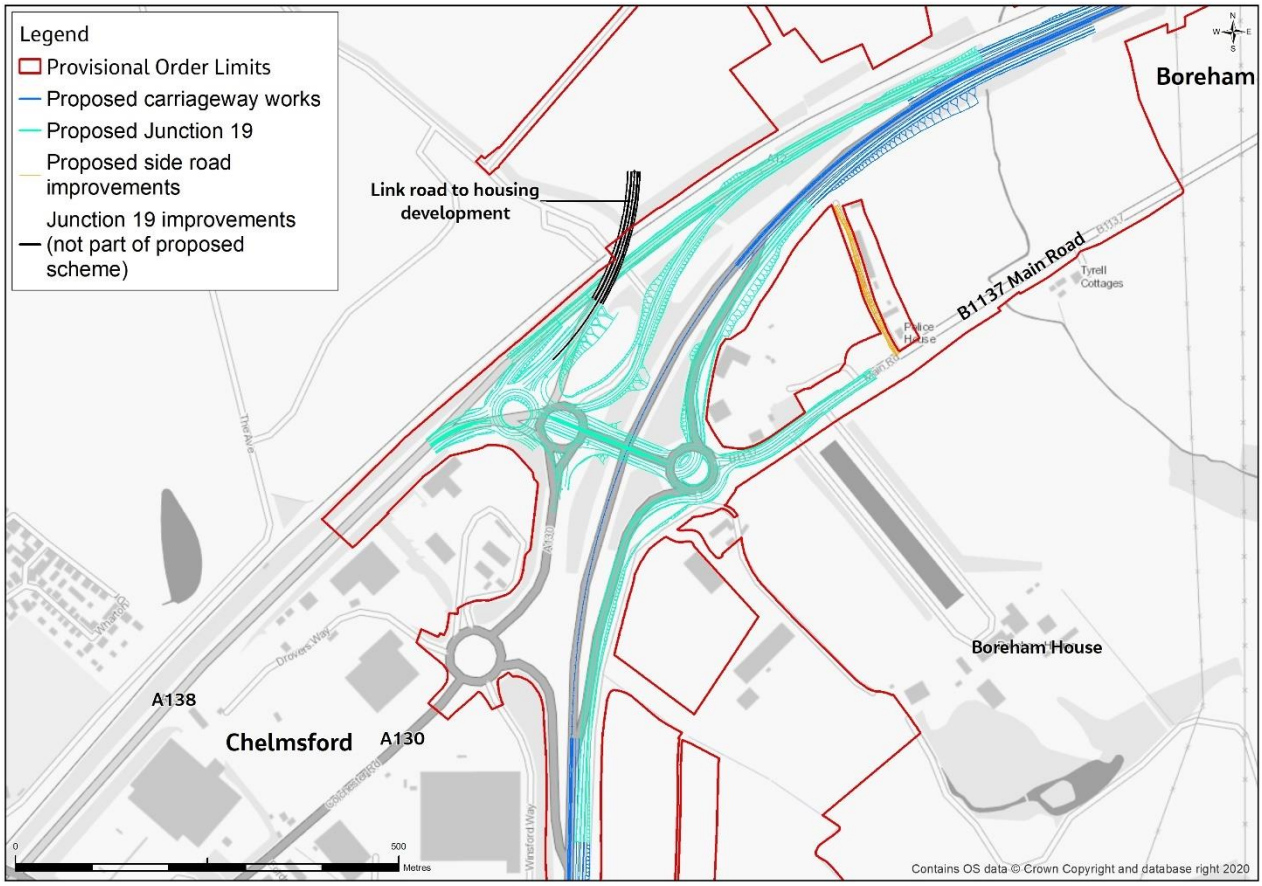
2.4.7 Junction 19 is being improved as part of the Beaulieu Park development. The changes are being made by the developer, and the construction is due to be completed by early 2023. As construction of the improvements required for Beaulieu Park are due to be completed before construction of the proposed scheme begins, consent will not be sought for them in the DCO application but these improvements have been taken into account in the design proposals.

2.4.8 The proposed scheme would deliver additional improvements to junction 19, including:

- additional lanes on Boreham Bridge (symmetrical widening)
- additional traffic lights added to the southern roundabout
- additional lanes on various roundabouts, and their approaches and exit roads
- a new controlled crossing which would allow both walkers and cyclists to cross the A12 safely and a new bridge for walkers and cyclists on the north side of junction 19 (Boreham interchange)

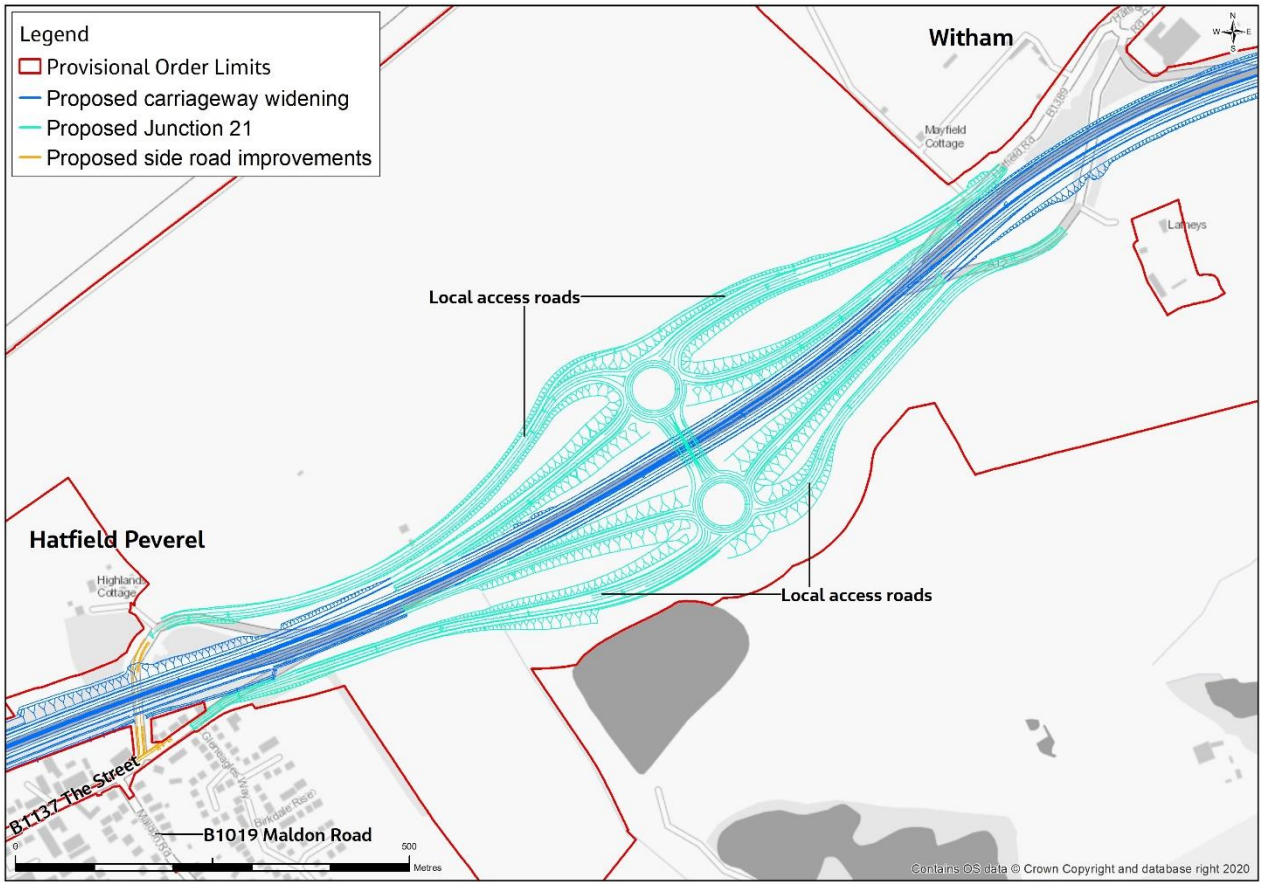
2.4.9 The proposed junction 19 layout is shown on Plate 2.2.

Plate 2.2 Overview of proposed junction 19 highway works



2.4.10 Junctions 20a and 20b would both be closed and replaced by a new junction 21, situated east of Hatfield Peverel between the existing junctions 20b and 21. It has been designed as an elevated two-tier junction with a dumbbell layout, with four access roads: a road linking the southern roundabout to Hatfield Peverel, intended as the main access between the proposed scheme and areas to the south and west, such as Hatfield Peverel and Maldon; a road linking the northern roundabout to Witham, intended as the main access between the proposed scheme and the west side of Witham; a local access road from the northern roundabout, designed for a cluster of properties north of Wellington Bridge (which would be retained for WCH only); and a local access road from the southern roundabout linking to Latney's Boarding Kennels, Cattery and Grooming Parlour only. The proposed junction 21 layout is shown on Plate 2.3.

Plate 2.3 Overview of proposed junction 21 highway works



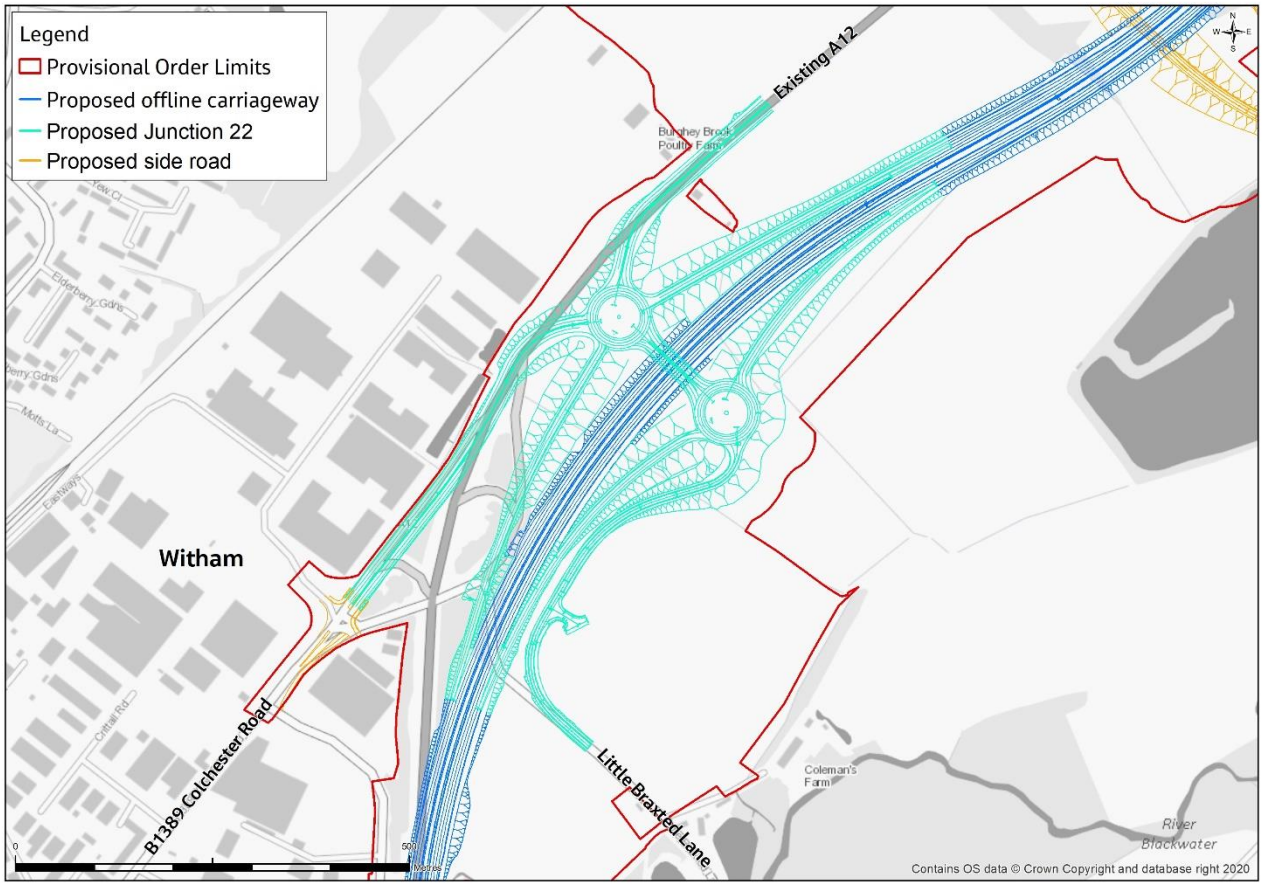
Design section 2

2.4.11 Design section 2 consists of approximately 7.1km of carriageway upgrade, from junction 21 south of Witham to junction 23 south of Kelvedon. It is proposed that between junctions 21 and 22 online widening works would be undertaken to the existing A12, upgrading the two-lane dual carriageway to a three-lane dual carriageway in each direction. From south of the existing junction 22, there is an offline section of works, bypassing Rivenhall End to the south-east before crossing the existing A12 to the east of Rivenhall End and re-joining the existing A12 carriageway at Cranes Bridge to the west of Kelvedon. There is one two-tier junction in this design section (junction 22).

2.4.12 The proposed junction 22 is located north-east of the existing junction 22 and has an elevated dumbbell layout. There are two access roads on the northern roundabout, utilising the existing A12 to link to Witham and Rivenhall End, and one access road on the southern roundabout, providing access to the realigned Little Braxted Lane and existing quarry. The proposed junction 22 layout is shown on Plate 2.4.

2.4.13 The existing junction 23 would be removed, with traffic movements associated with this junction being moved to junction 22 and junction 24 (see Chapter 3: Assessment of alternatives, for the reasons why junction 23 would be removed).

Plate 2.4 Overview of proposed junction 22 highway works



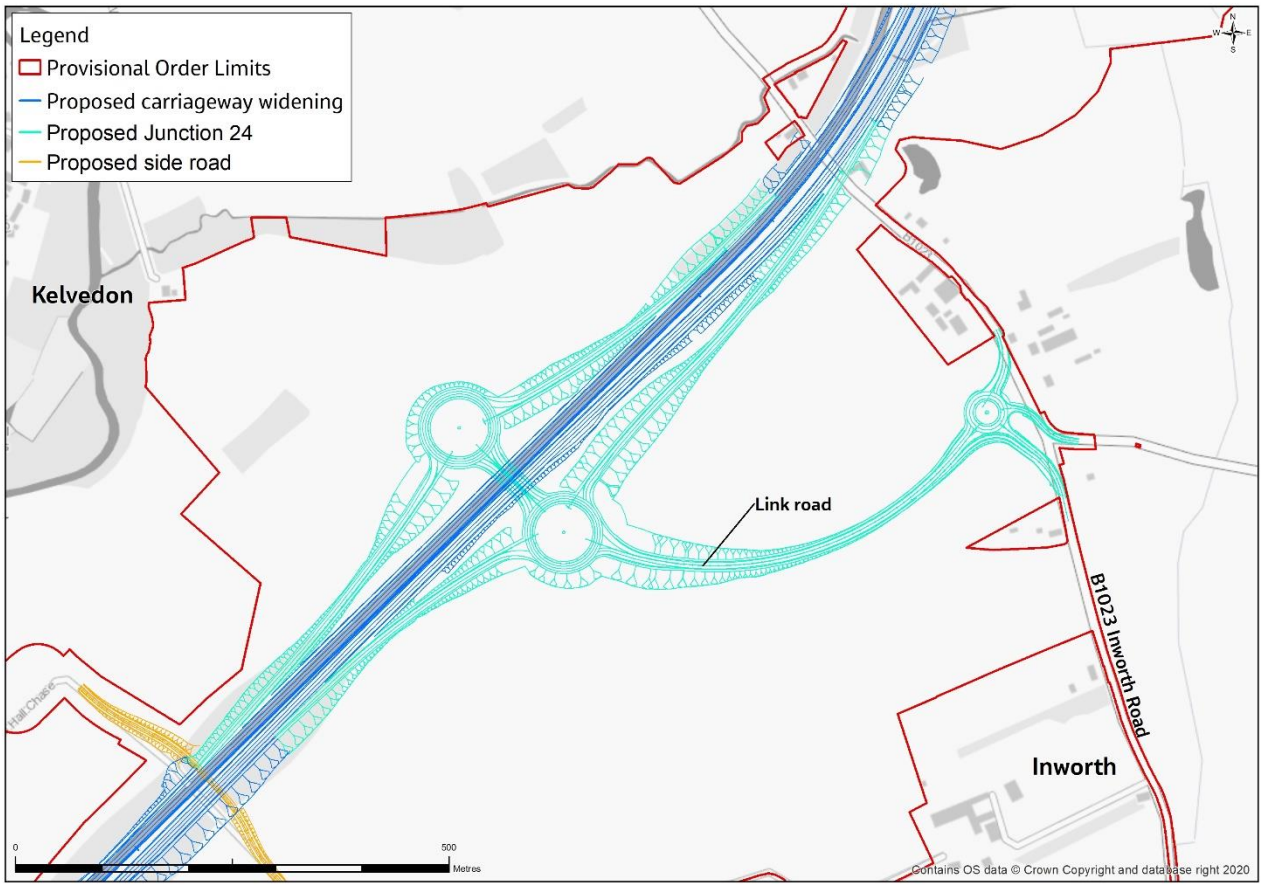
2.4.14 As noted in Section 2.3, the RIS3 A120 Scheme could result in a future connection to the A12 at the location of the existing junction 23. The proposed scheme does not include any works to facilitate that future project, but the two project teams are in discussion to ensure that the proposed scheme does not implement any design measures which would potentially compromise the ability of the A120 Scheme to proceed in the future.

Design section 3

2.4.15 Design section 3 comprises approximately 9.5km of carriageway upgrade, from the south of Kelvedon to Marks Tey, where the proposed scheme ends. There is approximately 1.7km of online widening, before the carriageway goes offline between junction 24 and junction 25. The remainder of the section consists of online widening through Marks Tey. The scheme boundary extends to the north of junction 25 to allow for temporary traffic management and roadside works in the verges, such as new signage and works associated with the junction 25 improvements. There are two junction upgrades in this design section (junctions 24 and 25).

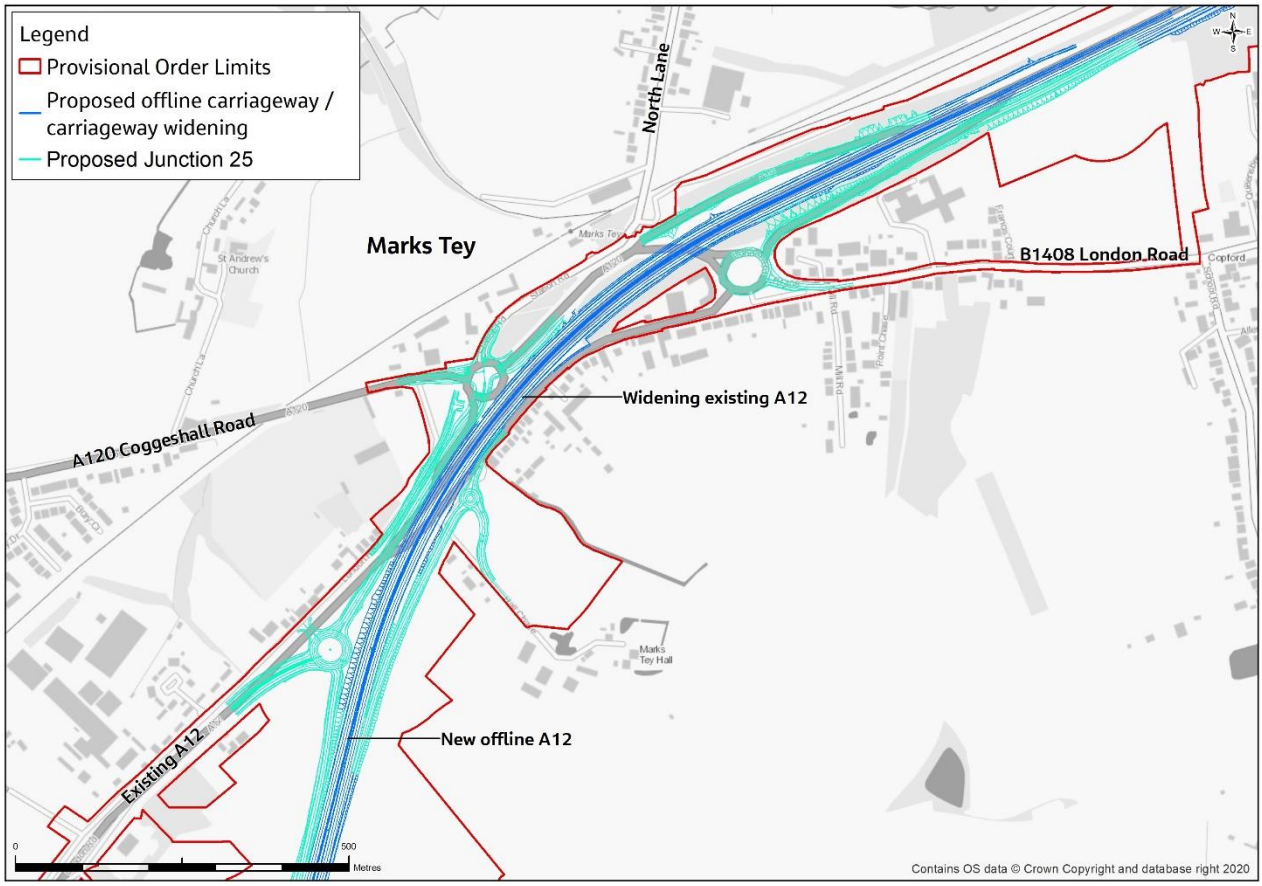
2.4.16 Junction 24 is a two-tiered dumbbell layout west of Inworth Road. A single link road would provide access between the proposed scheme and neighbouring towns, such as Kelvedon and Tiptree, via a new roundabout on the locally realigned B1023 Inworth Road. The junction is proposed to be in cutting, with the proposed scheme mainline travelling over the dumbbell link road. The proposed junction 24 layout is shown on Plate 2.5.

Plate 2.5 Overview of proposed junction 24 highway works



2.4.17 Junction 25 is a two-tier split dumbbell layout, connecting with surrounding roads in Marks Tey including the A120 and the B1408. It is proposed that the A120 Marks Tey interchange bridge would be retained to connect the junction roundabouts. The western Marks Tey Roundabout is proposed to be converted to a signalised junction. The proposed junction 25 layout is shown on Plate 2.6.

Plate 2.6 Overview of proposed junction 25 highway works



Side roads

2.4.18 There are 13 side road upgrades across the proposed scheme, as detailed in Table 2.3 (and shown on Figure 2.2: Temporary Working Areas, Side Roads and Structures, in Appendix A).

Table 2.3 Details of proposed side road upgrades

Side road	Description
Design section 1	
Bury Lane Bridge – Replacement Overbridge	This overbridge is proposed to be replaced to accommodate the widened A12 mainline. The proposed carriageway would approximately match the existing bridge width and would include a shared use footway/cycleway adjacent to the southbound traffic lane.
Station Road Bridge – Replacement Overbridge	This overbridge is proposed to be replaced to accommodate the widened A12 mainline. This is a constrained site, with property access directly adjacent to the bridge abutments on both sides. The proposed cross-section would be a two-way single carriageway, including a shared use footway/cycleway on both sides of the road.

Side road	Description
Howbridge Hall Road	A realignment is required for an existing private access road serving a single property along the south side of the existing A12 at Witham, as it would be impacted by the proposed road widening.
Junction 21 link roads	The proposed J21 upgrade is expected to cause an increase in southbound traffic on the B1389. To accommodate the increased traffic, a section of the B1389 in West Witham would be redesigned to provide a straight-through east-to-west arrangement on the approach to the new J21. The proposed cross-section would be a two-way single carriageway. A shared use footway/cycleway would be included which would tie in with proposed housing developments. The closure of J20a and J20b, along with the upgrade of J21 means that a link road between J21 and the B1137 would be provided to link J21 with Hatfield Peverel. As Wellington Bridge would be converted to a WCH bridge, a local access road from the northern roundabout would be provided for a cluster of properties north of Wellington Bridge. As J21 would be relocated, a local access road would be provided for access between J21 and Latney's Boarding Kennels, Cattery and Grooming Parlour.
Design section 2	
Rivenhall End West Roundabout	The proposed scheme runs approximately 220m to the south of the existing A12 and would sever the existing north-to-south connection via Henry Dixon Road and Braxted Road. The following are proposed to address the severance caused by the proposed scheme: a roundabout linking the existing A12 to Braxted Road and Henry Dixon Road; a new overbridge to Braxted Road from Rivenhall End and the de-trunked A12; Oak Road (north) to be closed at the existing A12; and Oak Road (south) junction with the de-trunked A12 to be converted to a simple priority junction.
Essex County Fire and Rescue Service Headquarters access	It is proposed that the existing A12 and J23 southbound on-slip would be utilised as access from Witham for the Essex County Fire and Rescue Service Headquarters and Hole Farm. The proposed cross-section would be a two-way single carriageway with a shared use footway/cycleway adjacent to the northbound carriageway.
B1024 Rivenhall Link Road	A new road linking Rivenhall End to Kelvedon is proposed to run adjacent to the northern carriageway of the proposed scheme. It would utilise a section of the existing J23 northbound off-slip. The proposed cross-section would be a two-way single carriageway with a shared use footway/cycleway adjacent to the northbound carriageway. Bus stops would be provided within this new section connecting the Essex County Fire and Rescue Service Headquarters to public transport links.
Highfields Lane bridge - Replacement Overbridge	The existing overbridge is proposed to be replaced by a new bridge adjacent to the existing to accommodate the A12 mainline widening. The bridge would connect to a realigned Maldon Road north of the A12, and to Highfields Lane to the south of the A12. The bridge would include a shared use footway/cycleway.

Side road	Description
Design section 3	
Ewell Hall Chase Bridge – Replacement Overbridge	The existing overbridge is proposed to be replaced by a new bridge adjacent to the existing to accommodate the A12 mainline widening. The proposed carriageway would include a single lane with a footway adjacent to the southbound verge.
Prested Hall and Threshelfords access road	It is proposed that the Threshelfords accommodation bridge be demolished, with a new bridge providing joint access to Threshelfords and Prested Hall, crossing over the proposed scheme near the existing J24. The new road is expected to be designated partly as an Essex Highways County Route local road and partly as a private road. The proposed Prested Hall access road is a two-way single carriageway with a shared use footway/cycleway adjacent to the northbound carriageway. The proposed Threshelfords access road is a two-way single carriageway with a shared use footway/cycleway adjacent to the westbound access and a single carriageway along the eastern access.
Existing A12 junction 24 improvements	The layout of the existing J24 would be adapted with a new five-arm roundabout to accommodate movements in all directions. The section of the existing A12 leading towards the proposed roundabout's eastern arm would be retained as a two-lane dual carriageway, with shared use footway/cycleways adjacent to both the northbound and southbound carriageways. New Lane would include a two-way single lane carriageway with a shared use footway/cycleway either side of the carriageway. The south-west arm along the B1024 London Road would become a two-way single carriageway (matching the existing), with shared use footway/cycleways adjacent to both the northbound and southbound carriageways. Heathfield Farm access road has been designed with a single lane.
Easthorpe Road	To maintain the existing connectivity with the de-trunked A12, Easthorpe Road would be replaced with a new offline overbridge to cross the proposed A12 mainline. A farm access road is located approximately 160m away from the existing junction between Easthorpe Road and the A12, and would be realigned to form a T-junction with the proposed new Easthorpe Road. A new four-arm roundabout has been proposed at the tie-in location with the existing A12 de-trunked section to provide all-direction movements. The proposed new Easthorpe Road is a two-way single carriageway with a shared use footway/cycleway adjacent to the southbound lane.
Damyon's Farm	Damyon's Farm is proposed as a new offline road for access to Easthorpe Green Farm and Wishingwell Farm. The proposed new road and overbridge is expected to be designated in accordance with Essex Highways County Route Local Road (PR2) and is assumed to be a Category D2 road. The tie-in with the de-trunked A12 is proposed to be a new three-arm roundabout. The proposed access road consists of a two-way single carriageway with a shared use footway/cycleway adjacent to the southbound carriageway.

Structures

2.4.19 Table 2.4 describes the proposed overbridge works. The proposed spans, cross-sections and structural design could be subject to change if there are changes to the proposed scheme's cross-section width. The location of structures is shown on Figure 2.2 in Appendix A.

Table 2.4 Overbridge descriptions

Overbridge	Description
Payne's Lane Footbridge	A footbridge has been proposed for WCH across the proposed scheme east of J19. The proposed width is 4.5m.
Bury Lane Bridge replacement	The existing Bury Lane Bridge, which crosses the existing A12 as part of J20a, is proposed to be demolished and rebuilt to accommodate the widening for the proposed scheme. The proposed width of the new bridge is approximately 13m.
Station Road Bridge replacement	The existing Station Road Bridge, which crosses the existing A12 to connect the northern and southern areas of Hatfield Peverel, is proposed to be demolished and rebuilt to accommodate the widening for the proposed scheme. The proposed width of the new bridge is approximately 13m.
Wellington Road Footbridge	The existing Wellington Bridge is proposed to be demolished and rebuilt as a footbridge for WCH provision across the proposed scheme west of J21. The proposed width of the new bridge is 4.5m.
Hatfield Road overbridge (J21)	Hatfield Road overbridge is part of the J21 design, connecting the two roundabouts. The proposed width is approximately 27m.
Footbridge 3 (name to be confirmed)	A footbridge has been proposed for WCH across the proposed scheme south of Witham. The proposed width is 4.5m.
Footbridge 4 (name to be confirmed)	A footbridge has been proposed for WCH across the proposed scheme south of J22. The proposed width is 4.5m.
Little Braxted Lane overbridge (J22)	Little Braxted Lane overbridge is part of the new J22, connecting the two roundabouts. The proposed width is approximately 25m.
Braxted Road overbridge	Braxted Road overbridge has been proposed to cross the proposed scheme with a modified Braxted Road alignment, west of the existing Braxted Road. The proposed width is approximately 13m.
Footbridge 5 (name to be confirmed)	A footbridge has been proposed for WCH across the proposed scheme east of Rivenhall End. The proposed width is 4.5m.
Highfields overbridge	It is proposed that the existing Highfields Bridge would be demolished and rebuilt to the west to accommodate the proposed scheme carriageway. The proposed width is approximately 13m.
Ewell overbridge replacement	It is proposed that the existing Ewell Bridge would be demolished and rebuilt to the east to accommodate the proposed scheme carriageway. The proposed width is approximately 7m.

Overbridge	Description
Prested Hall/Threshelfords overbridge	The existing Threshelfords accommodation bridge is proposed to be demolished. A new overbridge is proposed as part of the Prested Hall and Threshelfords access roads, south of the existing J24. The proposed width is approximately 13m.
Easthorpe Road overbridge	A new overbridge is proposed as part of the new Easthorpe Road alignment, which is designed to cross the proposed scheme. The proposed width is approximately 10m.
Doggetts Lane overbridge	A new overbridge is proposed to accommodate the new Damyon's Farm access road across the proposed scheme. The proposed width is approximately 10m.
Footbridge 6 (name to be confirmed)	A footbridge has been proposed for WCH across the proposed scheme west of J25. The proposed width is 4.5m.
Marks Tey Footbridge Replacement	The existing Marks Tey footbridge is proposed to be demolished and rebuilt as a footbridge for WCH across the proposed scheme through J25. The proposed width is 4.5m.

2.4.20 Table 2.5 describes the proposed underbridge works. The proposed spans, cross-sections and structural design could be subject to change if there are changes to the proposed scheme's cross-section width.

Table 2.5 Underbridge descriptions

Underbridge	Description
River Ter Bridge	The proposed new dual three-lane A12 mainline crosses the River Ter west of Hatfield Peverel. It is proposed that the existing three-span reinforced concrete structure would be retained. There are no structural modifications proposed. The additional lane in each direction would be provided by altering the width of the running lanes and verges.
Oliver's Bridge	The proposed new dual three-lane A12 mainline crosses Maldon Road (B1018) south of Witham. It is proposed that that this bridge would be widened within the extents of the existing deck without widening the physical structure.
Benton Bridge	The proposed new dual three-lane A12 mainline crosses Maldon Road (B1018) south of Witham. It is proposed that that this bridge would be widened within the extents of the existing deck without widening the physical structure.
Brain Bridge	The proposed dual three-lane A12 mainline crosses the River Brain, a single-lane unclassified road and a bridleway south of Witham. It is proposed that the existing structure would be widened to accommodate the new A12 cross-section, with three running lanes in each direction, a central reserve, and associated hard strips and verges. The structure would be extended by approximately 7.5m to the east and 5m to the west.

Underbridge	Description
Rivenhall South underbridge	An underbridge is required to cross the Rivenhall Brook east of Rivenhall End. Although the exact location has not been finalised, the proposed width is 46m.
Cranes Bridge	The proposed dual three-lane A12 mainline crosses the existing Kelvedon Road southbound on-slip (B1024) west of Kelvedon. The proposed upgrade would accommodate three running lanes in each direction, a central reserve, and associated hard strips and verges. Structural modifications are proposed to accommodate the increased cross-section, and the structure would be extended to the south by approximately 21m.
Ashmans Bridge	The proposed dual three-lane A12 mainline crosses the River Blackwater west of Kelvedon. The abutments and intermediate piers are supported on piled foundations. The proposed structure upgrade would accommodate a cross-section with three running lanes in each direction, a central reserve, and associated hard strips and verges. The structure would be extended by approximately 23m to the south to accommodate the increased cross-section.
New J24 underbridge	A new underbridge is proposed where the proposed main alignment crosses the new J24. The proposed width is 36.5m.
Inworth Subway	The proposed dual three-lane A12 crosses a cattle creep near Inworth. This would be abandoned as this access is no longer expected to be suitable.
Park Bridge	The proposed dual three-lane A12 mainline crosses the B1023 at Messing-cum-Inworth. The widened structure would accommodate a cross-section with three running lanes in each direction, a central reserve, and associated hard strips and verges. The widening would also need to allow for northbound and southbound slip roads for the new junction. The structure would be widened by approximately 27m to the east to accommodate the increased cross-section. There is currently a modification to this proposal being investigated. This would see the nose of the southbound off-slip being moved to the south along the mainline to minimise the impact on the property east of Park Bridge. Park Bridge would still require widening; however, the extent of the widening would be reduced. For this PEIR, it has been assumed that the full extent of widening would be required while the design modification is subject to further study as this is considered to have a worst case environmental impact for the options being considered.
Domsey Brook Bridge	The proposed dual three-lane A12 crosses Domsey Brook at Gore Pit. It is proposed that the structure would be extended to accommodate the new carriageway with three running lanes in each direction, a central reserve, and associated hard strips and verges. The structure would be lengthened by approximately 32m to the east to accommodate the additional lanes and slip roads.
Roman River Culvert	Proposed scheme would involve widening the southbound highway embankment and extending the existing watercourse culvert by approximately 8m. This would necessitate the realignment of a section of the Roman River south of the A12

2.4.21 Proposed scheme would involve widening the southbound highway embankment and extending the existing watercourse culvert by approximately 8m. This would necessitate the realignment of a section of the Roman River south of the A12.the route remains open. This is through provision of overbridges (see Table 2.4) or, where a direct connection is not feasible, alternative routes using suitable diversions are proposed.

2.4.22 The proposed scheme would impact 25 PRoWs, and a further 11 PRoWs would be impacted on sections of the A12 which would be bypassed by the proposed scheme. It also impacts a national cycle route, links at various proposed junctions and where the existing A12 is to be bypassed, and existing shared walking/cycling facilities.

2.4.23 Proposals for WCH provision have been developed in discussion with a broad range of stakeholder groups and with local authorities throughout the development of the proposed scheme. The proposals are shown on Figure 2.1 (Preliminary Environmental Masterplan) in Appendix A and include the following:

- Separate WCH links across four proposed major junctions, enabling users to bypass slip road junctions, including the national cycle route affected by the proposed scheme
- Provision of PRoW bridge connections at 19 locations, either as separate WCH facilities or in conjunction with accommodation bridges or side roads
- Provision of paths to link groups of PRoWs to proposed bridge facilities
- Provision of new toucan crossing facilities (crossings that allow both walkers and cyclists to cross)
- Improvements to existing shared pedestrian/cycling facilities
- Improved WCH connections across sections of the existing A12 to be bypassed, and reintroduction of bus stopping facilities
- For safety reasons, WCH (and possibly slow-moving vehicles) would be prohibited from using the A12 mainline between junctions 21 and 25 (Witham South interchange to Marks Tey interchange) and WCH would be encouraged to use the B1137 between junction 19 and Hatfield Peverel; if users are prohibited from using the A12, alternative routes would be provided for WCH and slow-moving vehicles (more details on restricted vehicles will be explained in the DCO application)

2.4.24 Effects on WCH from the proposed scheme are assessed in Chapter 13: Population and health.

Watercourse crossings

2.4.25 The proposed scheme would require new crossings of watercourses and potential improvements to existing culvert and bridge crossings. There are eight crossings of main rivers (see Table 2.6), six of which comprise existing crossings and two of which comprise new crossings on proposed offline sections of road. Three of the crossings would require minor realignments at the crossing points.

Table 2.6 Watercourse crossings

Watercourse	Description of crossing
Boreham Brook	Proposed scheme would involve slip road widening in this location. This would require widening the southbound highway embankment and extending the existing culvert approximately 10m to the south. The flood model shows the proposed scheme would increase the risk of flooding upstream of the crossing. It is anticipated that flood risk mitigation would be required if this culvert lengthening remains at further design stages. At this stage the mitigation measures have not been developed, however, space has been allowed within the provisional Order Limits for flood compensation.
River Ter	Proposed scheme would involve upgrading the A12 to three lanes per carriageway in this location. This widening would be achieved with no change to the existing bridge structure or highway embankment. It is anticipated that no flood risk mitigation would be required at this crossing.
River Brain	Proposed scheme would involve upgrading the A12 to three lanes per carriageway in this location. This would require widening of the highway embankment on both sides and would require an extension of the existing bridge under the highway. It is anticipated that no flood risk mitigation would be required at this crossing.
Rivenhall Brook	Proposed scheme would involve a new offline crossing of the Rivenhall Brook. It is proposed that the Rivenhall Brook would be realigned, and that the new A12 crossing of the river would be through a culvert structure (similar to the existing A12 crossing). It is anticipated that no flood risk mitigation would be required at this crossing.
River Blackwater	Proposed scheme would involve upgrading the A12 to three lanes per carriageway in this location. This would require widening the existing bridge structure (Ashmans Bridge) and the southbound highway embankment. It is anticipated that no flood risk mitigation works would be required at this crossing.
Domsey Brook (West Crossing)	Proposed scheme would involve widening and realigning the existing A12 in this location. This would require lengthening the existing arch structure which the Domsey Brook flows through under the existing A12 by approximately 50m. A short section of the watercourse immediately upstream of the crossing would be realigned. The flood model shows the proposed scheme would increase the risk of flooding upstream of the crossing. It is anticipated that flood risk mitigation would be required if this culvert lengthening remains at further design stages. At this stage the mitigation measures have not been developed, however, space has been allowed within the provisional Order Limits for flood compensation.
Domsey Brook (East Crossing)	Proposed scheme would require installation of a new offline crossing of the Domsey Brook through a culvert structure. It is anticipated that no flood risk mitigation would be required at this crossing.
Roman River	Proposed scheme would involve widening the southbound highway embankment and extending the existing watercourse culvert by approximately 8m. This would necessitate the realignment of a section of the Roman River south of the A12. It is proposed that the realigned channel would be designed to match the existing channel capacity. It is anticipated that no flood risk mitigation would be required at this crossing.

2.4.26 In addition to the main river crossings, there would be around 30 new culvert structures for ordinary watercourses and drainage channels, and improvements or extensions to around 10 existing culvert structures.

2.4.27 Preliminary assessment has identified that five ordinary watercourses (see Chapter 14: Road drainage and the water environment, for more details) require hydraulic modelling to assess the potential flood risk associated with these watercourses. This modelling is ongoing, and these results will be included in the Environmental Statement and accompanying Flood Risk Assessment (FRA). In advance of the detailed hydraulic modelling, provisional flood mitigation areas have been allocated as mitigation within the provisional Order Limits. Their requirement will be confirmed in the Environmental Statement.

2.4.28 Designs take into account climate change considerations as appropriate, and a preliminary FRA has been prepared to inform requirements (the conclusions of the preliminary FRA are included in Chapter 14: Road drainage and the water environment). The final FRA will form part of the DCO application.

Drainage

Existing highway drainage

2.4.29 The primary drainage elements along the existing A12 between junctions 19 and 25 include the following surface water drainage collection (edge collection) features:

- Concrete surface water channels with catchpit gratings at regular intervals
- Kerb inlet gullies and traditional kerb/gully drainage
- Combined kerb drainage
- Filter drains

2.4.30 The highway drainage networks serving the existing A12 generally have outfalls discharging to nearby field drains, open ditches, watercourses and main rivers. Some of the existing minor side roads have no defined drainage system and rely on over-the-edge drainage into field ditches or runoff into adjacent land.

2.4.31 Drainage surveys did not identify any existing surface water attenuation features, such as attenuation ponds, underground attenuation tanks, flow control devices and pollution control measures.

Proposed highway drainage

2.4.32 The proposed scheme highway drainage is being designed so that, where practicable, existing surface water drainage and outfalls are retained. Proposed offline road sections would have new surface water collection and conveyance systems and new outfalls. Online sections with proposed widening would also require new surface water collection and conveyance systems and this would generally be a like-for-like replacement in terms of the type of drainage system.

2.4.33 Where the road is in cutting, the surface water runoff would be drained to combined surface and sub-surface filter drains in the verges. Where the road is on embankment, the surface water runoff would generally be drained via surface water channels in the verges. Linear drain solutions (slot drains) could be provided instead of surface water channels for spatially constrained areas. The type of edge drainage collection system would vary across the proposed scheme extent and the most appropriate system will be selected in accordance with the requirements of DMRB.

2.4.34 Where kerbs are required, the surface water runoff would be drained via roadside gullies and/or a combined kerb and drainage system. The existing and proposed bridge structures would be provided with adequately sized bridge deck drainage units with outlets connected to carrier drains.

2.4.35 The proposed scheme would increase the amount of impermeable road surfacing, and therefore runoff rates and volumes would increase in the absence of additional attenuation. The runoff rates would be restricted to existing site condition runoff rates (for online road widening) or greenfield runoff rates (for new offline road sections) to mitigate increased flood risk.

2.4.36 Attenuation would generally be provided by attenuation ponds or underground storage units, prior to discharge to existing watercourses or existing drainage systems. For spatially constrained sites (e.g. road sections subject to online widening works), attenuation storage would be provided through the use of oversized pipes and chambers. Attenuation would also be achieved within shallow ditches and swales (linear grass covered depressions which lead surface water overland from the drained surface to an attenuation or discharge system).

2.4.37 The proposed drainage system is being designed to provide attenuation storage so that flooding in events up to and including the 1 in 100 year event with an allowance for climate change would be contained within the proposed scheme boundaries and that the proposed scheme would remain safe for use in that event.

2.4.38 The feasibility of using different sustainable drainage system (SuDS) techniques (e.g. infiltration methods, filter drains and swales) will be investigated when further ground investigation data become available. Until then, the preliminary drainage design will progress with an assumption of ‘no infiltration’, which represents the realistic design outcome. The potential use of infiltration techniques, if found to be feasible, may alter some of the current outfall assumptions and attenuation storage requirements.

2.4.39 The level of water quality treatment required for routine runoff to surface water will vary along the route of the highway. Treatment levels and pollution control requirements are being assessed in accordance with DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020a) and the Highways England Water Risk Assessment Tool (HEWRAT). More information on the HEWRAT assessment can be found in Chapter 14: Road drainage and the water environment.

Lighting

2.4.40 The lighting design is at an early stage of development. At this stage, a scheme-wide lighting assessment has been undertaken which determined that lighting would only be required at the junctions, and not on the mainline. The lighting zones for these junctions have not been calculated at this stage; however, some of the criteria for the equipment to be used have been identified. Luminaires are to have a glare rating of G4 or higher, which means they will be designed with zero tilt to produce no upward glare and minimal back light.

2.4.41 The design will be carried out in accordance with the latest BS 5489 standard (British Standards Institution, 2020) and Highways England's specifications. The design would also take into consideration guidance notes from the Institution of Lighting Professionals, including Guidance Note 1 for the Reduction of Obtrusive Light (2020) and Guidance Note 8 Bats and Artificial Lighting (2018).

Technology

2.4.42 The technology being designed as part of the proposed scheme provisionally includes the following:

- MS4 variable message signs mounted on cantilever and long span cantilever gantries
- Above lane signals mounted on gantries
- Closed-circuit television (CCTV) cameras
- Above ground traffic detectors
- Highways Agency Detection Enforcement Camera System (HADECS) and External Aspect Verification (EAV) technology
- Stopped vehicle detection (SVD) technology on masts or gantries
- Magnetometers to monitor vehicle movements
- Entry slip signals
- Electrical interface cabinets

2.4.43 Variable message signs, mounted on cantilever and long span cantilever gantries, would be used by the Highways England Regional Control Centres to display essential mandatory and advisory signalling to drivers, along with travel information and any potential or upcoming hazard warnings. These would be provided along the route as specified in Highways England guidance, upstream of emergency areas, and upstream of junction diverges. Signals would also be placed on these gantries above each lane to outline mandatory speed limits.

2.4.44 CCTV cameras would be positioned on both masts and gantries to provide a minimum of 95% coverage of the mainline with complete coverage of any emergency areas. Standard mast height would be between 10-15m above ground level.

2.4.45 Traffic detection would be undertaken by radar units mounted on posts at approximately 500m intervals, and within a short distance of every gantry location.

2.4.46 HADECS and EAV technology would be located at one gantry location per link, in order to enforce the variable mandatory speed limits set by the MS4s and AMIs.

2.4.47 Each of the above assets would require power and associated equipment cabinets to enable operation. These would be located in the verge near equipment clusters. Electrical interfaces would be provided at the highways boundary, approximately every 1-2km, ideally over or under bridges or adjacent to local roads to ensure safe and easy access for maintenance workers.

2.4.48 The technology to be included in the proposed scheme has not yet been finalised and is subject to further studies. The information provided above could therefore change prior to the DCO application. The Environmental Statement will provide an updated description of the proposed technology.

Emergency areas

2.4.49 The proposed scheme includes emergency areas at intervals between junctions 21 and 25. There are 10 northbound and 11 southbound, as shown on Figure 2.1 in Appendix A.

De-trunked A12 sections

2.4.50 The existing A12 between junctions 22 and 23 through Rivenhall End is proposed to be de-trunked (trunk road status removed) and returned to Essex County Council's Highway Authority control. The current de-trunking proposal includes the following potential improvements: layout alterations to the existing local road junction at Rivenhall End; closure of Oak Road to improve safety and restrict through traffic; speed limit reduction (40mph) through Rivenhall End; controlled WCH crossing points to eliminate the north-south severance, and pedestrian/cycle routes; and provision of a bus stop at Rivenhall End.

2.4.51 The existing junction 23 southbound on-slip would also be de-trunked and is proposed to be used for access to Hole Farm and Essex County Fire and Rescue Service Headquarters as a single carriageway with one lane in each direction.

2.4.52 It is proposed that the existing A12 dual carriageway between Feering and Marks Tey (between junctions 24 and 25) would be returned to Essex County Council's Highway Authority control. The total carriageway length is approximately 4.5km. This section of de-trunked road would continue to be used by local traffic to gain access into and out of Marks Tey, Feering, Kelvedon and other surrounding villages and would enable traffic to gain access to the proposed scheme via the new junctions 24 and 25.

2.4.53 The current preliminary design proposals are to maintain the dual carriageway as per the existing layout and provide roundabouts in three locations to improve connectivity with local road networks and WCH routes: a five-arm roundabout at the existing junction 24; a four-arm roundabout at Easthorpe Road; and a three-arm roundabout at Wishingwell Farm access road.

2.4.54 Collaboration and discussion with Essex County Council and other local authorities is ongoing to agree acceptable proposals for de-trunking. The de-trunking strategy is therefore subject to change as the design progresses.

Utilities

2.4.55 Underground and overground utilities and services are located adjacent to the existing A12, including internet cables, electricity cables, water pipes and gas pipes. These utilities would need to be diverted where works associated with the proposed scheme would encroach upon them. The diversion options that are being considered are described below. Discussions are ongoing with statutory undertakers (the organisations responsible for the various utilities) to agree diversions. The proposals described are therefore subject to change. This PEIR assesses the environmental impacts associated with the options set out below.

2.4.56 The proposed scheme includes changes to a number of existing utilities. These changes include the diversion of two high pressure gas pipelines operated by Cadent Gas Limited (the Diversions). The first high pressure gas pipeline is located between Springfield in Chelmsford and Little Braxted, running along the southern side of the A12 within the local authority areas of Chelmsford and Braintree. The second is located between the Witham Bypass and Little Braxted running along the south of the A12, also in the local authority area of Braintree. To the extent that the Diversions satisfy the criteria to be considered an NSIP under section 20 of the Planning Act 2008, the Diversions will be treated as NSIPs in their own right.

2.4.57 Even though the Diversions may be treated as NSIPs in their own right, as they are part of the proposed scheme they will form part of the application for development consent which will be made by Highways England to the Secretary of State for Transport. To the extent the Diversions are an NSIP in their own right, they would also be considered against the relevant energy National Policy Statements within the application.

Hatfield Peverel utilities

2.4.58 Two options are being considered for diverting Virgin Media and Vodaphone cables in this area:

- 2m utility corridor at the back of the verge
- Diverting them to the side road (The Street B1137) through Hatfield Peverel

2.4.59 Adding a track on top of the proposed retaining wall was also considered, but this has been dismissed due to the impracticality of access.

Hatfield Peverel access to the properties on Howbridge Hall Road utilities

2.4.60 Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary) away from the bottom of the earthworks slope. The corridor would be 5m to 6m offset from the top of the earthworks for planting and landscaping.

Properties on Howbridge Hall Road utilities

2.4.61 Vodafone, Openreach and Virgin Media cables would be diverted offline to the south of the properties on Howbridge Hall Road.

Witham bypass utilities

2.4.62 Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary). The corridor would be 5m to 6m offset from the top of the earthworks for planting and landscaping.

Properties on Maldon Road utilities

2.4.63 There is a potential impact between the proposed scheme earthworks and a high-pressure gas main, as well as with a proposed noise barrier and a high voltage cable while piling.

2.4.64 Two options are being considered for utilities diversions in this area:

- Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary). The corridor would be 5m offset from the top of the proposed retaining wall.
- The preferred option is to divert the utilities to the south of the properties on Maldon Road (5m away from the properties).

Blackwater Lane and Witham bypass utilities

2.4.65 Vodafone, Openreach and Virgin Media cables would be diverted away from the A12 mainline, through Blackwater Lane, Perry Road and Freebournes Road.

2.4.66 A high-pressure gas main runs through the same area and would potentially be diverted to the east of the A12. However, further discussion with the relevant operator will inform requirements for any diversion.

Junction 22 utilities

2.4.67 Further discussion with the relevant operators will inform requirements for any diversion required to the gas mains in this area. A potential solution involves aligning the gas mains in this area and bringing them together across the proposed scheme.

Junction 23 utilities

2.4.68 Two options are being considered for utilities in this area:

- Diverting utilities to the south side road (access road to Essex County Fire and Rescue Service Headquarters)
- Diverting utilities to the north side road (access road into Kelvedon)

Junction 23 and junction 24 utilities

2.4.69 Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary). The corridor would be 5m to 6m offset from the top of the proposed scheme earthworks for planting and landscaping.

Inworth Road utilities

2.4.70 Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary). The corridor would be 5m to 6m offset from the top of the proposed scheme earthworks for planting and landscaping. Utilities would potentially cross underneath the A12 at Park Bridge and would join an existing utilities corridor.

Junction 25 utilities

2.4.71 Utilities in this area would be diverted away from the A12 mainline and junction 25 works via London Road.

2.4.72 An alternative option moving utilities to the north side road was considered but has been dismissed due to the adverse impact on traffic during construction.

East of junction 25 utilities

2.4.73 Three options are being considered for diverting utilities in this area:

- Utilities would be diverted outside the highway boundary (5m corridor outside the highway boundary). The corridor would be 5m to 6m offset from the top of the proposed scheme earthworks for planting and landscaping. This option would have a potential impact on a historic landfill and the proposed realignment of Roman River.
- Utilities would to be kept in the A12 corridor in a widened verge.
- Create a utilities corridor to the south of properties along London Road. Further studies are required to confirm if this option is practicable.

Environmental design

2.4.74 The scheme design is an iterative process which considers the potential significant effects on environmental receptors. The first option in mitigating any impact is to seek design measures that would enable the impact to be avoided or, if this is not possible, reduced. This is referred to as embedded mitigation and includes measures such as changing the road's horizontal and vertical alignment, reducing the temporary and permanent footprint of the proposed scheme and altering construction methods.

2.4.75 Environmental considerations that have influenced the option development and selection process, and scheme design, are set out in Chapter 3: Assessment of alternatives. The ongoing design development will continue to be influenced by the EIA process.

Land for mitigation

2.4.76 It is not always possible to design out environmental impacts. As such, it is necessary to develop additional mitigation measures to reduce or offset impacts, and to include land within the proposed scheme Order Limits to deliver these measures.

2.4.77 Examples of permanent environmental mitigation that have been developed for the proposed scheme include noise barriers and bunds to mitigate noise level increases from road traffic, flood risk mitigation, landscape planting to screen visual effects, and biodiversity habitat creation.

2.4.78 More detail on specific mitigation for each environmental aspect is provided in Chapters 6 to 15 of this PEIR. Mitigation measures will continue to be developed throughout the design development, informed by the EIA.

2.4.79 A Preliminary Environmental Masterplan has been produced for this PEIR which shows the proposed scheme design and areas within the provisional Order Limits reserved for environmental mitigation. This is included in Appendix A (Figure 2.1). The Preliminary Environmental Masterplan shows the current design and provisional Order Limits, as this represents the outcome from the PEIR assessment in terms of the proposed design and mitigation measures.

2.4.80 The Environmental Masterplan will be updated following the statutory consultation, with a final version included in the Environmental Statement.

Demolition and land take

2.4.81 Land would be required both temporarily and permanently to construct, operate and maintain the proposed scheme. Permanent land-take requirements include the footprint of all the proposed highway infrastructure and associated earthworks, drainage works and access roads, together with environmental mitigation areas such as landscape planting and biodiversity habitat creation.

2.4.82 The total land take within the provisional Order Limits is estimated to be 847ha. Total areas required for temporary and permanent land take are subject to change with the evolving design and will be confirmed as part of the DCO application. In line with the requirements of the DCO, land take will be kept to a minimum and justified in the Statement of Reasons to accompany the DCO application.

2.4.83 There are a number of properties within the provisional Order Limits. Three of these, two of which are private residences, and one a private business, would require demolition. Consultation is ongoing with affected property owners. Further information is provided in Section 3.3 of Chapter 3: Assessment of alternatives.

2.5 Construction

Construction programme and phasing

2.5.1 Construction is currently scheduled to commence in 2023. The proposed scheme could take approximately four years to construct, with an assumed opening year of 2027. However, this will be reviewed as the scheme design is refined and the construction programme developed.

2.5.2 From the start-on-site date, the first six months would mainly involve the setting up of construction compounds, the diversion and protection of utility services, archaeological mitigation, and the implementation of other required environmental mitigation (such as protected species mitigation) before the main construction works could commence.

2.5.3 It is assumed that some of the ecology and archaeology mitigation work would be done in advance of the start-on-site date, as well as some of the critical diversions of utility services. All advanced works would be included in the DCO application and assessed in the EIA.

2.5.4 The extent and volume of earthworks is the main determining factor for the duration of the programme. In order to maximise the efficiency of the earthworks operations, these bulk activities would be carried out between mid-March and the end of October each year. There are therefore only three earthworks seasons in which to complete these works.

2.5.5 It is currently assumed, in order to meet the planned open-to-traffic date, that the proposed scheme would be constructed as a single project, with the three design sections of the proposed scheme described in Section 2.4 being undertaken concurrently.

2.5.6 Each section of the proposed scheme has complex construction works, the timings of which are critical to the construction programme. The construction programme is dictated by critical areas where existing traffic links are to be maintained while the new alignment and links are being constructed in a phased manner. In design section 1, this critical area is in Hatfield Peverel where three bridges need to be demolished and re-built. In design section 2 the critical area is around the construction of junction 22 and associated links. In design section 3, the critical area is the construction of junction 24 and the new underbridge.

2.5.7 The last eight months before the proposed scheme opens to traffic would be used for the scheme-wide installation and commissioning of lighting, technology and signage.

2.5.8 Peak construction works would likely occur in the second and third quarters of 2025 (subject to change until the construction programme is finalised). During this time, the earthworks operations would be at full capacity in every section of the proposed scheme and every borrow pit (see Table 2.9 and Figure 2.2) would be operating to its maximum capacity. Drainage works would also be at their peak, there would be 14 bridges at different stages of construction, and road surfacing works would be starting in earnest.

Compounds and haul roads

Main compounds

2.5.9 Due to the scope of works and anticipated staff numbers across the proposed scheme, two main compound areas have been identified, subject to further investigations. These are located at the existing junction 20b and at junction 22 (see Figure 2.2).

2.5.10 The junction 20b compound has been selected as a suitable location due to the complex work in design section 1 around Hatfield Peverel. The area of the proposed compound is approximately 86,000m^2. The compound would predominantly be used as the main base for the site team and would include welfare facilities, office space with sufficient parking, training rooms, and potentially an accommodation block, concrete batching plant, materials testing lab and aggregate processing area (subject to further design development). A

temporary access would be required from the junction 20b northbound on-slip. As the construction phase progresses, an access would need to be created off one of the access roads linking to the new junction 21.

2.5.11 The junction 22 compound has been selected due to its central location within the proposed scheme and the critical nature of works in this area. The area of the proposed compound is approximately 75,000m^2 and would predominantly be used by the project leadership and design teams. There would also be space for a large logistics yard, and potentially a concrete batching plant and asphalt plant, and material testing lab as well (for this PEIR, it is assumed these would be required). Access to the compound would be directly on/off the northbound carriageway of the A12.

2.5.12 The intention is to limit the impact to the local road network as far as practicable. The aim is to achieve this by accessing compounds from as close to the mainline as practicable, so site traffic does not congest lower-capacity local routes.

2.5.13 Compounds tend to be busy and therefore have been located away from domestic areas where feasible. The main compounds, at some stages, are likely to be in operation 24 hours a day (and have been assessed in this PEIR on this assumption), so lighting and noise impacts have been considered when locating compounds.

2.5.14 As a general approach, surface and foul water would be connected into existing buried mains with the relevant statutory undertaker's approval. Where this is not possible, the use of on-site treatment and discharge to local ditches and watercourses would be investigated with the relevant authority.

Satellite compounds

2.5.15 To mitigate the need for large numbers of staff to travel along the proposed scheme on a daily basis, four satellite compounds have been considered to supplement the two main staff compounds (see Figure 2.2):

- Two satellite compounds based at junction 19 for local works
- One satellite compound at Easthorpe Road between junctions 24 and 25 for the offline works in design section 3 (there is also a backup location for an accommodation block located adjacent to Easthorpe Road)
- One satellite compound at junction 25 for the works around that area

2.5.16 In addition to the above satellite compounds, temporary laydown areas (small compounds) would be required throughout the length of the proposed scheme. These would generally be self-contained units facilitating localised construction works by providing staff welfare facilities, parking areas for vehicles and material storage areas.

2.5.17 The number of satellite compounds and laydown areas may decrease in size and number depending on how the design and programme develops. The number of these areas included in the provisional Order Limits has therefore been taken as a reasonable scenario for the purposes of the PEIR assessment.

Haul roads (temporary roads)

2.5.18 To reduce the amount of construction traffic using the existing road network, temporary haul roads would be needed. Where practicable, these are likely to be routed alongside the existing mainline; however, where this is not practicable, additional temporary land take may be required.

2.5.19 Where the existing alignment of the A12 would be widened, this would be undertaken under traffic management by narrowing the existing lanes and introducing speed restrictions. A construction haul road would be utilised along the verge, with entry and exit points into the traffic management for construction traffic. Traffic management would be subject to an approved traffic management plan.

2.5.20 Borrow pit E (see Table 2.9 and Figure 2.2) would be used to fill the northbound side of the new junction 21, with material transported via haul roads. Borrow pit F would have two earthworks haul roads to transport fill material to the southbound side of junction 21 and to the south of Witham towards Oliver's Bridge.

2.5.21 For the Rivenhall End bypass between junctions 22 and 23, a haul road would be constructed within the footprint of the new road alignment. All general fill material would be transported from borrow pit I. There are currently two options (subject to further assessment) for how the material would be transported from borrow pit I (the provisional Order Limits assessed in this PEIR includes both of these options):

- Option 1 – A temporary bridge would be constructed over the A12, connecting borrow pit I with the Rivenhall End bypass. All material transport would be via dumper, reducing the requirement for vehicle movements on the local network. A haul road would also be needed to transport material to the south side of junction 23 and the area between Cranes and Ashmans Bridge.

- Option 2 – An earthworks haul road would be constructed from borrow pit I to junction 23. The fill material would then be transported via haul road to the Rivenhall End bypass. This option would be less complex with regards to the construction but may involve more vehicle movements on the local network, and can also be used to service the south side of junction 23 and the area between Cranes and Ashmans Bridge.

2.5.22 For the new offline bypass between junctions 24 and 25, a haul road would be constructed within the footprint of the new road alignment. It is anticipated that there would be a surplus of material within this section of the construction works. All surplus material would be transported to design section 2 via haul road.

2.5.23 Borrow pit J would provide sand and gravel structural backfill, which would move across the length of the proposed scheme by both online and offline haul roads. Two haul roads have been identified from borrow pit J, as well as to transport cut material from the new junction 24 on the southbound side. One haul road would be used to transport material west from the borrow pit to a plant crossing point at Highfields Lane before continuing onto the southbound

embankment between junction 23 and the new junction 24. A second haul road would be used for the southbound embankment east of Inworth Road. A plant crossing point would be required at Inworth Road.

2.5.24 Construction plant crossings are likely to be required across minor roads to join haul roads along the length of the proposed scheme. These would be temporary traffic signal controlled junctions to ensure road user safety.

Logistics and traffic management

Logistics

2.5.25 The workforce and material sourcing would aim to be as local to the proposed scheme as possible. However, this would not be practicable for all sub-contractors and speciality works. It is therefore anticipated that site staff and materials would access the proposed scheme via the M25/A12 route, this being the fastest route from the south and west, or via the A120/A131 from north of the country.

2.5.26 A compound would be set up off Gershwin Boulevard to be used as a small logistics yard. This would consist of an area for parking for small site vehicles and general materials storage for the proposed scheme.

2.5.27 The proposed scheme would aim for just-in-time deliveries of materials to the point of work to reduce inefficient material handling. Some bulk materials would need to be stored in logistics yards (within the main and satellite compounds) so they could be distributed when needed.

2.5.28 HGV movements during the construction phase would consist of two types of vehicle movements:

- Internal – these are the HGVs dedicated to the haulage of materials within the extents of the proposed scheme and this refers exclusively to the movement of excavated materials to and from the borrow pits and between work fronts (i.e. cut to fill).
- Imports – these encompass all the deliveries coming into the proposed scheme from outside its boundaries and include, but are not limited to, ready mix concrete, asphalt, granular materials, and miscellaneous materials such as pipes, signs, barriers, fences and cabins.

2.5.29 Peak daily HGV movements are likely to be approximately 450 deliveries into site and 450 out (900 movements in total). The outline construction programme is currently being developed. At this stage, it is estimated that the peak period of works could last between six and eight months.

2.5.30 Given the proximity of GEML and associated rail stations near the proposed scheme, the potential for importing and exporting material by rail is being investigated.

Traffic management

2.5.31 It is assumed that the existing A12 would be kept open at peak hours during construction of the proposed scheme. Where construction activities such as existing online bridge demolition or online bridge construction (for example, bridge deck beam installation) prohibits safe road operation, road closures

would be required at nights and weekends to minimise disruption. Plenty of advance notice and publicity regarding any road closures would be given to local communities and road users. Suitable diversions would be put in place. Widening of online sections of the A12 would require temporary traffic management measures during construction, such as narrow lanes, lane closures and contraflow. The two bypasses would be constructed offline, minimising the disruption to traffic flows along the existing A12 in these areas. The anticipated traffic management measures are summarised in Table 2.7.

Table 2.7 Traffic management

Construction element	Anticipated traffic management measures
Online widening	Traffic management where online widening works would take place would predominantly take the form of narrow lanes and speed restrictions to enable central reserve hardening, if required, and verge widening.
Offline bypasses between junctions 22 and 23, and between junctions 24 and 25	Where the proposed alignment goes offline and crosses existing local roads, new bypasses would be constructed first and only then would the existing roads be closed to ensure access for local traffic is maintained. In order to tie the roads in safely, temporary road arrangements including traffic lights and overnight/weekend closures would be required.
Junction 19	Widening the J19 bridge would require the central reserve to be upgraded to run traffic. This may need to be carried out under night-time full closures of the carriageway and with possible lane closures. This would create enough working space to install 24 hour narrow lanes to the northbound carriageway which would then switch to the southbound carriageway. Installation of the bridge decks would require full night-time carriageway closures.
Hatfield Peverel	The two sides of Hatfield Peverel are linked by three bridges that would be taken down and reconstructed as part of the proposed scheme. Most of the construction works are intended to be carried out off-site in a holding yard. The intention is to maintain traffic flows between both sides as much as possible by keeping at least one bridge open at all times. It is proposed to harden the existing central reserve to create additional space for construction traffic within the existing highway cross-section. This would then allow for 24-hour narrow lanes by moving all four lanes as close to the northbound verge as possible to provide working space to construct the southbound carriageway. Traffic would then be switched to the opposite side to construct the northbound carriageway when the southbound is complete. Opposing traffic would be divided by temporary barriers. An enforced speed system may be put in place. Any required bridge lifts and demolition may take place under full weekend carriageway closures and local road closures.

Construction element	Anticipated traffic management measures
Junction 21	J21 would mostly be constructed offline with only the slip roads and tie-ins requiring local road weekend closures, and the installation of the deck beams requiring a full weekend closure of the A12. Once the new junction is fully operational, the A12 traffic, both northbound and southbound, would be diverted onto the slip roads to facilitate the main carriageway widening.
Junction 22	Construction of the new J22 would require phased traffic management to maintain traffic flows. This would be a mix of 24-hour narrow lanes and overnight/weekend carriageway closures to be able to construct the tie-ins to the new J22 and new section of the A12 carriageway. Access to Colemans Farm Quarry and Little Braxted lane would be maintained throughout the construction period.
De-trunking between junctions 22 and 23	A temporary T-Junction arrangement would be required from the proposed Braxted Road onto Oak Road to maintain traffic flows with the A12 southbound carriageway via the existing slip roads onto the A12. The construction of roundabouts and the access to Essex County Fire and Rescue Service Headquarters would include daytime lane closures under two-way traffic lights and full road closures through the night to facilitate tie-ins.
Junction 24	Construction of the new J24 is key as the slip roads of the junction would be utilised to divert mainline traffic while the new underbridge structure is constructed. Weekend and possible night closures would be required to construct J24 tie-ins. The use of temporary barriers and an enforced speed system would be required for maintaining traffic flows through this section.
De-trunking between junctions 24 and 25	Temporary slip roads are likely to be required along the existing A12 southbound carriageway between J24 and J25 to link new side road diversions to the network. This would allow mainline construction to proceed. These temporary slip roads would then be built into the permanent roundabout arrangements during the de-trunking phase. The de-trunking phases would include daytime lane closures under two-way traffic lights and full road closures through the night to facilitate tie-ins.
Junction 25	The construction of the main carriageway up to J25 would progress offline. A temporary southbound entry slip road would be constructed so that the existing could be de-commissioned to enable the tie-in to the existing A12 carriageway through a mix of 24-hour narrow lanes and overnight/weekend carriageway closures. Re-configuration of the Marks Tey roundabout and London Road would require phased traffic management to maintain traffic flows including night-time closures and narrow lanes.
Technology and drainage	Overnight closures may be required where there is limited space in some verge areas to install directionally drilled telecommunications duct crossings and new drainage crossings under the existing A12 carriageway.

Construction element	Anticipated traffic management measures
Restrictions/operational constraints	Speed restrictions would be in place from when the works commence until completion. Lane closures would be between the hours of 20:00 to 06:00 (traffic count dependant) and full closures from 21:00 to 06:00 (traffic count dependant). Two-lane running would be maintained between the hours of 06:00 to 20:00 to minimise the disruption to traffic flows. All diversion routes for full closures would be pre-signed and advance warning signs would be installed prior to the closures dates.

2.5.32 The current A12 hard strip is very narrow and the verges are soft. This potentially means overnight road closures may be required to establish preliminary access into verge work areas, to create temporarily hardened runoff areas for safe access and egress during daytime live traffic times.

2.5.33 Overnight and weekend closures may be required at tie-in locations to install new road construction arrangements and complete surfacing.

2.5.34 Where road closures on the A12 are required, the diversion route would likely be (from west to east) via the A130, A131 and A120.

2.5.35 An outline Traffic Management Plan will be prepared and submitted with the DCO application. This will provide detailed traffic management proposals for each phase of construction work. The Traffic Management Plan is a live document and will be reviewed and updated during the construction preparation stage and throughout the construction phase and handover period.

Workforce management

2.5.36 At this stage, the approximate size of the workforce is expected to be between 1,000 and 1,500 staff on site each day (of which approximately two-thirds would be site based, and the remaining one-third site-office based).

2.5.37 It is expected that site staff would stay overnight in the local area, using towns such as Chelmsford, Colchester and Witham, if not already from the local area. There is also the possibility of an on-site accommodation block being constructed.

2.5.38 Peak workforce travelling times are expected to fall in line with the usual peak commuting times of 07:00–09:00 and 16:00–18:00. It is likely that the construction team would travel by shuttle bus from main compound areas to work fronts, satellite compounds and laydown areas where feasible to reduce the volume of site traffic on the road at these times.

2.5.39 This arrangement will not be possible for all sub-contractors/trade types due to the necessity of transporting work equipment in their company vehicles. Other methods of travelling to the proposed scheme and accessing work areas will be investigated.

Working methods

2.5.40 The majority of works would be undertaken during normal daytime hours with appropriate traffic management in place. Normal daytime hours are considered to be between 07:30 and 18:00 between Monday and Friday, and 07:30 and 13:00 on Saturday. In addition, there may be an hour before or after these times for site set up and close down (this would include activities such as deliveries, movement to place of work and general preparation works, but would not involve operation of plant or machinery). During the summer months, the working hours could extend to 07:00 to 19:00.

2.5.41 Work undertaken outside these hours, as well as on bank holidays, is considered off-peak working. There would be certain instances where night-time or weekend working would be required. Night-time or weekend working may be required for the following activities:

- Online pavement construction where the existing narrow width of the A12 would require a hardening of the central reserve to run traffic on a narrow lane arrangement during the day
- Resurfacing of the existing carriageway
- Offline carriageway and junction slip road tie-ins
- Demolition of existing structures, construction of new structures, and any potential movements of large transporters to deliver bridge superstructures from the offline construction areas to the permanent locations
- Some compounds may be in 24-hour operation at certain stages of the construction programme to facilitate off-peak working

2.5.42 Traffic diversions, alternative piling methods and offline bridge deck construction are options that are currently being investigated to mitigate the duration of any inconvenience due to overbridge road closures.

2.5.43 Piling would likely be required for construction of new structures, including bridges, gantries and retaining walls.

Plant and equipment

2.5.44 Construction activities would involve the use of heavy plant items with the potential to emit high levels of noise and vibration and contribute to pollution, such as excavators, dumper trucks, dozers and compaction equipment. Noisy activities also include demolition of existing features and piling for structures. Further information of noise impacts during construction is included in Chapter 12: Noise and vibration. Typical plant required for various construction activities is provided in Table 2.8.

Table 2.8 Typical construction plant

Construction activity	Typical plant and equipment required
Site clearance	Woodchipper, strimmer, chainsaw, mechanical and hydraulic breakers
Earthworks	Roller, bulldozer, grader, excavator, material sorting plant, tractor with bowser, dumper truck
Drainage	Roller, excavator, dumper truck, tractor with trailer, thrust bore rig, concrete delivery truck
Fencing	Excavator, auger, post knocker
Technology	Vibration plate, excavator, roader tipper and grab, directional dig rig, loader crane
Street lighting	Excavator, loader crane
Pavement	Vibrating roller, floor saw, hammer drills, dumper truck, asphalt/cement bound granular material layer
Structures demolition	Dumper truck, loader crane, demolition excavator, concrete crusher, cherry picker
Structure construction	Vibration plate, roller, excavator, loader crane, self-propelled modular transporter, crane, cherry picker, piling rig, concrete pump, concrete delivery truck
Slipform	Slipform paver, concrete delivery truck
Archaeology excavation	Excavator, dump truck
Miscellaneous	Delivery HGVs, motorised saws, tower lights

2.5.45 To mitigate the impacts associated with construction plant and equipment, standard mitigation measures would be undertaken as necessary during the construction phase of the works. This includes measures such as programming works to minimise work outside normal working hours and specifying use of lower-noise emitting equipment. Details on these standard measures is provided in Chapter 12: Noise and vibration.

Earthworks

2.5.46 Large amounts of fill material would be required for construction, particularly for junctions and the offline sections at Rivenhall End and Marks Tey. A proportion of this material may be generated from the construction works at the existing junctions, and if suitable, would be used within other sections of the construction works to minimise importing material. However, there is still a shortfall of material, estimated at approximately 631,000m^3.

2.5.47 The overall cut/fill balance for design section 1 shows a 201,000m^3 shortfall in material. The shortfall would be met by a surplus of cut material from junction 19 and design section 2 online widening, along with material from borrow pits E and F (see next sub-section for information on borrow pits).

2.5.48 The overall cut/fill balance for design section 2 shows an approximate 580,000m^3 shortfall of material. Borrow pit I would make up for this deficit in fill material, along with excess material from the cut of the new offline alignment between junctions 24 and 25.

2.5.49 The overall cut/fill balance for design section 3 shows approximately a 150,000m^3 surplus of material. The majority of this material would be transported for fill material within design section 2.

Borrow pits

2.5.50 Options have been assessed for import of bulk material or the use of on-site borrow pits to source the required material. The preferred option is to use on-site borrow pits which would reduce potential adverse impacts associated with transport of imported fill. Ground investigations and viability studies have been undertaken on 11 potential borrow pit sites. These studies have resulted in a short list of four borrow pits which have been included within the provisional Order Limits at this stage (see Figure 2.2). Table 2.9 summarises the borrow pits within the provisional Order Limits. Reasoning for why the other seven borrow pit locations were discounted is provided in Section 3.3 of Chapter 3: Assessment of alternatives.

Table 2.9 Borrow pits

Borrow pit	Location and size	Purpose
E	Located between the existing J20b and J21, between the A12 and the GEML. Access to this location would be via haul roads between the borrow pit and new J21. The total area of borrow pit E is approximately 140,000m^2.	To be utilised for fill material for the construction of the new J21, northbound side.
F	Located to the east of J21 on the south side of the A12 just below Witham. Access to this location could either be directly from the A12 or a temporary access would be created from J21. The total area available is approximately 130,000m^2.	To be utilised for fill material for the construction of the new J21, southbound side. Secondary function of the borrow pit is to supply material to the south of Witham towards Oliver's Bridge.
I	Located to the east of Rivenhall End and to the west of J23 (Kelvedon), between the A12 and the GEML. Access and egress to the borrow pit from the A12 would either be by a haul road to J23 or via a temporary bridge over the A12. The total area of borrow pit I is approximately 138,000m^2.	To be utilised for all fill material required in design section 2 of the proposed scheme, where the largest deficit of material is required.

Borrow pit	Location and size	Purpose
J	Located along the southbound side of the A12 with Inworth Road located immediately to the east, and Highfields Lane to the west. Access and egress to the borrow pit from the A12 would be immediately off the A12. A haul road west and a haul road east have been proposed to export material from the borrow pit. The total area of borrow pit J is approximately 214,000m^2.	To be utilised for granular shoulder fill and structural backfill across the proposed scheme.

2.5.51 The size, depth and material yields of the borrow pits are subject to ongoing ground investigation and material volume calculations. The areas provided in Table 2.9 are approximate values at this stage of the design development, to give an indication of the extent of the proposed borrow pits. It is possible that these areas could increase or decrease as further studies progress. Land has been included in the provisional Order Limits at this stage to accommodate a change in the size of the borrow pits. The parameters of the borrow pits will be refined for the Environmental Statement, which will also set out limits of deviation defining the maximum size and depth of borrow pits if development consent is granted.

2.5.52 If required, it is envisaged that aggregate processing plant would form part of the allocated borrow pit areas, and the PEIR assessment has been undertaken on this basis.

2.5.53 Environmental constraints and the sensitivity of the receiving environment have been considered when siting and designing the proposed borrow pits. This includes specifying a 30m exclusion zone where badger setts, hedgerows and trees are located near the proposed borrow pits. Borrow pits have been located to avoid densely populated areas. Where isolated properties are in close proximity to the borrow pits, a seeded bund would be installed around the pit perimeter to provide noise and visual mitigation.

2.5.54 Restoration proposals and the final land use of the proposed borrow pits is subject to further assessment. For the purposes of the PEIR assessment, it is assumed that borrow pits would be left as water bodies as a worst-case scenario. Restoration proposals will be developed further for the Environmental Statement in consultation with relevant stakeholders.

Drainage and de-watering

2.5.55 Temporary dewatering of excavations (the removal of water from solid material or soil), including borrow pits, embankment cuttings and for structure foundations could be required during construction which could have a potential negative impact on groundwater and groundwater quality. Further assessment is being undertaken to identify the impacts of dewatering activities. Ground investigations are also being undertaken to assess the risk of contaminated land impacting on groundwater and any need for protective measures.

Utilities diversions

2.5.56 The options being considered for utility diversions are described in Section 2.4. Utility diversions would take place prior to the main construction works, after DCO consent has been granted. Some critical diversions may take place before the start-on-site date; it is assumed that in these cases diversions would be delivered under the statutory undertaker's permitted development rights. In any event, all advanced works would be included in the DCO application and assessed in the EIA.

Environmental management

2.5.57 All construction works would be undertaken with appropriate environmental controls in place, in line with an Environmental Management Plan (EMP). A first iteration of the EMP will be included with the DCO application (see Section 5.4 of Chapter 5: Environmental assessment methodology).

Carbon management

2.5.58 In order to deliver Highways England's aspirations with respect to the minimisation of carbon emissions and the efficient use of resources, the carbon intensity of the proposed scheme will be established and monitored throughout the design and construction phases.

2.5.59 Processes to evaluate greenhouse gas emissions (GHG) associated with construction of the proposed scheme are being embedded into the design process, thereby informing and identifying opportunities for iterative reductions in such emissions. These processes will inform the design stages allowing GHG emissions to be considered in a timely manner, rather than at the end of the design process. The sharing of information is being promoted, along with the identification of innovations and engagement with suppliers, across the project team to ensure that GHG emissions along the supply chain have been considered.

Sustainable procurement

2.5.60 In addition to ensuring a carbon efficient design, a sustainable procurement strategy will be implemented to ensure that low carbon materials are specified, where practicable, and that the carbon intensity of materials and sub-contract packages is measured and monitored throughout. This will include the responsible sourcing of the key material elements (asphalt, concrete, aggregate, steel, aluminium, plastics, timber and wood derived products) to be used in the construction of the proposed scheme (see Chapter 11: Material assets and waste, for more details).

Materials and waste management

2.5.61 Material resource efficiency will be implemented throughout the detailed design and construction of the proposed scheme. This will include the implementation of resource efficient construction principles, adoption of responsible sourcing practices, preparation of a Site Waste Management Plan and compliance with relevant legislation, policies and statutory guidance for materials and waste. Site-won (including demolition and excavation) materials arising from the

proposed scheme will be reused and recycled, and where practicable, construction materials will be responsibly sourced from local sources of supply with consideration for secondary and recycled content.

2.6 Operation and maintenance

2.6.1 There are a number of high-level principles which the proposed scheme is actively pursuing for the maintenance of assets once operational. These include, but would not be limited to, the following:

- Exploring off network access for assets to reduce the number of lane or road closures required to facilitate maintenance
- Combining maintenance programmes to allow for the most effective use of traffic management and reduce the amount of work requiring deployment of traffic management on the network
- While the scope has yet to be defined, there is an aspiration for the proposed scheme to provide a maintenance-free period of five years post completion, with exceptions and not including cyclic and reactive maintenance activities
- Where embankments would be steeper than 1:3 slopes, exploring environmental planting solutions which have near to zero maintenance requirements
- All new grasslands within mechanical gradient tolerances for mowers would be low nutrient as standard (the low nutrient standard is defined as not using topsoil in the design of new grassland plots)
- No topsoil would be applied to areas of the soft estate that are deemed safety critical such as sight lines, in front of signs, and access areas (this would reduce vegetation height and plant growth, improving safety and reduce maintenance requirements while also contributing to biodiversity)
- Use of technology to facilitate maintenance, including use of wireless assets to reduce the need for ducting
- Exploring the diversion of statutory utility corridors outside the highway boundary to reduce the operational impact to the A12 when assets require maintenance
- During detailed design, materials would be further considered which could reduce the amount of maintenance required for an asset
- Complementing national policies to reduce the risk to road workers and researching the potential application of new and innovative solutions which could be of benefit to operations and maintenance

2.7 Changes in traffic flows

2.7.1 The impact that the scheme is predicted to have on traffic flows is discussed in detail in the Traffic Modelling Report for Consultation. A summary of the predictions is provided below.

2.7.2 On the A12 itself, the following impacts are expected:

- Traffic would reduce significantly on the two sections of the existing A12 that are bypassed as part of the proposed scheme (Rivenhall End and between junctions 24 and 25).
- Traffic levels would increase on the A12 between junctions 19 and 25, as well as on the sections of the A12 on either side of the scheme. Because the A12 would see such an improvement in journey times and reliability, traffic would re-route onto the A12 away from other less suitable routes. People are also predicted to make more trips along the A12 corridor in general if the road is improved.

2.7.3 On local roads, a summary of key impacts is provided below. Details of predicted traffic changes, including tables and maps, are provided in the Traffic Modelling Report for Consultation.

B1137 Main Road, Boreham

2.7.4 Following the closure of the junction 20a access onto the A12 towards Chelmsford, most traffic which previously used this access would instead join the A12 at the new junction 21. However, some traffic is predicted to travel instead along Main Road and use A12 junction 19. This would result in an increase in traffic on Main Road through Boreham in the AM peak of around 175 vehicles per hour. Although traffic would increase, it would still be within the operational capacity of the road and the day-to-day performance of the road would not be expected to worsen. Traffic in the PM peak is not predicted to change significantly.

The Street, Hatfield Peverel

2.7.5 Junctions 20a and 20b would be closed as part of the proposed scheme. This would mean, for instance, that traffic wanting to go southbound on the A12 from Maldon Road would now be sign-posted to the new junction 21 rather than using The Street and junction 20a.

Little Braxted Lane

2.7.6 The proposed new junction 22 provides a direct access to Little Braxted Lane and in the future it is expected that traffic would increase on Little Braxted Lane. This has been discussed this with local parish councils and Essex County Council, and the Applicant will continue to work collaboratively with them to consider whether interventions are required.

Braxted Park Road

2.7.7 Traffic from Tiptree would be able to access the A12 southbound directly using the new junction 24 via Inworth Road. The existing route to join the A12 at Rivenhall End via Braxted Park Road would therefore see a reduction in traffic.

Braxted Road, Kelvedon

2.7.8 The route from Braxted Park Road into Kelvedon via Braxted Road is predicted to have an increase in traffic. Although the percentage increase in traffic is high, this is due to the very low level of traffic on this road to begin with. The absolute change is small at around 40-70 vehicles per hour in the AM and PM peak, or around one car per minute. It is not expected to affect the day-to-day performance of the road.

B1024 Kelvedon

2.7.9 Traffic on the B1024 near Kelvedon and Gore Pit (London Road, Kelvedon High Street, Feering Hill) is predicted to reduce. Junction 24 would be replaced by a new junction (catering for traffic travelling in all directions) with a direct connection to Inworth Road. This means that traffic from south of the A12 such as Tiptree would no longer need to travel via Kelvedon and Feering to access the A12.

B1023 Inworth Road

2.7.10 Inworth Road north of the A12 would have a reduction in traffic, as traffic from Tiptree would be able to join the A12 directly at the new junction 24 rather than travel via Kelvedon or Feering. The location of the new junction 24 was proposed by several stakeholders and has several benefits. However, the proposals would see an increase in traffic on Inworth Road south of the A12 using this route to access junction 24 from the south. While assessments indicate that Inworth Road is suitable for the expected increase in traffic, the provisional Order Limits currently include land to allow for potential improvements.

Easthorpe Road

2.7.11 Easthorpe Road would no longer join the A12 directly, as that section of the A12 would be bypassed and retained for use by local traffic. There is predicted to be an increase in traffic on Easthorpe Road. Although the percentage increase in traffic is high, this is due to the very low level of traffic on this road currently. The absolute change is small at around 10-20 vehicles per hour in the AM and PM peaks, which is not expected to affect the day-to-day performance of the road.

2.8 Design uncertainty and limits of deviation

2.8.1 This PEIR is based on an early preliminary design of the proposed scheme. The location and provisional Order Limits of the proposed scheme are shown on Figure 1.1 (Appendix A). In accordance with the guidance provided in the Planning Inspectorate's (2018) Advice Note Nine: Rochdale Envelope, the provisional Order Limits have been drawn at this stage to allow some flexibility. The scheme design process is ongoing, and as such, it is not possible at this point in time to define exactly the footprint of the proposed scheme. Figure 1.1 is intended to show the realistic scenario, including temporary working areas that could be required for construction compounds, temporary works, material storage, haul roads and potential borrow pits, based on current knowledge.

2.8.2 The DCO application will include Works Plans with limits of deviation for the proposed scheme design. Limits of deviation provide an envelope of development, as opposed to specific dimensions, and are used to allow design flexibility. The ongoing EIA will help to inform the limits of deviation. For example, where there are environmental sensitivities, the limits of deviation may be smaller, and the design more fixed, to avoid the design impacting on a particular environmental feature.

Temporary works

2.8.3 The construction methodology is still in development. The construction methodology in Section 2.5 provides approximate descriptions for temporary construction activities such as compounds and borrow pits. These are provided to give an indication of the extent of these activities but could be refined in the period leading up to the DCO application.

2.8.4 The Environmental Statement will provide more detail on the construction methodology, including the limits of deviation envelopes to define the maximum extents of temporary construction activities.

Permanent works

2.8.5 The scheme design is ongoing. The scheme description provided in Section 2.4 is therefore subject to change between statutory consultation and submission of the DCO application, including changes to address stakeholder comments received during the consultation. For certain aspects of the design, particularly structures and side roads, options are still under consideration to determine the optimum design solution. The provisional Order Limits have been set at this stage to accommodate multiple options and allow for changes in the highway alignments and junction layouts, as well as other associated infrastructure.

2.8.6 The Environmental Statement will provide an assessment of the proposed scheme design based on the realistic worst-case scenario afforded by the limits of deviation to be sought within the DCO application. For the permanent elements of the proposed scheme, this will include the maximum vertical and horizontal extents of the highway carriageway, junctions and side roads; locations of technology, lighting and signs; size and location of drainage features and WCH provision; and utility diversion corridors. The worst-case assessment may vary depending on the environmental aspect under consideration; for example, the worst case for visual effects may be the maximum height of a structure afforded within the limits of deviation envelope, while the reverse may be true for potential noise effects.

3 Assessment of alternatives

3.1 Introduction

3.1.1 This chapter outlines the alternative design options that were considered during the development of the proposed scheme. The options appraisal process is summarised below within the context of Highways England's Project Control Framework (PCF):

- PCF Stage 0 – strategy, shaping and prioritisation. At this stage, initial analysis is conducted to assess the viability of transport scheme solutions to the problem, including road network and non-road network solutions.
- PCF Stage 1 – options identification. At this stage, traffic modelling and economic and environmental assessment are undertaken on a number of options. This informs decisions on which options to present during non-statutory public consultation.
- PCF Stage 2 – options selection. At this stage, the public are consulted on the recommended options from PCF Stage 1. Refinements are then made to the option designs, traffic modelling and economic and environmental assessments following feedback from the consultation. At the end of the stage a Preferred Route Announcement (PRA) is made to announce the decision on which option to progress.
- PCF Stage 3 – preliminary design. This is the stage the proposed scheme is currently at and involves developing the preferred option to the required level for undertaking an EIA and applying for a DCO. Alternative ways of constructing the preferred option will be explored throughout PCF Stage 3 (see Section 3.3).

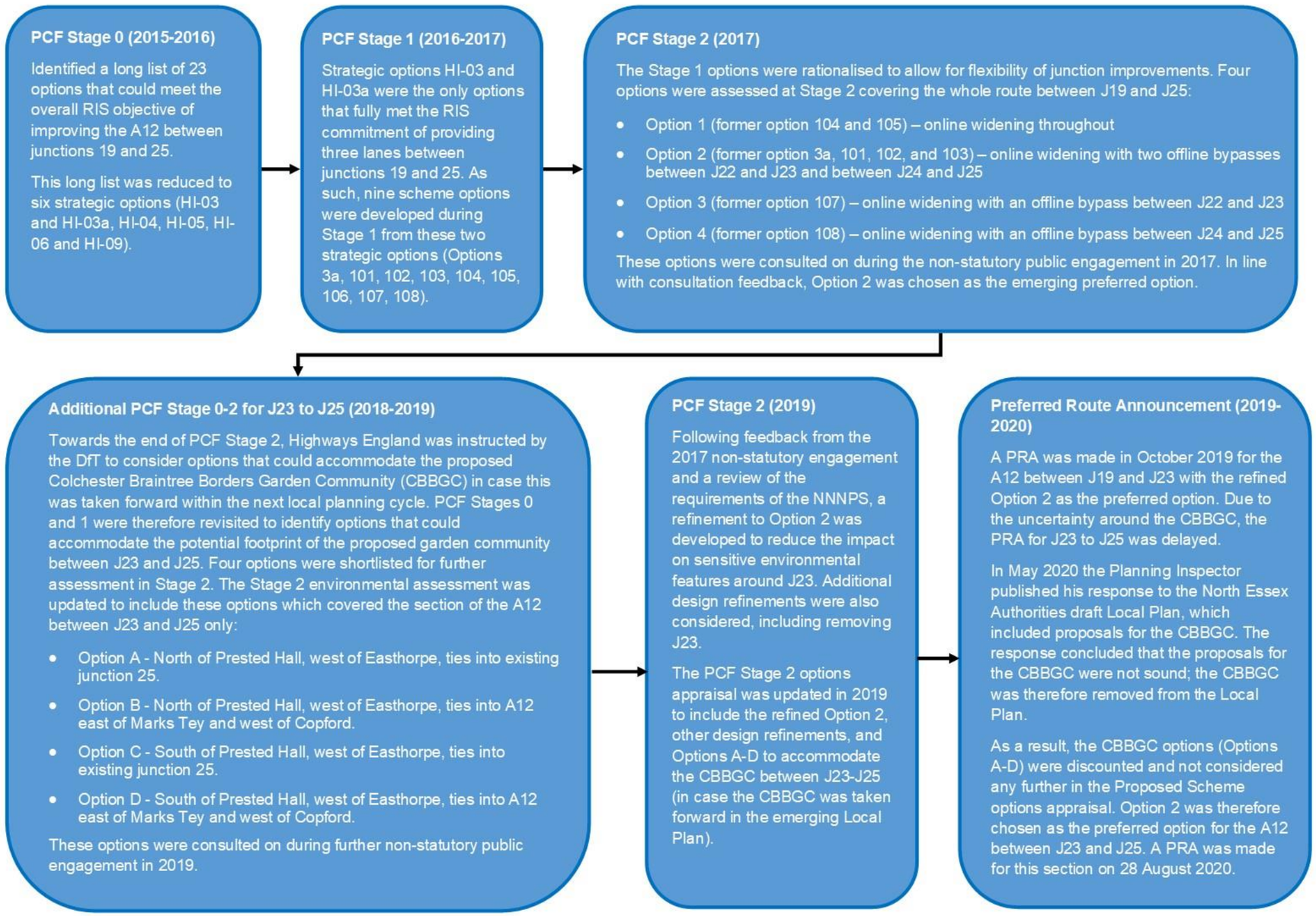
3.1.2 In 2017, a non-statutory consultation was held in relation to proposals to widen the A12 from junction 19 at Chelmsford to junction 25 at Marks Tey where the A120 joins the A12. Four options were presented for the A12 between junctions 19 and 25 (Options 1-4). Further information on the consultation is provided in Chapter 4: Consultation. Following the consultation, the option designs were refined in preparation for a PRA.

3.1.3 However, the North Essex Authorities were pursuing a joint Local Plan which proposed several garden communities (including the CBBGC). If the CBBGC were to go ahead, it would likely impact on Options 1-4 that were presented in the 2017 consultation, specifically on the section between junction 23 and junction 25. Additional options therefore had to be developed to consider the section of the A12 between these junctions that could accommodate the potential footprint of the proposed garden community (Options A-D).

3.1.4 Given the uncertainty that the CBBGC introduced to the proposed scheme option development, two PRAs were made for the proposed scheme (one covering junctions 19 to 23 announced in October 2019, and another covering junctions 23 to 25 announced in August 2020).

3.1.5 An overview of the design history is provided in Plate 3.1. Section 3.2 provides more detail on the scheme options considered at each design stage, the preferred option, and the environmental considerations in coming to this decision.

Plate 3.1 Design history overview



3.2 Scheme history

PCF Stage 0 options appraisal (strategy, shaping and prioritisation)

3.2.1 The Options Appraisal Report (OAR) (Highways England, 2016) set out a long list of 23 options that could meet the overall objective of improving the A12 between junctions 19 (Boreham interchange) and 25 (Marks Tey interchange). It included 15 highways improvement options, five public transport options and three collision reduction and incident management measures. The long list of options (including non-road options such as improvements to public transport) was reduced to six strategic options using the DfT's Early Assessment and Sifting Tool. The six options included two options that fully met the RIS commitment of improving the A12 corridor to three lanes between junctions 19 and 25 (options HI-03 and HI-03a) and four lower cost options that looked at improvements to the most congested sections of the corridor (HI-04, HI-05, HI-06 and HI-09). Table 3.1 summarises the PCF Stage 0 strategic options.

Table 3.1 PCF Stage 0 strategic options

Option	Comments	Summary
HI-03: Offline improvements between J22 and J23, and between J24 to J25. Online widening and junction improvements including removal of J20b.	Strong strategic case as it provides upgrades to the whole section between J19 and J25. It is a higher cost option but offers good value for money.	Taken forward to PCF Stage 1
		
HI-03a: Offline improvements between J22 and J23, and between J24 to J25. Online widening and junction improvements with reduced specification.	Strong strategic case providing upgrades to the whole section of the A12 between J19 and J25. This is a slightly lower cost option than HI-03.	Taken forward to PCF Stage 1
		
HI-04: Offline improvements between J22 and J23, and between J24 to J25. Online widening and junction improvements.	Good strategic and lower cost scheme. However, by not including J23-J24, it may be difficult to justify upgrading this section at a later date.	Dismissed
		

Option	Comments	Summary
HI-05: Offline improvements between J22 and J23. Online widening and junction improvements.	Good lower cost option which would provide a viable solution to the scheme objectives. Initially taken forward, but later dismissed as did not meet the RIS objectives.	Dismissed
		
HI-06: Offline improvements between J22 and J23. Online widening and junction improvements.	Option would offer a good strategic and lower cost scheme. However, by not including J21-J22 and J23-J25, it may be difficult to justify upgrading these sections at a later date.	Dismissed
		
HI-09: Online widening between J20a and J21 and junction improvements.	Lower cost option but provides a low strategic benefit compared to other options. Initially taken forward, but later dismissed as did not meet the RIS objectives.	Dismissed
		

Blue links indicate three-lane carriageway capacity through existing, new or upgraded roads. Blue circles indicate junction upgrades. A black circle indicates junction removal/rationalisation.

PCF Stage 1 options appraisal (options identification)

3.2.2 PCF Stage 1 involved developing further options that would meet the overarching RIS statement and the scheme-specific objectives. As HI-03 and HI-03a were the only options that met the RIS commitment, these were taken forward into PCF Stage 1 for further assessment. Nine scheme options were developed from these two strategic options. These included four options which had two offline bypasses but different junction arrangements (Options 3a, 101, 102 and 103), two which were wholly online with different junctions (104 and 105), one option with a significant length of new bypass to the north of the existing A12 (106) and two options with a single bypass (107 and 108). These options were appraised during PCF Stage 1.

3.2.3 Option 106 was discounted at PCF Stage 1 as it involved two major structures crossing the GEML railway, which would have significant costs and significant landscape and visual environmental impacts.

3.2.4 It was also concluded during PCF Stage 1 that most junctions were likely to require some level of improvement, although there was some flexibility around improvements and potential closing of one or more junctions at Hatfield Peverel (junctions 20a, 20b and 21). Therefore, four alternative alignments (ignoring junction variations) were taken forward to the non-statutory engagement in PCF Stage 2:

- Option 1 (former option 104 and 105 alignment) – online widening throughout and provision of a local access road to provide alternative access to existing single tier junctions
- Option 2 (former 3a, 101, 102 and 103 alignment) – online widening with two offline bypasses between junctions 22 and 23 and between junctions 24 and 25
- Option 3 (former 107 alignment) – online widening with an offline bypass between junctions 22 and 23
- Option 4 (former 108 alignment) – online widening with an offline bypass between junctions 24 and 25

3.2.5 The PCF Stage 1 options are summarised in Table 3.2.

Table 3.2 PCF Stage 1 scheme options

Option number	Description	Taken forward to PCF Stage 2
3a	Three lanes provided throughout with offline sections to the south of the A12 between J22-J23 and J24-J25 to remove local direct accesses to the A12.	Option 2
101	Three lanes provided throughout with offline sections to the south of the A12 between J22-J23 and J24-J25 to remove local direct accesses to the A12. Remove J20a and J20b and replace with a combined J20 to the south of Hatfield Peverel.	
102	Same as 101 except without a new J20 and assumes complete removal of J23.	
103	Three lanes provided throughout with offline sections between J22-J23 and J24-J25 to remove local direct accesses to the A12. Remove J22 and J24 but upgrade J21 and J23 to provide access to Witham and Kelvedon respectively.	

Option number	Description	Taken forward to PCF Stage 2
104	Three lanes provided throughout completely online with removal of single tier junctions by providing local access roads. Remove J20a and J20b and replace with a combined J20 to the south of Hatfield Peverel.	Option 1
105	Three lanes provided throughout completely online with removal of single tier junctions by providing local access roads. Remove J20a and J20b and replace with an improved J21 with access roads to Hatfield Peverel.	
106	Same as 101 but offline to the north of the A12 (and railway) between J22-J25.	Dismissed
107	Three lanes provided throughout with offline sections to the south of the A12 between J22-J23.	Option 3
108	Three lanes provided throughout with offline sections to the south of the A12 between J24-J25.	Option 4

PCF Stage 2 options appraisal (option selection)

3.2.6 Options 1 to 4 were taken forward to public consultation in January 2017 at the start of PCF Stage 2. In addition, further work was undertaken to develop technical, economic and environmental assessments for the proposed scheme. An interim environmental appraisal was undertaken in 2017 to assess the PCF Stage 2 Options 1 to 4.

3.2.7 The interim environmental appraisal concluded that Option 1 was the environmentally preferred option. This is because the option would be constructed online within the existing A12 corridor rather than creating a new infrastructure feature within the landscape. This would have less ecological, landscape and setting effects than Options 2, 3 and 4.

3.2.8 The offline options at Rivenhall (Option 2 and Option 3) would extend over an area of known minerals deposits, some of which have a licence to extract, and other areas that do not currently have permission for extraction. There was a risk that the offline options could sterilise minerals, or that time would be required in the programme to allow extraction before construction of the road. Sterilisation of mineral deposits is a topic highlighted within the NNNPS. In addition, Options 2, 3 and 4 would affect larger areas of the best and most versatile (BMV) land (grade 2 or 3 land under the Agricultural Land Classification).

3.2.9 The offline options at Rivenhall End would also involve offline development in the Blackwater Valley, with the potential to significantly affect the sensitive landscape character, as well as archaeological and ecological assets within this area. These options also lie close to the Rivenhall Long Mortuary Enclosure scheduled monument and would likely have a significant effect on the setting of this site and the surrounding historic landscape.

3.2.10 Option 2 was assessed as the least favourable for the environment overall, due to the likely significant effects on cultural heritage, mineral deposits, landscape, ecology and flood risk. However, it would also have benefits in relation to air quality and noise effects for receptors along the existing A12, notably through the community of Rivenhall End. It was seen to be the most resilient of the four options, as it assumes that the existing dual carriageway would remain.

3.2.11 Option 2 would be safer for road workers during both construction (due to the length of offline sections that could be constructed away from live traffic) and operation (as there would be an alternative route along certain sections of the A12 on which to divert traffic during road maintenance). Option 2 was also the most popular option from the non-statutory public consultation (see Chapter 4: Consultation).

3.2.12 Therefore, the Scheme Assessment Report[2] produced in 2017 concluded that Option 2 was the recommended preferred route (Highways England, 2017a).

Additional options appraisal (PCF Stage 0-2) – CBBGC options

3.2.13 Towards the end of PCF Stage 2, Highways England was instructed by the DfT to consider options that could accommodate the proposed CBBGC in case this was taken forward within the next local planning cycle. Further options were therefore developed that could accommodate the potential footprint of the proposed garden community.

3.2.14 All of the CBBGC options appraisal work assumed that Option 2 was emerging as the preferred option from the previous PCF Stage 2 work described in the above section. Option 2 designs were therefore assumed up to junction 23 (Kelvedon South interchange) and the new options looked at alternatives to incorporate the proposed CBBGC between junction 23 and junction 25.

3.2.15 Four CBBGC options were shortlisted for more detailed assessment, as follows:

- Option A – alignment goes north of Prested Hall, west of Easthorpe, and ties into the existing junction 25
- Option B – alignment goes north of Prested Hall, west of Easthorpe, and ties into the A12 east of Marks Tey and west of Copford
- Option C – alignment goes south of Prested Hall, west of Easthorpe, and ties into the existing junction 25
- Option D – alignment goes south of Prested Hall, west of Easthorpe, and ties into the A12 east of Marks Tey and west of Copford

3.2.16 Options A-D were presented at a non-statutory consultation in October 2019 to gain views from stakeholders and the local community on the options proposed to accommodate the CBBGC (if taken forward in the draft Local Plan). There was strong opposition to these options due to the wider opposition towards the CBBGC (see Chapter 4: Consultation).

[2] The Scheme Assessment Report can be viewed on the Highways England website https://highwaysengland.co.uk/A12

3.2.17 In May 2020, the Planning Inspector published his response to the North Essex Authorities' draft Local Plan, which included proposals for the CBBGC. The response concluded that the proposals for the CBBGC were not sound. As a result, the North Essex Authorities decided to remove the CBBGC from the Local Plan.

3.2.18 As the CBBGC was no longer a committed development, and given the strong opposition from the local community towards the proposed CBBGC route options and the greater environmental impacts due to the longer offline alignments, Options A to D were discounted and not considered any further in the proposed scheme options appraisal. The preferred option between junctions 23 and 25 therefore reverted back to Option 2.

Design refinements (PCF Stage 2)

3.2.19 The 2017 Scheme Assessment Report recommended Option 2 as the preferred route. However, through value engineering and subsequent option refinement, elements of the option design were adjusted, and had to be re-assessed. As well as scope changes through value engineering, designs were refined to take on board stakeholder comments (see Chapter 4: Consultation) and to better align the proposed scheme with policy within the NNNPS, as required for development consent.

NNNPS review

3.2.20 Although Option 2 was chosen as the emerging preferred option in 2017, it was assessed as the least favourable in terms of the environmental impact. The key impacts identified were as follows:

- Flood risk: for the Exception Test to be passed it must be demonstrated that the proposed scheme provides wider sustainability benefits to the community that outweigh flood risk; and an FRA must demonstrate that the proposed scheme will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall. Option 2, prior to design refinements, would have involved offline development in the River Blackwater floodplain.

- Historic environment: where the proposed development would lead to substantial harm to or total loss of significance of a designated heritage asset, the Secretary of State should refuse consent unless it can be demonstrated that the substantial harm or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm. Historic England raised concerns over Option 2, prior to design refinements, as the new offline bypass would have likely resulted in substantial harm to the Rivenhall Long Mortuary Enclosure scheduled monument, as well as associated archaeological remains that contribute to the wider historic setting of the monument.

- Minerals sterilisation: where a proposed development has an impact on an MSA, the Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources. Option 2 had the largest footprint in the MSA.

- BMV agricultural land: applicants should take into account the economic and other benefits of BMV agricultural land (defined as land in grades 1, 2 and 3a of the ALC). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Option 2 had the largest footprint in areas of BMV land.

3.2.21 A refined Option 2 alignment was created to reduce impacts on the Rivenhall Long Mortuary Enclosure scheduled monument and the River Blackwater floodplain. For the refined Option 2, the length of the bypass between junctions 22 and 23 was reduced, re-joining the existing A12 at a point just east of Rivenhall End, thereby taking the alignment away from the scheduled monument and reducing potential development in the floodplain. The refined option would also result in reduced loss of BMV land and sterilisation of minerals compared to the original Option 2. The refined Option 2 therefore reduces overall impacts in compliance with the NNNPS.

Value engineering

3.2.22 In addition to the refined Option 2 described above, a number of additional design refinements were introduced as part of a value engineering exercise:

- Descoping verge and central reserve works between junction 19 and junction 20a. The carriageway is already three lanes in this section, so descoping works here would still be consistent with the RIS commitment for three-lane provision.

- Removal of existing junction 23 (the previous proposals had included a new junction 23). This would improve safety, reduce fill material requirements, and reduce environmental impacts (including on the River Blackwater and associated floodplain). Traffic modelling indicated that the removal of junction 23 from the proposed scheme would result in minimal adverse impact to traffic due to the relatively few vehicles that utilise the junction.

- Given the removal of junction 23, a local access road would be required to facilitate access in and around Kelvedon. The entire existing A12 between junctions 22 and 23 would be retained as a local access road, with provision of a new mini-roundabout to provide access over the A12 to the Essex County Fire and Rescue Service Headquarters. The local access road would be retained as a dual carriageway from junction 22 to the Essex County Fire and Rescue Service Headquarters. A single carriageway would be provided from the mini-roundabout connecting to the B1024 into Kelvedon.

- Retaining the River Ter Bridge width (i.e. three lanes gained by changing verges, working widths and lane markings, as opposed to physically widening the bridge).

- Assumption on the use of borrow pits for fill material instead of importing material. A number of potential borrow pit locations were investigated in PCF Stages 2 and 3 (see Section 3.3).

3.2.23 The outcome of the PCF Stage 2 options appraisal, including the design refinements described above, is shown in Table 3.3. Although the refined Option 2 superseded the original Option 2 from 2017, the original alignment is included in Table 3.3 to demonstrate the difference in impacts as a result of the design refinements.

3.2.24 An addendum to the 2017 Scheme Assessment Report was produced to document the outcome of the PCF Stage 2 design refinements that had taken place since 2017 (Highways England, 2020e).

Table 3.3 Potential effects from PCF Stage 2 options

Option	Overall environmental score	Conclusions of the environmental appraisal (based on a high-level assessment of the PCF Stage 2 designs)
Do nothing	Not assessed	This is assessed as the baseline to compare other options to. Air quality and WCH access is likely to get worse due to increased congestion and traffic.
Option 1 (online)	Potential significant adverse effect – mitigation may be possible	An online option would have less impact to ecology and landscape in general, as there would be minimal land take and severance. It would also avoid impacts to the Colemans Farm quarry site near Rivenhall End. There would be impacts to people and the landscape of urban areas as the road is widened, and from the loss of existing vegetation screening. There would be no improvement to noise important areas due to the traffic remaining online at these locations. Although Option 1 is likely to have the least overall impact, there are still potential significant effects, particularly to the landscape and setting of historic buildings along the A12. It is likely these effects could be mitigated.
Original Option 2 (two bypasses)	Significant adverse effect – unlikely to be able to mitigate	This option has the potential for significant environmental effects, particularly in relation to the offline sections which would sever areas of BMV agricultural land and have a detrimental effect on landscape and ecology. The offline section between J22-J23 would be within the Blackwater Valley, with the potential to cause significant effects to the landscape character. The footprint would also affect an archaeologically rich area and would likely cause substantial harm to the setting of the Rivenhall Long Mortuary Enclosure scheduled monument, as well as associated archaeological remains that contribute to the wider historic setting of the monument. Large areas of floodplain, an operational quarry and an MSA would also be affected. The operational quarry at Colemans Farm near Rivenhall End has a planning condition for restoration to be one of Essex's

Option	Overall environmental score	Conclusions of the environmental appraisal (based on a high-level assessment of the PCF Stage 2 designs)
		flagship biodiversity sites. If the footprint of the road were to impinge on the planned restoration area, then equivalent biodiversity areas would need to be provided elsewhere. The offline section between J24-J25 would result in significant impacts on the setting of a number of listed buildings, notably major impacts to the grade II listed building, Doggets Hammer Farm, located within 20m of this option. Mitigation would include reducing the extent of works into these sensitive features. However, it is likely that some effects could not be mitigated, with significant residual effects remaining (particularly on archaeological remains).
Refined Option 2 (two bypasses; J22-J23 bypass ties back into A12 east of Rivenhall End)	Potential significant adverse effect – mitigation may be possible	As with Option 2, this option has the potential for significant environmental effects, particularly in relation to the offline sections which would sever areas of BMV agricultural land and have a detrimental effect on landscape and ecology. However, the proposed bypass between J22 and J23 would tie back into the existing A12 east of Rivenhall End and would therefore have a reduced impact on the Rivenhall Long Mortuary Enclosure scheduled monument and on the setting of the Palaeolithic landscape compared to the original Option 2. This alignment would also reduce the area of development in the River Blackwater floodplain. Although there would still be adverse effects on these sensitive features, it is likely that mitigation could be implemented to reduce the effect. Areas of floodplain, the operational quarry, an MSA, and the listed buildings between J24-J25 would all still be affected.
Option 3 (Rivenhall bypass)	Significant adverse effect – unlikely to be able to mitigate	This option has the potential for significant environmental effects. The main difference compared to Option 2 is that it only includes the Rivenhall bypass between J22 and J23, and not the second bypass between J24 and J25. The offline section would sever areas of BMV agricultural land and would have a detrimental effect on landscape and ecology. The offline section would be within the Blackwater Valley, with the potential to cause significant effects to the landscape character. The footprint would also affect an archaeologically rich area and would likely cause substantial harm to the setting of the Rivenhall Long Mortuary Enclosure scheduled monument, as well as associated archaeological

Option	Overall environmental score	Conclusions of the environmental appraisal (based on a high-level assessment of the PCF Stage 2 designs)
		remains that contribute to the wider historic setting of the monument. Large areas of floodplain, the operational quarry at Colemans Farm, and an MSA would also be affected. Mitigation would include reducing the extent of works into these sensitive features. However, it is likely that some effects could not be mitigated, with significant residual effects remaining (particularly on archaeological remains).
Option 4 (Marks Tey bypass)	Potential significant adverse effect – mitigation may be possible	This option has the potential for significant environmental effects. The main difference compared to Option 2 is that it only includes the Marks Tey bypass between J24 and J25, and not the second bypass between J22 and J23. This offline section would sever areas of BMV agricultural land and would have a detrimental effect on landscape and ecology. There would also be significant impacts on the setting of a number of listed buildings, notably major impacts to the grade II listed building, Doggets Hammer Farm, located within 20m of this option. There would be no bypass between J22 and J23; the option would therefore avoid impacts on the Rivenhall Long Mortuary Enclosure scheduled monument. This alignment would also reduce the area of development in the River Blackwater floodplain. There is still potential for significant effects on other receptors from the proposed Marks Tey bypass, but it is likely these could be mitigated.
Option A to D (options to accommodate the CBBGC between J23-J25)	N/A	Options discounted as a decision was made to remove the CBBGC from the North Essex Authorities' draft Local Plan, on the basis that the Planning Inspector found the proposals to be not sound.

Preferred Route Announcement

3.2.25 Option 2 was chosen in 2017 as the emerging preferred option. Given the reduced environmental impact of the refined Option 2 compared to the original Option 2 alignment, a PRA was made in October 2019 for the A12 between junctions 19 and 23 with the refined Option 2 as the preferred option (incorporating the design refinements described in the previous section).

3.2.26 Following the decision to remove the CBBGC from the North Essex Authorities' draft Local Plan, and the subsequent dismissal of the CBBCG options (Options A-D) in Spring 2020, Option 2 was chosen as the preferred option for the A12 between junctions 23 and 25. A PRA was made for this section on 28 August 2020.

3.3 Further scheme development

PCF Stage 3 design changes

3.3.1 Since a preferred route has been announced, the environmental assessment and scheme development are now considering alternative ways of delivering the proposed scheme. This includes consideration of:

- the location and type of technology to be included (e.g. traffic signals and gantries)
- the construction methodology and programme (including the phasing of construction works and number and location of compounds and haul roads)
- optimising the cut-fill balance to reduce material requirements and waste
- the location and extent of carriageway widening
- the alignment of new offline carriageway
- the location and design of proposed WCH routes
- the type, location and extent of environmental mitigation

3.3.2 Alternative ways of delivering the proposed scheme have been considered to avoid or reduce environmental impacts through the scheme design. This embedded mitigation is summarised in Table 3.4.

Table 3.4 PCF Stage 3 design development

Design element	Design change and reasoning
Junction 19	The developer of the Beaulieu Park housing development, located adjacent to the existing J19, will be upgrading J19 in advance of the proposed scheme works to tie into the development, which is currently under construction. Further studies have shown that the proposed scheme could use the Beaulieu Park developer design with some additional modifications to increase junction capacity, including a widened overbridge from two to three lanes and various additional lanes on roundabouts, approaches and exits. The current design proposals now make greater use of existing infrastructure (reducing the footprint of the proposed scheme), and would reduce the impact on the setting of Boreham House registered park and garden.

Design element	Design change and reasoning
Junction 21	J21 has moved further west (closer to Hatfield Peverel) compared to the PCF Stage 2 design. This new location is considered the optimum location for attracting more traffic to use the junction, while avoiding the need for demolition of existing properties in Hatfield Peverel. J21 would attract strategic traffic away from the B1137 Main Road in Boreham onto the proposed A12 mainline, reducing the impact on local roads. The new J21 arrangement could potentially result in congestion at the B1137 The Street and Maldon Road junction in Hatfield Peverel. While this is expected to happen with or without the proposed scheme going ahead, the new J21 location would change how the traffic moves around the junction. By reducing traffic on The Street, more traffic would turn right to go to the new J21. Options are currently being explored to mitigate this impact in discussion with Essex County Council, the local planning authorities and the parish council.
Junction 22	The alignment of the mainline around J22 has been revised to reduce the impact on Colemans Farm Quarry. The alignment now comes offline further north than the PCF Stage 2 design, therefore limiting impacts to phases 2, 3, 4 and 5 of the quarry's extraction programme. In addition, J22 has moved further north-east to reduce the impact on the quarry's processing area. Options have also been explored for reducing earthworks and fill material requirements at J22. This has involved modifying the vertical alignment of the mainline and east-facing slip roads to allow the proposed A12 to go below J22 and Braxted Road. As well as reducing material requirements for J22, reducing the vertical alignment would also reduce landscape and visual effects due to the reduced profile of the junction.
Junction 24	Early design options located the proposed J24 offline to the south of the existing J24. The new J24 has now been relocated to Inworth Road. The new location provides better connectivity between Tiptree and the SRN, and reduces traffic making strategic journeys on the wider local road network when compared against the PCF Stage 2 design. The current proposals for J24 would reduce the visual impact on Prested Hall (grade II listed building) and improve the earthworks cut/fill balance. Traffic could increase along Inworth Road. Traffic modelling indicates that Inworth Road is suitable for the expected increase in traffic, however some changes may help manage the traffic better. Measures are therefore being explored to mitigate this impact in discussion with Essex County Council, the local planning authorities and the parish council. The provisional Order Limits have been extended down Inworth Road to accommodate these potential measures.

Design element	Design change and reasoning
Prested Hall access	The long, tree-lined driveway to Prested Hall would be severed by the proposed scheme. Options have been considered for maintaining access to Prested Hall: • Create a new drive in the location of the existing one – this option is unlikely to be feasible as the proposed A12 mainline would be higher at the point it severs the drive, and as such, there would not be enough space to get the ramp up at the gradient required for WCH. There would also be a loss of distinctive trees along the driveway. • New offline access from the existing A12 where a new five-arm roundabout would be constructed in the location of the existing J24. An overbridge would be constructed over the new A12 mainline to the west of the existing Prested Hall driveway. The new access road would then tie into the southern-most section of the driveway. Most of the trees along the drive on the southern side of the new A12 would be lost where it ties back in. • Merging the Prested Hall access with the Threshelfords access road further to the west. The new Prested Hall access road would be provided from the existing J24 using part of the existing A12 northbound carriageway. It then joins with the Threshelfords access road before crossing the A12 via a new Threshelfords overbridge. The third option – merging the Prested Hall access with the Threshelfords access road – has been chosen following comments from local stakeholders. The proposed access arrangements are shown on Figure 2.1 (Preliminary Environmental Masterplan). This option would result in the least amount of new infrastructure being constructed in the area (i.e. one new structure over the proposed A12 mainline as opposed to two), and would have the least impact on the existing Prested Hall driveway as trees on the remnant sections of the driveway would be retained.
Junction 24 to 25 alignment	The horizontal alignment of the A12 mainline between J24 and J25 has been improved to reduce the area of land between the new and existing A12. The new alignment also avoids a registered veteran tree to the south of Easthorpe Road. Required works to a farm access track in this area have also been redesigned to position the track away from the veteran tree (outside of the root protection area).
Junction 25	The current design proposals seek to maximise the use of existing infrastructure at J25 to facilitate improvements for WCH. Modifications to the junction design have been made to mitigate for the fact that northbound traffic from Kelvedon may choose to continue along the de-trunked A12, rather than join at J24. This includes the following design changes: western roundabout converted to compact signalised junction (crossroads); eastbound to westbound U-turn provision on dumbbell link; and kerb realignment to provide additional capacity at the eastern roundabout (see Plate 2.6 in Chapter 2: The scheme).
Retaining walls	The proposed earthworks have been reviewed. In certain locations, retaining walls have been proposed, instead of earthworks slopes, to reduce land take, minimise encroachment into third party land, and limit adverse impacts on environmental features.

Design element	Design change and reasoning
Floodplain compensation	Areas were included within the provisional Order Limits provided with the Environmental Scoping Report for flood risk mitigation. Flood risk modelling has been undertaken since the Environmental Scoping Report was published. The modelling has concluded that the proposed scheme is unlikely to increase flood risk at the following locations, and therefore that mitigation is no longer required: • River Ter • River Brain • River Blackwater • Rivenhall Brook • Roman River The provisional Order Limits have accordingly been reduced in these areas.
Utility diversions	Section 2.4 (Chapter 2: The scheme) describes the options being considered for utility diversions. This has included offline diversions (i.e. utility corridors away from the proposed A12 mainline) to avoid sensitive environmental features. In some instances, the provisional Order Limits have been extended, compared to those shown in the Environmental Scoping Report, to allow for offline utility diversions. Further discussion with the relevant operators will inform requirements for any diversion required.
Property demolition	Two private residences would need to be demolished north of the A12 near Rivenhall End. This is a result of shortening the proposed bypass between J22 and J23. The bypass has been shortened to avoid the proposed scheme resulting in significant harm to a scheduled monument, a high value and irreplaceable cultural heritage asset. The bypass was also shortened to reduce flood risk associated with building infrastructure in the floodplain of the River Blackwater. One private business would need to be demolished near Inworth Road. This is a result of moving the new J24 west of Inworth Road. The junction was moved to improve traffic flows, reduce the impact on Prested Hall listed building, and reduce the material requirements of constructing the junction. Opportunities for reducing this impact are being explored.

3.3.3 As a result of ecology and arboricultural surveys, the proposed scheme design has been refined throughout where practicable to avoid habitats, protected and notable species and trees identified as meeting veteran and Grade A criteria.

3.3.4 The design of the proposed scheme is ongoing. As stated in Table 3.4 and Chapter 2: The scheme, certain elements of the design have not been decided upon, and options are still being considered. Environmental considerations will continue to influence design decisions. The assessment of alternatives chapter of the Environmental Statement will detail these considerations.

Borrow pit strategy

3.3.5 Section 2.5 (Chapter 2: The scheme) describes the borrow pit locations that have been included in the provisional Order Limits. The location of borrow pits has considered the anticipated type and quantity of material yields, location, access to the A12 and proposed works, proximity to residential areas, groundwater levels, archaeology, and other environmental factors. Borrow pit locations which have been discounted so far include:

- Borrow pit A (south-west of junction 20a) – discounted due to the requirement to use Mowden Hall Lane for access, which would be unsuitable for construction traffic. Main Road also segregates this borrow pit from the A12, meaning construction traffic would need to travel via Hatfield Peverel or Boreham to access the A12. This would have an impact on the quality of life of residents of Boreham and Hatfield Peverel.
- Borrow pits B, C and L (north of Hatfield Peverel and GEML) – discounted due to the borrow pits' distance from the A12. The GEML segregates these borrow pits from the A12, meaning construction traffic would need to travel via Hatfield Peverel, or a temporary bridge over the railway line would be required to access the A12. Sending construction traffic through Hatfield Peverel would have an impact on the quality of life of residents.
- Borrow pit D (east of Hatfield Peverel, between the A12 and GEML) – discounted due to the borrow pit's close proximity to borrow pit E (which has a greater quantity of material available). The site for borrow pit D was also selected as a suitable site for a construction compound.
- Borrow Pit G (east of junction 21 on the south side of the A12) – originally short-listed as a reserve borrow pit, but was subsequently discounted as studies determined it was no longer required.
- Borrow pit H (south of the A12 between junctions 21 and 22) – discounted as access onto the A12 would be difficult due to the level difference of the borrow pit and the A12. This would require transportation of materials via the town of Witham which would impact on the quality of life of residents. This borrow pit is also located close to residential properties along Maldon Road so there would be potential dust, noise and visual impacts associated with the borrow pit operations.

3.3.6 In addition to discounting the above borrow pits, environmental considerations have also influenced the design development of the borrow pits included within the provisional Order Limits (described in Section 2.5). This has included changing the size, shape and depth of the borrow pits to allow:

- 30m exclusion zones around borrow pits where badger setts, hedgerows and trees are located
- room around the borrow pit perimeters to install a seeded bund to provide noise and visual mitigation to nearby property
- an exclusion zone around an area of infilled land at borrow pit J containing suspected asbestos material
- suitable PRoW diversions

3.3.7 Environmental considerations, including the results of further environmental surveys, will continue to influence the design, operation and restoration of the proposed borrow pits.

Compound siting

3.3.8 Section 2.5 (Chapter 2: The scheme) describes the construction compounds that have been included in the provisional Order Limits. The siting of compounds has considered location, access to the A12 and proposed works, access to existing utility supplies, proximity to residential areas, and other environmental factors. Compound locations which have been discounted so far include:

- Junction 21 north – did not score well due to being located adjacent to a new housing estate, which would be affected by noise and light pollution impacting on the properties closest to the compound, especially if the compound would operate through the night. A lack of utilities at this location also contributed to this site being discounted.
- Junction 22 south – although this site scored well due to the location, proximity to available utilities and ease of access/egress onto the A12 via junction 22, it was discounted as the area was required for a potential drainage pond and for essential environmental mitigation.
- Junction 23 north – site has limited connectivity and access to the proposed works due to being situated next to Kelvedon and the junction only having two accesses onto the A12. A lack of utilities at this location also contributed to this site being discounted.

4 Consultation

4.1 Statutory consultation

4.1.1 The proposed scheme is currently in a period of statutory consultation. Highways England are consulting with prescribed consultees as per the requirements of Section 42 of the Planning Act 2008. The consultees include, for example, Natural England, the Environment Agency and Historic England, relevant planning authorities and interested parties (e.g. landowners and tenants).

4.1.2 The local community and wider public are also being consulted on the proposed scheme via the statutory consultation programme in line with Section 47 of the Planning Act 2008.

4.1.3 A Statement of Community Consultation (SoCC) has been produced and published for the formal statutory consultation period. The SoCC outlines how Highways England will formally consult with the local community about the proposed scheme.

4.1.4 The purpose of this consultation is to seek comments from the local community and statutory consultees on the proposed scheme. This PEIR has been produced to support the consultation. This PEIR includes environmental information to enable consultees to understand the likely significant environmental effects of the proposed scheme, and measures proposed to mitigate such effects, to help inform their consultation responses.

4.1.5 The statutory consultation will include a virtual exhibition, webinars (these will be live online events where technical experts will talk through the design proposals and answer any questions) and publication of brochures, reports and other information made available in local community facilities and online. Due to the timescales announced in the government's Road Map out of COVID-19 restrictions, the statutory consultation will be complemented by public events. Due to the fluidity of the COVID-19 pandemic, if the government's Road Map changes so will the public events. If public events are cancelled, additional webinars will be arranged.

4.1.6 Once the statutory consultation has closed, a Consultation Report will be produced and submitted as part of the DCO application. This will summarise the feedback received during the consultation as well as how the project team have considered this feedback in the scheme design. The Consultation Report will demonstrate how Highways England has complied with the consultation requirements of the Planning Act 2008.

4.2 Non-statutory engagement

Public engagement

4.2.1 A public consultation was held for Options 1-4 between 23 January and 3 March 2017. The consultation included seven public information events held in communities along the A12 corridor. The consultation received 907 responses, of which 824 were positive, 757 expressed a preference for one of the four options, and 67 had no preference. The most popular option was Option 2 (bypass between junctions 22 and 23, and a bypass between junctions 24 and 25) with 49% of respondents stating this as their preferred option. A considerable amount of support for this came from the local councils and local communities, who felt that Option 2 would have the least impact on residents of Rivenhall End. Additional reasons for support of Option 2 included:

- it would be the most future proof
- it would cause the least disruption during construction
- it would be the most resilient
- it would have the least impact on local residents

4.2.2 The second most popular option was Option 1 (online widening), with 28% of respondents stating this as their preferred option. Although there was support for this option due to the reduced impact on ecology, landscape and archaeology, there were also concerns that it would not be as resilient, and if it would be feasible to construct (given the disruption anticipated from online construction).

4.2.3 The consultation also asked whether respondents felt improvements were needed at each junction along the length of the proposed scheme. All junctions received a majority of support for improvements, with many respondents citing poor visibility, unclear signage and dangerous slip roads. In particular, there was support from both the public and local authorities for rationalising junctions 20a and 20b (Hatfield Peverel), providing a new junction serving traffic travelling both northbound and southbound. Junction 23 received the least amount of support for improvement, but still a majority, with 51% feeling improvements were needed. For those who did support the need for improvements, the primary concern was the existing junction arrangement which respondents suggested led to congestion in the village of Kelvedon.

4.2.4 Options A-D were presented at a second public consultation between 21 October and 1 December 2019 to gain views from stakeholders on the options proposed to accommodate the CBBGC. The feedback received was independently analysed and published alongside the PRA for junctions 23-25. A total of 822 responses were received. The majority of respondents commented that they strongly opposed all routes on the basis that they were against the proposed garden community, or that they preferred the routes presented in 2017. However, as the CBBGC was not taken forward in the North Essex Authorities' draft Local Plan, these options were not considered further.

4.2.5 Further information on the previous consultation results and the preferred route announcements can be viewed on the Highways England webpage at www.highwaysengland.co.uk/A12.

Technical engagement

4.2.6 In addition to the public consultation events, a detailed programme of engagement has been developed and implemented throughout PCF Stages 1 to 3. This engagement has focused on forums and workshops with a wide range of relevant stakeholders, including statutory environmental bodies and local/county authority environmental officers. The purpose of these forums and workshops was to communicate key messages about the proposed scheme, and to gather feedback about the scheme from stakeholders to influence the options selection process and ongoing scheme development.

4.2.7 Table 4.1 highlights key responses from statutory environmental bodies during the options appraisal, and subsequent meetings to progress the development of the preferred option.

Table 4.1 Key consultation responses

Stakeholder	Consultation response
Environment Agency	In their 2017 consultation response, the Environment Agency did not wish to state a preferred option but reiterated general principles that should be considered as the scheme progresses: • The scheme presents an opportunity to provide improvements to the water environment along the route. • The flood risk assessment will need to demonstrate that the scheme would result in no impediment to flows or net loss of floodplain for all events up to and including the 1 in 100 year fluvial event inclusive of climate change. • The proposed scheme must not cause deterioration in a water body's status or prevent its achievement of good ecological status/potential in the future, to be compliant with the Water Framework Directive. • The proposed scheme will need robust pollution prevention measures and a high level of treatment for surface water run off to protect water bodies. A meeting was held with the Environment Agency in October 2019 to discuss and agree drainage design criteria and methodologies for FRA. Subsequent meetings were held to review the results of baseline fluvial modelling studies for the seven main rivers affected by the proposed scheme. A meeting was held in July 2020 to discuss comments received on the Environmental Scoping Report and methodologies for groundwater impact assessment and for Water Framework Directive (WFD) compliance assessment. In November 2020, another meeting was held to discuss the methodology for water quality assessment. Two meetings were held in January 2021 to outline the initial outcome of the WFD compliance assessment and hydraulic modelling outputs. Proposed flood mitigations were also discussed during the meeting and a follow up meeting was held in February 2021 to discuss river biodiversity metrics and otter mitigation.

Stakeholder	Consultation response
Natural England	In their 2017 consultation response, Natural England did not wish to state a preferred option but reiterated general principles that should be considered as the scheme progresses, including: • Habitat along and adjacent to roadsides is often used by a wide range of species, such as bats, birds and reptiles and there may be licensing requirements. • Natural England welcome the enhancement of existing habitat where possible and creation of new habitat where current areas are lost through the scheme. They would wish to see plans which seek to achieve a net increase in biodiversity. A meeting was held with Natural England in September 2020 to discuss the proposed scheme. An update was provided on the results of ecology surveys undertaken and the proposed scope and methodologies for future surveys, including the potential to adopt Natural England's District Level Licensing approach for great crested newts. In addition, the conclusions of the Stage 1 Habitats Regulations Assessment (HRA) were presented. A meeting was held in November 2020 to discuss questions from Natural England on the content of the Environmental Scoping Report and the progress with District Level Licensing. Results of further surveys, key constraints and potential impacts were also discussed as well as preliminary mitigation proposals and biodiversity net gain. A meeting was held in February 2021 to discuss the findings of the latest ecology surveys and proposals for mitigation.
Historic England	In their 2017 consultation response, Historic England had concerns regarding Option 2 and Option 3, and to a lesser degree, Option 4, with respect to appropriate preservation of the historic environment. Option 1 should be given great consideration as it would be within an existing highway corridor, as opposed to creating a new corridor (leading to further urbanisation). In addition, they provided the following feedback: • The A12 corridor has a high archaeological importance and sensitivity. Previous applications for quarrying in the area have been refused due to the impacts to cultural heritage. The Rivenhall End section is particularly sensitive given the number of known assets within the area. These contribute to a wider Palaeolithic landscape. • There is currently one scheduled monument, but the area has not been subject to detailed assessment. The appreciation of the value of the historic environment should not rely solely on an appreciation of the location of designated heritage assets but consider the interactions with the wider landscape. There is significant potential for further nationally important sites to be discovered along this section. • Historic England asked why a bypass was required along the Marks Tey section and whether the project had considered providing a local access road to allow private accesses to be removed instead, as this would have less impact than the dual carriageway. They also noted that the Marks Tey section has very few records, but this should be treated as an absence of information, due to lack of surveys, rather than an absence of archaeology. It is likely to be a high-risk area for archaeology as there are often strings of settlements and villas that follow the line of roman roads.

Stakeholder	Consultation response
	A meeting was held with Historic England, Essex County Council (county archaeologist) and Colchester Borough Council (archaeological advisor) in October 2019 to discuss the concerns around the offline section of Option 2 at Rivenhall End and the refined alignment to reduce the length of this offline section, thereby moving the alignment away from the Rivenhall Long Mortuary Enclosure scheduled monument. There was general agreement in the meeting that the revised alignment would be acceptable, subject to further investigations and assessments for unknown archaeology. The approach and scope for geophysical surveys and trial trenching was discussed and a series of follow-up meetings held between October 2020 and January 2021 to discuss the results of the geophysical surveys and the scope and specification for trial trenching. In February 2021, a meeting was held with Historic England, Essex County Council and Colchester Borough Council to discuss the methodology for the built heritage assessment, including consultee comments provided in the Scoping Opinion.

4.2.8 In addition to the statutory environmental bodies detailed in Table 4.1, other stakeholders have been consulted, including local and county authority environmental officers, Public Health England and Essex Wildlife Trust. Stakeholder feedback relevant to the ongoing assessment is provided in the individual aspect chapters of this PEIR (Chapters 6 to 15).

4.2.9 Technical engagement will continue throughout PCF Stage 3 to discuss the scope, potential effects and proposed mitigation with relevant stakeholders. This engagement will take the form of email exchanges, telephone calls, virtual meetings and face-to-face meetings where required (subject to COVID-19 restrictions at the time the engagement takes place).

5 Environmental assessment methodology

5.1 Environmental scoping

5.1.1 An Environmental Scoping Report was submitted to the Planning Inspectorate on 28 October 2020 (Highways England, 2020d) and can be viewed at the following link:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

5.1.2 The Environmental Scoping Report was produced to document the proposed scope of the environmental assessment, including a description of the aspects and matters to be included in the Environmental Statement.

5.1.3 The Planning Inspectorate reviewed and consulted on the Environmental Scoping Report and published a Scoping Opinion on 7 December 2020, and republished with an errata sheet on 15 March 2021, which can be viewed at the following link:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000016-CHLM%20-%20Scoping%20Opinion.pdf

5.1.4 Highways England is maintaining ongoing dialogue with the Planning Inspectorate and other statutory stakeholders to ensure that the scope of the EIA is proportionate and meets the requirements of the EIA Regulations.

5.1.5 The scope of the assessment could be refined, with agreement from stakeholders, as additional data and survey information become available. Where feedback from consultation has influenced the assessment methodology or scope, this has been stated in the individual aspect chapters within this PEIR.

Aspects and matters scoped out of the assessment

5.1.6 The construction and operation of the proposed scheme would not introduce any source of radiation and would only generate limited amounts of heat from technology. The assessment of heat and radiation is therefore not considered relevant to the proposed scheme and has been scoped out of further assessment. No further environmental aspects have been scoped out of the assessment in their entirety.

5.1.7 Certain matters of environmental aspects have been scoped out of the assessment, in line with the Scoping Opinion. In summary, these are as follows:

- Ecological SSSIs and National Nature Reserves – there are no ecological SSSI or National Nature Reserves within 2km of the proposed scheme. The Planning Inspectorate agrees that, due to the distance between these sites and the proposed scheme, significant effects on these sites are unlikely and these sites can be scoped out of the Environmental Statement. However, two SSSIs have been considered (one within 200m of the affected road network, and another which is hydrologically linked to the proposed scheme).

- Invasive non-native plant and animal species (INNS) – given the negligible value assigned to INNS, the Planning Inspectorate agrees that any impacts to INNS would not result in significant effects, and therefore impacts to INNS can be scoped out of the Environmental Statement. INNS will be considered in relation to legislative compliance.

- Geological SSSIs – the Marks Tey Brickpit SSSI is located outside the footprint of the proposed scheme. Indirect effects due to dust or leachate can be mitigated through standard construction measures. On this basis, the Planning Inspectorate agrees that effects on the SSSI can be scoped out of the Environmental Statement.

- Effects on the health of site users and the general public during the operational phase – contamination within the proposed scheme area would be removed during construction, reducing the potential for contact with contaminated soil. Furthermore, implementing appropriate site-specific risk assessments and method statements would reduce exposure. The Planning Inspectorate agrees that it is unlikely for the human health of site users and the general public to be significantly affected during the operational phase, and therefore this matter can be scoped out of the Environmental Statement.

- Effects from material assets and waste during the operational phase – DMRB LA 110 (Highways England, 2019c) specifies that the assessment should only report on the first year of operational activities (opening year). Any construction phase effects overlapping within this period will be captured within the construction phase assessment. It is assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large-scale future maintenance, renewal or improvement works would be undertaken by Highways England's East of England Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110. On this basis, the Planning Inspectorate agrees that this matter can be scoped out of the Environmental Statement.

- Effects from traffic vibration during the operational phase – DMRB LA 111 (Highways England, 2020b) states that operational vibration should be scoped out of the assessment methodology as a maintained road surface will be free of irregularities, so operational vibration would not have the potential to lead to significant adverse effects. It is considered that there is nothing within the design of the proposed scheme that would change this assumption. The Planning Inspectorate agrees that significant vibration effects during operation are unlikely to arise and this matter can be scoped out of the Environmental Statement.

- Risk of reservoir flooding – The Planning Inspectorate agrees that flooding due to reservoir failure may be scoped out of the Environmental Statement on the basis that such reservoirs are subject to a monitoring and maintenance regime and the probability of a flooding event is low.

- Risk of coastal flooding – The Planning Inspectorate agrees that coastal flooding can be scoped out of the Environmental Statement as the proposed scheme is not located near the coast, and none of the watercourses within the study area are tidal.

5.1.8 Additional matters were proposed to be scoped out of the assessment but have been scoped back in following feedback from consultees in the Scoping Opinion. These are discussed in the aspect chapters within this PEIR.

5.2 Surveys, predictive techniques and methods

Design Manual for Roads and Bridges

5.2.1 The environmental assessment is being undertaken in line with the general standards set out within DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020c), as well as the aspect-specific DMRB standards. DMRB is the established guidance for assessing the environmental impacts of highway schemes and has been developed by Highways England in collaboration with relevant stakeholders. DMRB has recently undergone an extensive update to capture the requirements of the EIA Regulations 2017.

5.2.2 Where relevant, the environmental assessment will draw on relevant topic guidance and best practice. More details on the methods to be used are provided in each of the aspect chapters within this PEIR.

Study areas

5.2.3 Various study areas have been used to assess the impact on environmental receptors based on DMRB standards and topic-specific guidance. Specific study areas are outlined in the individual aspect chapters.

Temporal scope

5.2.4 For the purpose of the EIA, construction is assumed to start in 2023, the opening year is 2027 and the design year is 2042 (15 years after opening to traffic).

Surveys and assessment

5.2.5 Extensive surveys have been undertaken to inform the environmental assessment, including:

- extended Phase 1 habitat survey
- otter and water vole surveys
- badger and dormice surveys
- bat (activity and roosts) surveys
- freshwater environment (fish, invertebrates, aquatic plants, white-clawed crayfish) surveys
- great crested newt surveys

- reptile surveys
- wintering birds, breeding birds, and barn owl surveys
- landscape winter walkover (with summer walkovers planned in summer 2021)
- arboriculture surveys
- air quality monitoring
- ground investigations including groundwater monitoring and testing for contaminated soils
- geophysical surveys for below ground archaeology
- trial trenching surveys for below ground archaeology have started and are scheduled to be completed before DCO submission
- ALC soil surveys
- noise monitoring surveys are due to be undertaken in 2021

5.2.6 The above surveys were generally undertaken in 2020/2021. In some instances surveys were undertaken in 2017 to inform the option development and selection process. In these instances, surveys are being updated to ensure that results are up to date. More information on surveys and their timeframes is provided in the aspect chapters of this PEIR.

5.2.7 In addition to surveys, other predictive techniques are being used to inform the EIA, such as air quality, noise and flood risk modelling. Further information on the surveys and assessments that have been undertaken is provided in the individual aspect chapters.

5.2.8 At the time of writing, some of the surveys and modelling are only partially complete due to seasonal constraints and the availability of design information. These surveys will be completed in full during summer 2021 and reported on within the Environmental Statement. Additional surveys will also be required to inform the EIA, and these have been identified in the aspect chapters.

Traffic modelling

5.2.9 Predictions of future traffic levels both with and without the proposed scheme are produced using a traffic model. A traffic model was created to represent the transport system in this area of north Essex on a typical weekday. It covers the whole of the UK to capture the actual start and end of every trip, but is more detailed in the areas around Chelmsford, Braintree, Colchester, Maldon and the towns and villages in between.

5.2.10 The hours modelled in the traffic model are from 07:00–08:00 in the morning (the morning peak) and 17:00–18:00 in the evening (the evening peak) as these are the busiest times of day on the A12 in this area, confirmed by using 2016 traffic count data. A typical hour in the middle of the day is also modelled (the inter-peak).

5.2.11 A traffic model known as the 'base year model' was developed to represent existing traffic conditions as they were in 2016. The information on where people are travelling to and from has been taken from an analysis of the movement of a vast number of mobile phones. This information is then scaled to match traffic counts and merged with other data sources to provide the travel patterns of cars, vans and HGVs across the country.

5.2.12 The traffic model is then used to predict how traffic conditions will change in the future. Information on planned future housing and job developments are taken into account, as well as information on predicted growth in people, jobs and traffic provided by the DfT.

5.2.13 Traffic models are created for two main future scenarios: the Do-Minimum (i.e. without the proposed scheme) and the Do-Something (i.e. with the proposed scheme). Traffic models are developed for 2027 (the expected year of scheme opening) and 2042 (15 years after opening). Traffic flows and speeds on each road in the study area have been provided to inform the preliminary environmental assessment.

5.2.14 Full details of how the traffic model was developed is provided in the Traffic Modelling Report for Consultation.

Future baseline

5.2.15 The baseline conditions used for assessment purposes are the predicted future conditions that would exist in the absence of the proposed scheme either (a) at the time that construction is expected to start, for impacts arising from construction, (b) at the time that the proposed scheme is expected to open to traffic, for impacts arising from its operation, or (c) the design year, 15 years after opening. The future baseline is considered in each of the environmental aspect chapters, as relevant to the assessment in question.

5.3 General assessment assumptions and limitations

5.3.1 This PEIR has been prepared at an interim stage of the proposed scheme's preliminary design process. Stakeholder feedback received during the statutory consultation will be considered and could influence the design. There could therefore be changes to the provisional Order Limits to accommodate changes in temporary working areas, or changes in the permanent footprint associated with the design and/or environmental mitigation areas. The provisional Order Limits presented in Figure 1.1 are considered a realistic estimate of likely land use requirements, which are likely to be refined as the proposed scheme is developed towards the DCO application.

5.3.2 This PEIR therefore represents a 'snap-shot in time' of the ongoing environmental assessment process. It does not report the full results of the EIA, which will be presented in the upcoming Environmental Statement. As such, the environmental information presented in this PEIR is based on assessment and survey data available at the time of writing the report. Where data gaps or uncertainty in assessment conclusions exist at this stage, this is stated in the aspect chapters.

5.3.3 Each aspect assessment presented in this PEIR provides a different level of maturity in terms of assessment conclusions, based on the level of design and survey information available. Some assessments are quantitative, while others are qualitative at this stage. Identified mitigation and likely significant effects will be refined as the design and EIA progress.

5.3.4 The provisional Order Limits extend down Inworth Road. This is to accommodate potential measures to mitigate the expected increase in traffic along Inworth Road as a result of the proposed scheme. At this stage, the mitigation measures have not been developed as they are subject to ongoing discussions with Essex County Council, the local planning authorities and the parish council.

5.3.5 The provisional Order Limits includes small areas of land on the B1019 (Maldon Road), in Rivenhall End, Feering, and on Kelvedon Road (off Inworth Road). These are included to allow for signage upgrades. The works associated with these areas would be minimal and would have a negligible impact on the environment. These areas have therefore not been included when setting the assessment study areas for the PEIR.

5.3.6 It is assumed that the information provided by third-party public sources is accurate at the time of preparing this report. Data sources will be verified and updated throughout the EIA process. References are included to provide details of relevant sources at this stage.

5.3.7 Topic-specific assumptions and limitations are included within each aspect chapter. This includes information on any data gaps at this stage in the assessment and how these gaps will be filled for the Environmental Statement.

5.3.8 This PEIR was prepared during the global COVID-19 coronavirus pandemic. At the time of writing the report (winter and early spring 2021), the UK government had implemented extensive lockdown measures across England. Depending on the duration and extent of future restrictions, some of the site-based/survey work proposed as part of the scope may not be achievable, and traditional methods of public engagement may also be affected. If this is the case, viable and robust alternatives to the approach set out in this PEIR will be identified in discussion with relevant consultees to agree a pragmatic way forward.

5.4 Mitigation and enhancement

5.4.1 Mitigation measures aim to avoid, reduce and, where possible, remedy significant adverse environmental effects. The purpose of any mitigation measure is to eliminate the effect, or if not possible, to reduce its significance. Mitigation measures for the proposed scheme are being developed in accordance with the mitigation hierarchy of avoidance, reduction, restoration and compensation.

5.4.2 For the purposes of the environmental assessment, three types of mitigation are described in this report. These are adapted from the Institute of Environmental Management and Assessment (IEMA) 2015 guidance on environmental assessment:

- Embedded mitigation: intrinsic part of design evolution (e.g. reducing height of an embankment to reduce visual impact), taking into account guidance provided in DMRB GG 103 and LD 117–119 (Highways England 2019b; 2020f–h). This will form part of the proposed scheme description in the Environmental Statement.

- Standard mitigation: this is required regardless of the EIA because it is generally imposed through legislative requirements or standard sector practices (e.g. implementing considerate contractor practices to reduce nuisance from site work). These measures would be captured in an Environmental Management Plan (EMP).
- Additional mitigation: requires further activity in order to achieve the anticipated outcome. It will be described in the aspect chapters of the Environmental Statement and secured through the Register of Environmental Actions and Commitments (REAC) and the DCO.

5.4.3 Standard and additional mitigation make up 'essential mitigation' as per DMRB LA 104. Essential mitigation is defined as measures critical for the delivery of the scheme which can be acquired through statutory powers.

5.4.4 An EMP will be produced in line with DMRB LA 120 Environmental Management Plans (Highway England, 2020i), which will contain all measures, including the REAC, to manage environmental effects in construction and operation. This initial first iteration of the EMP will be submitted with the DCO application and will provide the equivalent to a Code of Construction Practice (CoCP), and therefore the framework for the future production of the more detailed second iteration of the EMP prior to construction.

5.4.5 If effects cannot be mitigated, compensatory measures would be considered, for example, to provide replacement habitat.

5.4.6 Enhancement measures have also been considered. An enhancement is defined as a measure that is over and above what is required to mitigate the adverse effects of the proposed scheme. Unlike mitigation and compensation measures, enhancements are not factored into the determination of significance; however, the potential benefits of these measures are presented within the relevant aspect chapters, in accordance with the NNNPS.

5.4.7 Mitigation and enhancement measures have been outlined in this PEIR. Measures will be developed further throughout the EIA process and will be detailed in the Environmental Statement. Mitigation and enhancement proposals will be developed in consultation with statutory consultees, where appropriate.

5.5 Identifying potential effects

5.5.1 The aspect chapters identify potential impacts that might occur due to the construction and operation of the proposed scheme. These impacts in turn can lead to environmental effects (defined as the consequence of an impact). Impacts can affect the environment in a variety of ways. Effects may be adverse or beneficial, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term.

5.5.2 For an effect to occur, there needs to be an impact source, pathway and receptor.

5.5.3 In EIA, effects are assessed in terms of their significance to give decision makers a measure of the importance, or gravity, of the environmental effect.

5.6 Significance criteria

5.6.1 Significance of effect is derived through a combination of the sensitivity of a receptor affected (value or importance) and the magnitude of the impact (amount of change). A typical matrix for these variables is provided in DMRB LA 104 (replicated in Table 5.1, Table 5.2 and Table 5.3) and is shown visually in Plate 5.1.

Table 5.1 Sensitivity criteria (taken from DMRB LA 104)

Value (sensitivity)	Typical descriptors
Very high	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

5.6.2 Certain disciplines do not use a matrix-based approach, because they use calculations to assess effects in numerical terms. This includes noise, air quality and flood risk.

5.6.3 In all cases, professional judgement is applied to the assessment to underpin the outcomes identified through the matrix or calculation assessments. Where professional judgement is used, this is accompanied by text to explain the reasons and justification.

Table 5.2 Magnitude criteria (taken from DMRB LA 104)

Magnitude of impact	Typical criteria descriptors
Major adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
Moderate adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
Minor adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Negligible adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.

Magnitude of impact	Typical criteria descriptors
Minor beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Moderate beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Major beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.

Table 5.3 Significance matrix (taken from DMRB LA 104)

Environmental value (sensitivity)		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

5.6.4 Significance categories are described in Table 5.4 (replicated from DMRB LA 104). This describes effects with a very large or a large significance as being 'material' and 'likely to be material' in the decision-making process respectively. Therefore, large and very large effects are considered 'significant' for the purposes of the EIA Regulations. Moderate effects are described as potentially being material in the decision-making process. Moderate effects are therefore also typically considered as significant.

5.6.5 The significance of effect is only assessed after embedded, standard and additional mitigation have been factored in, in line with DMRB LA 104. This is known as the residual effect. To arrive at a conclusion of significance, the effectiveness of design and mitigation measures must be assessed and described. This can be achieved by, for example, explaining the intended outcomes of the mitigation, and assessing how mitigation affects the magnitude of impacts (including impact probability, duration, scale, frequency and reversibility).

Plate 5.1 Matrix for the assessment of significant effects with professional judgement

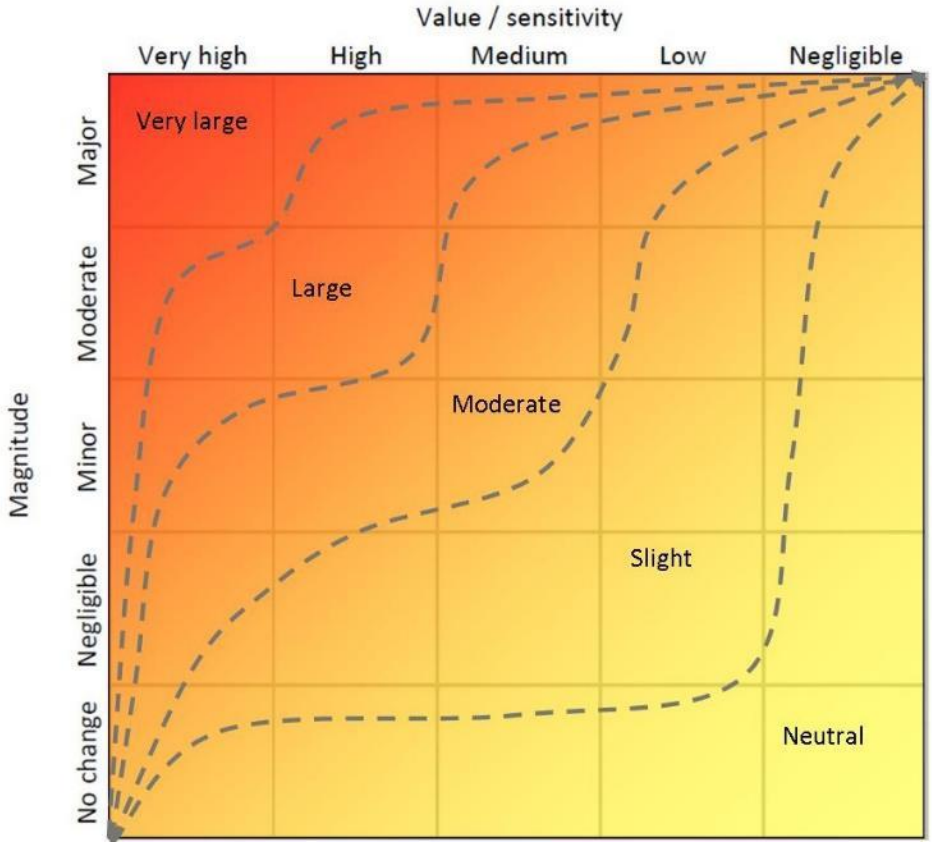


Table 5.4 Significance of effect categories (taken from DMRB LA 104)

Significance category	Typical descriptors of effect
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.7 Assessment of interrelationships

5.7.1 The EIA considers the interrelationships between environmental effects (intra-project effects). This is defined as the effects of multiple residual effects from the proposed scheme on a receptor (i.e. 'within scheme' effects associated with combined impacts across more than one environmental aspect).

5.7.2 These interrelationships can generally be grouped into four broad categories: the effects on residential receptors and communities; effects on the historic environment; effects on biodiversity; and effects on the water environment. The interrelationship of effects on these receptors are covered in the relevant aspect chapter:

- Effects on residents and communities (e.g. the combined effects from air quality, noise, severance and setting) are covered under the population and health aspect
- Effects on the historic environment (e.g. from noise, vibration, land use change, and changes in setting) are covered under the cultural heritage aspect
- Effects on biodiversity (e.g. from noise, light, habitat loss and fragmentation) are covered under the biodiversity aspect
- Effects on water quality (e.g. from physical works, road runoff, accidental spillage and contaminated land) are covered under the road drainage and the water environment aspect

5.7.3 The significance of effect will be determined in line with the relevant aspect assessment methodology (as set out in Chapters 6 to 15 of this PEIR).

5.7.4 The 'in-combination' effect from climate change (i.e. where climate has the potential to exacerbate or, conversely, diminish the effect of an existing impact of the proposed scheme) is assessed in the environmental aspect chapters, where relevant, using significance criteria from the respective chapters.

5.8 Cumulative effects

5.8.1 The NNNPS (paragraph 4.16) states that the Environmental Statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (inter-project cumulative effects). Chapter 16: Cumulative effects assessment sets out the approach to the cumulative effects assessment and is based on the guidance provided in the Planning Inspectorate's (2019) Advice Note Seventeen.

5.9 Major accidents and disasters

5.9.1 The EIA Regulations require that risks due to accidents and disasters be considered within the EIA. At this stage, a two-stage qualitative assessment has been undertaken using technical judgement to identify whether the proposed scheme is at risk from major accidents and disasters. Firstly, a screening matrix was completed detailing a long list of major accidents and disasters that could occur (see Appendix C). Accidents and disasters requiring further consideration were subject to a second more detailed risk assessment. The more detailed risk assessment considered the following:

- The vulnerability of the proposed scheme to risks of major accidents and disasters
- Any consequential changes in the predicted effects of the proposed scheme on environmental aspects from major accidents and disasters

5.9.2 The risk assessment concluded that there are two residual risks remaining that would need to be addressed through the design of the proposed scheme. These are inland floods and mass ground movements.

5.9.3 Inland floods are mainly covered under Chapter 14 on road drainage and the water environment, in terms of reducing future flood risk, and partly within Chapter 15 on climate change adaptation. Impacts and mitigation associated with these are covered in the relevant aspect chapter.

5.9.4 Mass movements and ground hazards, including risks of subsidence and geological faults, are documented within a Preliminary Sources Study Report. This summarises the potential geohazards and risks associated with the ground conditions that need to be factored into the ongoing design process. These risks are being further assessed through a programme of ground investigation surveys. The results and proposed mitigation will be presented within a Ground Investigation Report and will be used to inform the designs.

5.9.5 The Preliminary Sources Study Report also contains an initial review of potential land contamination that may be present within the study area. Potential sources of contamination include made ground, landfills and industrial areas. The proposed scheme could potentially open up pathways between contaminated sources and environmental receptors. These potential impacts are assessed within the relevant aspect chapters such as geology and soils (Chapter 10), population and health (Chapter 13) and road drainage and the water environment (Chapter 14).

5.10 Transboundary effects

5.10.1 A transboundary effects screening matrix was provided in the Environmental Scoping Report. The Planning Inspectorate has undertaken a screening assessment to identify if the proposed scheme is likely to have significant effects on the environment in a European Economic Area state in accordance with Regulation 32 of the EIA Regulations. This concluded that the proposed scheme is unlikely to give rise to significant effects on any European Economic Area state. It is therefore assumed that transboundary effects are scoped out of the assessment; however, the screening matrix will be reviewed prior to the submission of the DCO application and included in the Environmental Statement.

5.11 Supporting assessments

Habitats Regulations Assessment

5.11.1 A Stage 1 Habitats Regulations Assessment (HRA) screening exercise has been undertaken. The HRA identifies possible source-receptor pathways to designated sites, as detailed in Chapter 9: Biodiversity. The preliminary conclusions of the Stage 1 HRA are that no likely significant effects on any European sites are anticipated, when considered alone or in combination with other plans and projects.

5.11.2 Natural England will be consulted to confirm whether an Appropriate Assessment is required. Information to inform an HRA will form part of the DCO application.

Water Framework Directive

5.11.3 The impact of the proposed scheme on Water Framework Directive (WFD) objectives is being assessed in line with the Planning Inspectorate's (2017a) Advice Note Eighteen: The Water Framework Directive.

5.11.4 A standalone WFD compliance assessment will be prepared as an appendix to the Environmental Statement and the conclusions summarised in the road drainage and water environment chapter of the Environmental Statement.

5.11.5 The preliminary conclusions of the assessment indicate WFD compliance, subject to further consultation with the Environment Agency.

Flood Risk Assessment

5.11.6 A Flood Risk Assessment (FRA) is being undertaken as part of the EIA and will be reported in a standalone report which will form an appendix to the Environmental Statement.

5.11.7 The road drainage and water environment chapter of this PEIR summarises key findings from the preliminary FRA where appropriate.

Health Impact Assessment

5.11.8 The impact of the proposed scheme on health is assessed in the population and health aspect (Chapter 13). This will be supported by technical appendices in the Environmental Statement. A standalone Health Impact Assessment (separate from the EIA) will therefore not be undertaken as health will be covered within the EIA.

5.12 Residues and emissions

5.12.1 The EIA Regulations require an estimate, by type and quantity, of expected residues and emissions. This information is provided in the relevant aspect chapters. Table 5.5 sets out the residues and emissions that must be reported on to satisfy the EIA Regulations, as well as the aspect chapters which cover them.

Table 5.5 Residues and emissions

Residue or emission	Aspect chapter
Water pollution	Chapter 14: Road drainage and the water environment
Air pollution	Chapter 6: Air quality
Soil and subsoil pollution	Chapter 10: Geology and soils
Loss of soil resource	Chapter 10: Geology and soils
Noise	Chapter 12: Noise and vibration
Vibration	Chapter 12: Noise and vibration
Light	Chapter 8: Landscape and visual
Heat	N/A – scoped out of assessment
Radiation	N/A – scoped out of assessment
Types and quantities of waste	Chapter 11: Material assets and waste

6 Air quality

6.1 Topic introduction

6.1.1 Air pollution is associated with adverse health impacts and is recognised as a contributing factor in the onset of conditions such as heart disease and cancer. In addition, air pollution disproportionately affects the most vulnerable in society: children and the elderly, and those with pre-existing heart and lung conditions. There is often a strong correlation with issues of inequality because areas with poor air quality are also often less affluent areas (Department for Environment, Food and Rural Affairs (Defra), 2006). Furthermore, in certain circumstances air pollution may adversely affect ecosystems through elevated nitrogen and acid deposition.

6.1.2 This chapter of the Preliminary Environmental Information Report (PEIR) describes the findings of a preliminary assessment of the likely effects of the proposed scheme on air quality, during both the construction and operational phases. The assessment considers the following matters:

- Baseline conditions: a review of existing air quality conditions within the study area
- Construction dust: a qualitative assessment of the potential impacts of construction dust on relevant sensitive receptors
- Local air quality: a detailed assessment of the potential air quality impacts of the proposed scheme, during both its construction and operation, on representative human health sensitive receptors within the study area
- Designated sites: an assessment of the potential for changes in air quality as a result of the proposed scheme to impact relevant designated ecological sites within the study area
- Compliance risk: an assessment of the potential risk of the proposed scheme to affect compliance with the annual mean nitrogen dioxide (NO_2) EU Limit Value in the 'shortest possible time'

6.1.3 This chapter is supported by the following figures (see Appendix A):

- Figure 6.1 Air Quality Assessment Study Area
- Figure 6.2 Air Quality Baseline Conditions
- Figure 6.3 Background NO_2 Concentrations
- Figure 6.4 Construction Dust Assessment – Sensitive Receptors
- Figure 6.5 Modelled NO_2 Concentrations in the Peak Construction Year (2025) Do Something Scenario for Human Health Receptors
- Figure 6.6 Modelled Change in NO_2 Between the Peak Construction Year (2025) Do Something Traffic Scenarios for Human Health Receptors

- Figure 6.7 Modelled Ecology Receptors
- Figure 6.8 Modelled Compliance Risk Assessment Receptors
- Figure 6.9 Modelled NO_2 Concentrations in the Opening Year (2027) Do Something Scenario for Human Health Receptors
- Figure 6.10 Modelled Change in NO_2 Between the Opening Year (2027) Do Minimum and Do Something Scenarios for Human Health Receptors

6.1.4 This chapter uses some technical air quality terminology. These terms are presented and described in a glossary at the end of this chapter.

6.2 Stakeholder engagement

6.2.1 Stakeholder engagement has been undertaken with the four local authorities through whose authority areas the proposed scheme passes. These local authorities are Colchester Borough Council, Chelmsford City Council, Maldon District Council and Braintree District Council. This engagement was undertaken in August 2020 and focused on agreeing the air quality assessment methodology. There were no fundamental changes to the assessment methodology due to comments received from the Planning Inspectorate's Scoping Opinion.

6.2.2 Table 6.1 identifies the key feedback received from the Scoping Opinion (Planning Inspectorate, 2021).

Table 6.1 Key stakeholder feedback for air quality aspect

Stakeholder	Comment	Response
Planning Inspectorate	Ensure that observed air quality monitoring trends and results from the application of the Department of Environment, Food and Rural Affairs' (Defra's) annual mean NO_2 projection tool are fully explained in the Environmental Statement.	The Defra projection tool will not be applied to the monitored concentrations because projected NO_2 concentrations will be directly modelled at receptors in future years as part of the assessment.
Planning Inspectorate	Provide detail as to how study-based air quality monitoring was collected, processed, and annualised.	A summary of the collection, processing and annualization of air quality monitoring data is provided in Section 6.7 of this chapter (baseline conditions). Full details will be provided in the Environmental Statement.

Stakeholder	Comment	Response
Planning Inspectorate	Provide justification for the placement of Highways England air quality monitoring sites.	The study-based air quality monitoring locations were selected to best facilitate the setting up of the air quality model, e.g. for the purposes of model verification. A representative number of locations were selected near the current and proposed alignment of the A12 to indicate local baseline conditions. More detail will be provided in the Environmental Statement.
Planning Inspectorate	Provide clarification if background NO_x concentrations exceed 30µg/m^3 which is the air quality objective (AQO) for NO_x.	Mapped background concentrations indicate that NO_x concentrations are over 30µg/m^3 in the 2016 base year. However, background concentrations were below 30µg/m^3 in the assessed construction and opening years. Further details are provided in Section 6.7 of this chapter.
Planning Inspectorate	Provide clarification on the spatial distribution of background concentrations. More specifically, show the concentration gradient across the Traffic Reliability Area (TRA) with respect to the provisional Order Limits.	Background concentration ranges across the modelled receptor locations are presented in tabular form in Section 6.7 of this chapter. Figure 6.3 shows the spatial distribution of background NO_2 concentrations as 1km grid squares.
Planning Inspectorate	There is little or no information provided about Defra's Pollution Climate Mapping (PCM).	Details of Defra's PCM model (Defra, 2020c) have been provided in Section 6.7 of this chapter.
Planning Inspectorate	Ensure that justification of the selected receiving environment is fully described as per the Design Manual for Roads and Bridges (DMRB) LA 105.	Justification for the selection of receptors has been provided in Section 6.7 of this chapter. The worst-case receptors have been selected in the study area.

Stakeholder	Comment	Response
Colchester Borough Council	The Environmental Scoping Report proposes an assessment of air quality in relation to the proposed scheme using DMRB LA 105. The proposed air quality assessment methodology is acceptable, however we would like to draw attention to the air pollution hotspot on the A120 in Marks Tey. The scoping report neglects monitoring data collected by Colchester Borough Council in 2019 which suggest relatively poor air quality on the A120 approximately 1km from the A12 junction 25. Air quality conditions at this location are described in the 2020 Colchester Borough Council Air Quality Annual Status Report and it is essential that any comprehensive assessment takes this into account.	The latest available monitoring data, for the year 2019, have been collated for the relevant local authorities and presented in Section 6.7 of this chapter. Worst-case receptor pollutant concentrations have been modelled in this air quality assessment within 200m of roads where air quality traffic screening criteria are triggered.
Maldon District Council	Any construction dust assessment should have regard to the Institute of Air Quality Management (IAQM) guidance document: Assessment of Dust from Demolition and Construction 2014 (revised 2016).	The assessment will follow DMRB LA 105 guidance. DMRB LA 105 is informative for the assessment of major road schemes. The level of construction dust mitigation required following assessment with the DMRB LA 105 methodology would be equivalent to the outcomes with the IAQM guidance.
Maldon District Council	Any air quality assessment should have regard to the IAQM guidance document: Guidance on Land-Use Planning and Development Control: Planning for Air Quality 2017.	The assessment will follow DMRB LA 105 guidance. DMRB LA 105 assesses significant effects against relevant thresholds for air quality.

6.2.3 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

6.2.4 In addition to the comments raised through the Scoping Opinion, stakeholders have also raised concerns about the effect on air quality from the proposed scheme on Maldon Road, particularly the junction with the B1137 The Street. The effect on air quality from the proposed scheme in this area has been described in Section 6.8.

6.3 Legislative and policy framework

6.3.1 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.

6.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraphs 5.3 to 5.4 of the NNNPS outline the potential impact of construction or operation of national network projects (i.e. changes in pollutant emissions) on human health as well as protected species and habitats. These paragraphs also outline UK legislation, such as local air quality objectives (AQOs), as well as EU legislation, such as Limit Values, for the main pollutants in the Ambient Air Quality Directive (2008/50/EC), which Member States are required to meet by various dates. EU Limit Values are transcribed within the Air Quality Standards Regulations 2010 and are therefore still included in post-Brexit legislation.

- National AQOs are defined in the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002. The Ambient Air Quality Directive (2008/50/EC) forms the basis for UK air quality legislation. EU Limit Values are transposed into UK law by the Air Quality Standards (England) Regulations 2010. The AQOs for oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter less than 10µm (PM_{10}) are shown in Table 6.2. Pollutant $PM_{2.5}$ is also listed as the finer fraction of PM_{10} to include much of the combustion-based particulates responsible for serious respiratory illnesses.

- Paragraphs 5.6 to 5.9 state that where the impacts of any project may have a significant effect on air quality, then an assessment must be undertaken as part of the Environmental Statement. These paragraphs then go on to describe that the Environmental Statement must include existing air quality levels, forecasts of air quality at the time of project opening and significant effects on air quality, using Defra's future national projections of air quality during the modelling process. A judgement on the risks as to whether the project would affect the UK's ability to comply with the Ambient Air Quality Directive must also be included.

Table 6.2 AQOs for NO_x, NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration	Averaging period
Nitrogen oxides (NO_x)	30µg/m^3	Annual mean
Nitrogen dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40µg/m^3	Annual mean

Pollutant	Concentration	Averaging period
Particulate matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40µg/m^3	Annual mean
Particulate matter ($PM_{2.5}$)	25µg/m^3	Annual mean

6.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

6.4 Assessment methodology

6.4.1 A detailed assessment of air quality has been undertaken in accordance with the guidance in the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality (Highways England, 2019d). By using the guidance within DMRB LA 105 the proposed scheme can be measured against the NNNPS policy requirements.

6.4.2 Traffic data were provided for this assessment using the A120 Braintree to Marks Tey SATURN model with a base year of 2016. The final iteration of traffic data for this PEIR were provided on 8 February 2021 and included a number of committed developments that form the core traffic model, as discussed with Essex County Council.

6.4.3 In accordance with DMRB LA 105, the Environmental Scoping Report (Highways England, 2020d) sets out the criteria which were used to assess significance for the air quality assessment. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

Construction dust

6.4.4 A construction dust assessment was undertaken in accordance with DMRB LA 105, which considered all sensitive receptors within 50m, 50–100m and 100–200m of all construction activity bounded by the provisional Order Limits. The nearby receptors were considered in combination with the likely construction activities to inform a dust risk potential of the proposed scheme to the receiving environment. As the scheme design is subject to change, the risk potential will be used to inform proposed mitigation measures, which will be included in the upcoming Environmental Statement and first iteration of the Environmental Management Plan (EMP).

Construction traffic

6.4.5 In accordance with DMRB LA 105, the impact of construction activities on vehicle movements has been assessed because the construction programme would last for more than two years. For the assessment of construction traffic, detail was limited at this stage to non-traffic modelled estimates of activity between junctions 15 and 28 of the A12 and interconnecting roads (e.g. A138, B1018 and B1019), as provided by the proposed scheme's transport modelling team[3]. The 2027 Do-Minimum (DM; without the proposed scheme) traffic data was back-casted to 2025 (the peak construction year) using provided adjustment factors, so that 2025 DM and 2025 Do-Something (DS; DM with construction traffic) scenarios could be assessed.

6.4.6 Data were processed into a format commensurate with the operational traffic assessment described below, including derivation of speed-banded emissions and identification of a construction-traffic specific ARN. Worst-case receptors were identified in addition to those selected for the operational traffic assessment, including human and ecological receptors. The local air quality assessment of construction traffic impacts then followed the same methodology as the operational local air quality assessment detailed below, but for the construction year of 2025.

Operational traffic

6.4.7 The main steps in assessing the impact of operational traffic include the following:

- **Defining the study area:** The operational phase study area was defined within the TRA (see glossary) based on changes in modelled traffic between the opening year DM (without proposed scheme) and DS (with proposed scheme) scenarios (see Section 6.6). This provided the affected road network (ARN) (i.e. those roads expected to experience changes in traffic conditions with the potential to affect air quality). A representative number of worst-case human health, compliance risk and ecological receptors were then selected within 200m of the ARN. The identification of sensitive receptors is described in Section 6.7.

- **Emissions calculations:** Emission rates for NO_x and PM_{10} were estimated from speed-banded traffic data inputs using Highways England v3.1 speed-banded emission factors (which are based on version 10.0 of Defra's Emission Factors Toolkit).

- **Dispersion modelling:** Annual mean concentrations of road NO_x and PM_{10} were modelled at receptors using the Atmospheric Dispersion Modelling System Roads (ADMS-Roads) dispersion model, version 5.0 (Cambridge Environmental Research Consultants, 2020). Meteorological inputs were included based on 2016 data from a meteorological site at Andrewsfield Aerodrome in Essex.

[3] Construction traffic for this PEIR was derived from a qualitative assessment, predominantly based on estimations of imported material quantities undertaken by the proposed scheme's transport modelling team.

- **Verification:** Base year modelled road NO_x concentrations were compared to monitored road NO_x in an attempt to account for any systematic bias in the air quality dispersion modelling approach, following the methodology described in Local Air Quality Management: Technical Guidance (TG16) (LAQM.TG(16); Defra, 2018). The verification process identified whether adjustment(s) to the raw modelled road NO_x concentrations were required. Based on the verification, an appropriate adjustment factor of 1.531 was applied to the modelled road NO_x. The same adjustment factor was also applied to modelled road PM_{10}.

- **Post-processing/adjustment (NO_2):** The verification based model adjustment factor was applied to modelled road NO_x concentrations in all scenarios. The NO_x to NO_2 conversion tool v8.1 (Defra, 2020a) was then used, along with the adjusted and sector-removed mapped background NO_2 concentrations (see Section 6.7, Defra, 2020b), to calculate annual mean NO_2 concentrations at sensitive receptors. Long-term trend (LTT) adjustment factors were applied to annual mean concentrations at human health and ecological receptors in accordance with the methodology described in DMRB LA 105. LTT adjustment factors are applied to ensure that the modelled roadside NO_2 concentrations derived using the Defra modelling tools are not too optimistic relative to observed roadside monitoring trends.

- **Post-processing/adjustment (PM_{10}):** The verification based model adjustment factor was applied to modelled road PM_{10} concentrations in all scenarios. The verification-adjusted modelled road PM_{10} concentrations were added to the adjusted and sector-removed mapped background PM_{10} concentrations (Defra, 2020b). No further adjustments were required.

- **Pollution Climate Mapping (PCM):** The total NO_2 concentrations at PCM compliance risk receptors were processed as described in the bullet points above. LTT adjustment factors are not applicable to PCM compliance risk receptors and were therefore not applied to the PCM receptors in this assessment. As per the DMRB LA 105 methodology, the total NO_2 concentrations were compared to the opening year Defra-modelled concentrations at PCM Census IDs, and any risks to the EU Limit Values were identified.

- **Nitrogen deposition:** Following identification of the ecological sites and appropriate transect locations, the project ecologist was consulted to confirm the relevant nitrogen-sensitive habitats. Baseline nitrogen (N) deposition rates and critical loads were obtained from the Air Pollution Information System website (APIS) (Centre for Ecology and Hydrology, 2020). The change in DM and DS road NO_2 concentrations (verification and LTT adjusted) were converted to N deposition rates (kg N/ha/yr) using the following conversion factors recommended by DMRB LA 105:

  - grassland and similar habitats: 1µg/m^3 of NO_2 = 0.14kg N/ha/yr
  - forests and similar habitats: 1µg/m^3 of NO_2 = 0.29kg N/ha/yr

The total N deposition rate for each receptor was calculated by adding the road-based N deposition rates to the relevant baseline N deposition rates.

Assessment of significance

6.4.8 The significance of the environmental effects were determined following the DMRB LA 105 criteria.

6.4.9 For the local air quality assessment at human health receptors, Table 6.3 shows the guideline bands for the number of properties experiencing a 'small' to 'large' change in NO_2 that would inform a judgement of significant air quality effects in the human health receptors. The significance was determined based on these guideline bands, in combination with professional judgement of any potential risks.

Table 6.3 Magnitude of change criteria in annual mean NO_2, applied in the judgement of significant air quality effects of the proposed scheme

Magnitude of change in NO_2 concentration	Total number of properties with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4µg/m^3)	1 to 10	1 to 10
Medium (>2µg/m^3)	10 to 30	10 to 30
Small (>0.4µg/m^3)	30 to 60	30 to 60

6.4.10 For the local air quality assessment at ecological receptors, the air quality assessment identified receptors where there was potential for significant effects in terms of nitrogen deposition. As per DMRB LA 105, the criteria used to determine whether an ecological receptor had potentially significant effects were as follows:

- Total N deposition rate greater than the minimum critical load for the relevant habitat
- An increase in N deposition rate with the proposed scheme equivalent to more than 1% of the minimum critical load
- An increase in N deposition rate of more than 0.4 kg N/ha/yr. The threshold of 0.4 kg N/ha/year is set out in DMRB LA 105

6.4.11 At receptors where these criteria are met, results will be reviewed by the competent expert for biodiversity as part of the upcoming Environmental Statement, to determine the overall significance for ecological features, as per DMRB LA 105.

6.4.12 For PCM compliance risk, a significant effect was concluded if the proposed scheme was perceived to create a risk of delaying the UK's reported ability to comply with the EU Limit Value (40µg/m^3 at qualifying features) in the shortest possible time.

6.4.13 If any impacts are concluded to be significant, a Project Air Quality Action Plan would be produced outlining mitigation with the aim of reducing this risk. Significance would then be reassessed as per the criteria in DMRB LA 105.

6.4.14 In accordance with DMRB LA 105, the assessment determined whether the scheme had a significant effect on human health and ecological receptors. In addition, the assessment also determined whether there is a risk that the project will impact on the reported date of compliance with the EU Limit Values. The receptors included in the assessment are different for these assessments. Furthermore, the approach to generating predictions in the future are not comparable, particularly in relation to the assessment of human health and compliance. The PCM compliance assessment was consistent with the approach taken by Defra to determine whether a qualifying feature is likely to exceed the Limit Value.

6.5 Assessment assumptions and limitations

6.5.1 The air quality impact assessment was based on a series of computer models of future conditions. The process began with modelling future traffic flows, which is subject to its own inherent degree of uncertainty. The traffic model used at this preliminary assessment stage is based on a 2016 traffic base year. A revised air quality assessment will be undertaken when updated data from the A12 PCF Stage 3 DCO traffic model (based on a 2019 base year) are available, the results of which will be presented within the Environmental Statement.

6.5.2 These traffic data were used in an emissions model. The emissions data were then fed into a dispersion model and a total concentration was derived to compare future air quality conditions both with (DS) and without (DM) the proposed scheme. The air quality models drew on parameters that are projected into the future. The modelling process included atmospheric dispersion modelling, which provides an estimate of concentrations arising from input emissions and historical meteorological data.

6.5.3 Semi-quantitative construction traffic data were derived through a desk-based study by the proposed scheme's transport modelling team between junctions 15 and 28. This was done because information was not available regarding their exact movements via traffic modelling at the time of the assessment. The traffic data applied considered the movement of construction vehicles on a limited basis between these two junctions of the A12.

6.5.4 Two main construction compounds have been proposed, one at junction 20b and the other at junction 22, with four satellite compounds, two of which are at junction 19, one at junction 24 and junction 25. For the purposes of this PEIR assessment, it has been assumed that construction traffic travels to the main compound at junction 20b, then returns to its original destination via the same route. When this assumption was made, the compound at junction 20b was the only 'main' compound. This assumption was retained, as incorporating other 'main' compounds would have increased the number of required assumptions and associated uncertainty. The PEIR assessment was therefore undertaken based on the most reliable information at the time of the assessment with involvement from the appointed construction contractor for the proposed

scheme. Construction traffic will be provided in more detail for inclusion in the Environmental Statement. It was also assumed that the construction traffic would be distributed across a day as follows:

- Cars (i.e. site staff) – 50% of the two-way Annual Average Daily Traffic (AADT) in the AM period and 50% in the PM period
- Heavy Goods Vehicles (HGVs) – evenly split per hour between 08:00 and 16:00, so 25% of the two-way AADT will travel in the AM (between 08:00 and 10:00) and 75% will travel in the inter-peak period (between 10:00 and 16:00)

6.5.5 It has been assumed that construction vehicles would utilise the existing A12 for access to parts of the site, with the exception of the A138, B1018 and B1019. The majority of local roads were assumed to be unsuitable for HGV traffic.

6.5.6 As with any computer model that seeks to predict future conditions, there is uncertainty in the predictions made. Elements of impact prediction such as the specific concentration of a given pollutant at a given property, or whether an exceedance of AQOs or EU Limit Values would or would not occur at a specific location, are not precise and are always subject to a margin of error. However, the assessment process is considered to be based on the most reasonable, robust and representative methodologies, taking advice from published guidance.

6.5.7 Sensitive receptors were determined using an Ordnance Survey AddressBase+ dataset. There may in some cases be properties, such as those recently built, which are not yet present within these data sources. Under these circumstances, receptors for planned development were assumed to be located on the boundaries nearest to the ARN or where proposed property outlines were made available.

6.6 Study area

6.6.1 In line with the DMRB LA 105 guidance, potential air quality impacts from construction dust were considered within 200m of all construction activities.

6.6.2 The study area for the construction and operational traffic air quality assessments was defined following the screening process outlined within DMRB LA 105, which identifies an ARN from the TRA based on predicted changes in traffic between the peak construction year (2025) DM and DS or between the opening year (2027) DM and DS scenarios.

6.6.3 As per DMRB LA 105, roads were included in the ARN where any of the following criteria were met between the 2025 DM and DS (for construction traffic), or between the 2027 DM and DS (for operational traffic):

- Daily traffic flows change by more than 1,000 AADT
- Heavy Duty Vehicle (HDV) flows change by more than 200 AADT
- Daily average or peak hour speed-band change
- Horizonal road alignment changes by 5m or more

6.6.4 The study area was then defined as the ARN plus all roads within 200m of any sensitive receptors (i.e. human health, ecological or PCM Census IDs) within 200m of the ARN.

6.6.5 The TRA and study area is shown on Figure 6.1.

6.7 Baseline conditions

Baseline sources

6.7.1 A review of baseline air quality conditions in the defined air quality study area has been undertaken based on information from the following sources:

- Chelmsford City Council 2020 Air Quality Annual Status Report (Chelmsford City Council, 2020b)
- Braintree District Council 2019 Air Quality Annual Status Report (Braintree District Council, 2019)[4]
- Maldon District Council 2020 Air Quality Annual Status Report (Maldon District Council, 2020)
- Colchester Borough Council 2019 and 2020 Air Quality Annual Status Reports (Colchester Borough Council, 2019 and 2020)
- Brentwood Borough Council 2020 Air Quality Annual Status Report (Brentwood Borough Council, 2020)
- Epping Forest District Council 2020 Air Quality Annual Status Report (Epping Forest District Council, 2020)
- Uttlesford District Council 2020 Air Quality Annual Status Report (Uttlesford District Council, 2020)
- Babergh and Mid-Suffolk District Councils 2020 Air Quality Annual Status Report (Babergh District Council, 2020)
- Harlow Council 2020 Air Quality Annual Status Report (Harlow District Council, 2020)
- Havering Air Quality Annual Status Report for 2018 (London Borough of Havering, 2019)
- Defra background mapping data (Defra, 2020b)
- Defra PCM model NO_2 projections (Defra, 2020c)
- Ordnance Survey AddressBase+ data

[4] The 2020 Annual Status Report had not been completed at the time of this assessment. Monitored NO_2 concentrations for the year 2019 were therefore collated through correspondence with the Environmental Health Officer at Braintree District Council.

- Air Pollution Information System website (Centre for Ecology and Hydrology, 2020)
- Ecological open data (Natural England, 2020a)
- Ancient Tree Inventory (Woodland Trust, 2020)
- Maps of the surrounding area

6.7.2 All data used in the baseline assessment are publicly available, with the exception of the Ordnance Survey AddressBase+ data which were purchased.

6.7.3 In addition to the sources listed above, this review of baseline conditions includes data collected during field-based surveys for air quality and ecology.

Baseline conditions

6.7.4 Figure 6.1 shows the TRA and study area (indicated by the ARN) for the air quality assessment. The proposed scheme is located within the administrative boundaries of Chelmsford, Braintree, Maldon and Colchester. The study area (indicated by the ARN) extends over these four local authority areas.

6.7.5 In addition, the TRA extends over parts of Brentwood, Epping Forest, Uttlesford and Babergh, in addition to running along the Chelmsford/London Borough of Havering boundary on the M25 and the Epping Forest/Harlow boundary on the M11. The ARN was not located within any of these local authorities but monitoring data were collated from these local authorities for the purposes of model verification.

Local authority monitoring data

6.7.6 In fulfilment of their Local Air Quality Management requirements, the aforementioned local authorities conduct NO_2 monitoring across their administrative areas using automatic monitors and diffusion tubes. Figure 6.2 shows the location and monitored annual mean 2019 NO_2 concentrations for monitoring sites near the ARN. Table 6.4 shows the monitoring data for the locations that are within approximately 1km of the ARN.

Table 6.4 Local authority monitoring data from diffusion tubes and automatic sites within approximately 1km of the ARN

Site ID	Local authority	Site type	Valid data capture for monitoring period (%)[a]	Grid reference		Annual mean NO_2 concentration (µg/m^3)				
				X (m)	Y (m)	2015	2016	2017	2018	2019
BR3	Braintree	Roadside	100.0	583859	216497	**47.1**	**46.4**	**51.9**	**46.1**	**45.8**
BR4	Braintree	Urban Background	100.0	577800	222500	15.9	17.3	18.3	16.2	16.6
BR5	Braintree	Roadside	100.0	582002	215111	**40.8**	**45.9**	**45.3**	**40.4**	39.1
BR7	Braintree	Roadside	100.0	577680	221964	30.5	28.3	31.6	29.2	27.8
BR9	Braintree	Roadside	83.0	583891	216467	**43.9**	**46.3**	**46.1**	**40.7**	35.5
BR11	Braintree	Roadside	100.0	586386	219106	27.3	30.1	27.1	23.1	22.1
BR13	Braintree	Roadside	100.0	581851	214151	-	-	-	33.0	32.9
BR21	Braintree	Roadside	100.0	582143	214630	-	-	-	-	28.2
BR22	Braintree	Roadside	92.0	582033	215081	-	-	-	-	24.0
CM2[b]	Chelmsford	Roadside	86.5	571640	207179	28.1	28.9	28.0	29.2	34.5
CB08	Chelmsford	Roadside	100.0	571383	206926	28.6	28.9	33.2	29.3	28.0
CB27/27A/27B	Chelmsford	Roadside	100.0	574080	203469	36.6	35.0	36.4	32.4	31.8
CB31	Chelmsford	Roadside	100.0	575265	209975	24.8	26.7	26.0	24.4	24.3
CB32	Chelmsford	Roadside	100.0	571581	207144	31.6	31.9	33.3	29.0	29.3
CB38/39/40	Chelmsford	Roadside	100.0	571640	207179	28.3	28.3	30.3	29.0	28.0

Site ID	Local authority	Site type	Valid data capture for monitoring period (%)[a]	Grid reference		Annual mean NO_2 concentration ($\mu g/m^3$)				
				X (m)	Y (m)	2015	2016	2017	2018	2019
CB52	Chelmsford	Roadside	100.0	571367	207014	30.8	30.4	34.3	31.9	29.9
CB80	Chelmsford	Roadside	100.0	571710	207246	25.3	25.3	27.5	26.8	24.6
CB81	Chelmsford	Roadside	78.4	571674	207282	26.0	29.2	32.5	32.1	29.0
CB82	Chelmsford	Roadside	100.0	571438	206966	32.8	31.9	34.6	34.7	31.5
CB83/83B/83C	Chelmsford	Roadside	95.4	571462	206999	39.1	38.0	39.4	36.4	35.8
CB89	Chelmsford	Roadside	100.0	571426	206979	-	37.4	41.7	38.5	37.4
CB90	Chelmsford	Roadside	100.0	571480	207019	-	30.5	29.6	26.9	26.1
CBC20	Colchester	Urban Background	100.0	599063	225097	18.2	20.2	20.6	21.7	19.5
CBC58	Colchester	Suburban	100	595094	225099	28.6	32.2	27.3	29.9	-
CBC59	Colchester	Suburban	100	595031	225196	29.7	33	32.9	32.3	-
CBC65	Colchester	Roadside	100.0	598797	224489	25.2	26.2	25.3	24.3	23.3
CBC90	Colchester	Roadside	100.0	591312	223431	25.3	28.0	26.6	27.1	26.7
CBC96	Colchester	Roadside	100.0	599909	228288	18.7	20.5	20.8	18.4	19.9
CBC97	Colchester	Roadside	100.0	599452	227884	25.4	28.4	25.8	26.0	26.8
CBC107	Colchester	Roadside	100.0	599389	225373	28.8	30.9	30.5	30.9	32.3
CBC108	Colchester	Roadside	100.0	599354	225802	29.6	30.9	29.6	32.4	29.9

Site ID	Local authority	Site type	Valid data capture for monitoring period (%)[a]	Grid reference		Annual mean NO_2 concentration ($\mu g/m^3$)				
				X (m)	Y (m)	2015	2016	2017	2018	2019
CBC109	Colchester	Roadside	100.0	599398	225432	31.1	33.0	31.2	33.3	34.5
CBC118	Colchester	Roadside	100.0	599269	226122	31.2	30.8	29.6	28.5	30.1
CBC119	Colchester	Roadside	100.0	599230	226272	21.5	20.7	20.9	21.9	22.1
CBC123	Colchester	Roadside	100.0	598938	226707	-	-	21.0	24.7	22.0
CBC125	Colchester	Roadside	91.7	599227	226509	-	-	-	30.2	34.7
CBC126	Colchester	Roadside	100.0	597244	225178	-	-	-	-	17.9
CBC131	Colchester	Roadside	100.0	595025	225166	-	-	-	-	39.8
CBC132	Colchester	Roadside	100.0	595106	225123	-	-	-	-	32.5
CBC135	Colchester	Roadside	58.3	591366	223679	-	-	-	-	30.6
CBC136	Colchester	Roadside	58.3	590444	223502	-	-	-	-	37.9
CBC137	Colchester	Roadside	58.3	590325	223495	-	-	-	-	**44.6**

Note: Values in **bold** denote exceedances of the level of the annual mean AQO (40µg/m^3).

[a] Monitored concentrations have been annualised by the local authorities where data capture was below 75%.

[b] Continuous monitoring site. All other sites are diffusion tubes.

6.7.7 Of the sites shown in Table 6.4, one measured NO_2 concentration above the annual mean AQO (40µg/m^3) in 2019 and is adjacent to the ARN – BR3 at Foxden, Rivenhall, in Braintree – and therefore has the potential to be affected by the proposed scheme. However, the monitoring data indicate that, after being distance-corrected to the nearest relevant exposure location (for the application of the annual mean AQO), this site is below the AQO, i.e. not in exceedance. Location BR9 is also adjacent to the ARN and recorded an exceedance in 2018 but was below the AQO in 2019 and was also below the AQO after distance correction.

6.7.8 Sites BR5 and CBC137 have recorded exceedances of the AQO in recent years. However, they are not located within 200m of the ARN and are therefore not expected to be affected by the proposed scheme.

6.7.9 Future NOx emissions are projected to decline, and the majority of monitoring locations are at the roadside instead of locations of relevant exposure. However, the baseline NO_2 monitoring data indicate that recent concentrations are above the annual mean AQO at locations near the ARN. This has guided the placement of worst-case receptors in this assessment, in combination with the projected traffic modelling.

6.7.10 In addition to monitoring NO_2, Chelmsford City Council operate three automatic monitoring stations to measure PM_{10} concentrations. One of these sites (site CM2) is within 1km of the ARN and measured an annual mean concentration of 25.3µg/m^3 in 2019, which is below the annual mean AQO for PM_{10} of 40µg/m^3 by a considerable margin. This implies a low risk of the proposed scheme exceeding the annual mean AQO for PM_{10}.

Project specific monitoring data

6.7.11 Highways England commissioned an NO_2 diffusion tube survey to cover perceived gaps in the coverage provided by local authority monitoring data with regard to the proposed scheme. This survey was undertaken across 11 sites (see Figure 6.2) between May 2017 and July 2018. Annualised, bias-adjusted results for the year 2019 (see Figure 6.2 and Table 6.5) and 2016 (for model verification; see Table 6.6) were derived in accordance with the guidance provided in LAQM.TG(16) (Defra, 2018).

6.7.12 Table 6.5 shows the annualised year 2019 concentrations from the Highways England commissioned diffusion tube survey. The monitored NO_2 concentration at site J10, positioned at the A12 roadside near junction 25 (Marks Tey interchange), was found to exceed the level of the annual mean AQO. Worst-case receptor locations near site J10 have been modelled as part of this assessment.

Table 6.5 Monitoring data from diffusion tube survey at locations in proximity to the A12

Site ID	Grid reference		2017/2018 period data capture (%)	Weighted average 2017/2018 period NO_2 concentration ($\mu g/m^3$)	Annualised and bias adjusted 2019 NO_2 concentration ($\mu g/m^3$)
	X (m)	Y (m)			
J1	575707	210324	83.3	29.1	27.9
J2	579507	212002	100.0	30.9	29.7
J3	582908	214601	100.0	37.5	36.0
J4	584055	216314	100.0	28.9	27.8
J5	585646	217244	91.7	15.4	15.2
J6	585529	218651	83.3	15.7	14.5
J7	587687	218873	100.0	29.2	28.1
J8	587781	220289	91.7	22.1	21.6
J9	589992	221243	75.0	18.0	18.2
J10	591515	223594	100.0	43.5	**41.8**
J11	571645	207182	100.0	34.6	33.2

Note: Values in **bold** denote exceedances of the level of the annual mean AQO (40µg/m^3).

6.7.13 For the purposes of model verification, local authority annual mean NO_2 concentrations for the year 2016 were collated (i.e. for the same year as the base year of the traffic model). Table 6.6 shows the monitored concentrations used in the final model verification process. Although all monitoring sites across the TRA were considered in the initial verification exercise, various sites were then excluded at locations where emissions or dispersion behaviour could not be appropriately represented in the model, such as at junctions or where entrainment effects were likely to dominate.

Table 6.6 Monitored annual mean 2016 NO_2 concentrations used for model verification

Site ID	Site type	Grid reference		Data capture (%)	2016 annual mean NO_2 concentration ($\mu g/m^3$)
		X (m)	Y (m)		
BR7	Roadside	577680	221964	100	28.3
CB27/CB27A/CB27B	Roadside	574080	203469	91.7	35.0
CBC78	Roadside	591254	223367	100	26.9

Site ID	Site type	Grid reference		Data capture (%)	2016 annual mean NO_2 concentration ($\mu g/m^3$)
		X (m)	Y (m)		
CBC89	Roadside	591036	223163	100	28.3
CBC90	Roadside	591312	223431	100	28.0
J1	Roadside	575707	210324	83.3*	32.3
J2	Roadside	579507	212002	100*	34.3
J3	Roadside	582908	214601	100*	**41.6**
J4	Roadside	584055	216314	100*	32.1
J5	Roadside	585646	217244	91.7*	17.5
J6	Roadside	585529	218651	83.3*	16.7
J7	Roadside	587687	218873	100*	32.4
J8	Roadside	587781	220289	91.7*	24.9
J10	Roadside	591515	223594	100*	**48.3**
J11	Roadside	571645	207182	100*	38.4
CBC8	Roadside	597640	223661	100	24.7
CBC92	Roadside	597996	223913	100	20.5
BR10	Roadside	578400	211532	100	**46.1**
CBC58	Suburban	595094	225099	91.7	32.2
CBC59	Suburban	595031	225196	100	33.0

Note: Values in **bold** denote exceedances of the level of the annual mean AQO ($40\mu g/m^3$).

*Data capture is shown for the 2017/18 monitoring period, as in Table 6.5. The monitored concentrations were annualised to the year 2016.

Air quality management areas (AQMA)

6.7.14 There is one AQMA, Lucy Lane North AQMA in the Borough of Colchester, within 200m of the ARN. This is located immediately adjacent to the ARN near junction 26 of the A12 and its location is shown on Figure 6.2. In 2019, an annual mean NO_2 concentration of $39.8\mu g/m^3$ was measured in the AQMA, indicating compliance with the annual mean AQO for NO_2 of $40\mu g/m^3$.

Mapped background pollutant concentrations

6.7.15 Defra background mapped concentrations cover the whole country on a 1km x 1km grid and are published for each year from 2018 to 2030. Background concentrations represent the average concentration within each grid, rather than localised concentrations within the grid, which would be measured through monitoring. To calculate background concentrations for the 2016 base year, back casting factors for NO_x, NO_2 and PM_{10} were first applied to the mapped concentration data for 2018, derived using monitoring data from five Automatic Urban and Rural Network (AURN) background sites. Following this, a comparison of the back-casted 2016 mapped background concentrations with 2016 AURN-monitored NO_x and NO_2 concentrations was undertaken yielding a further adjustment factor. This second factor was applied to the mapped background concentrations for all assessment years. The in-square major road sector contributions were removed to avoid double counting in accordance with LAQM.TG(16).

6.7.16 Table 6.7 shows the range of modelled background pollutant concentrations applied within this assessment. The range covers the grid squares associated with the receptors modelled.

Table 6.7 Mapped background pollutant concentrations (Defra, 2020b)

Pollutant	Annual mean background pollutant concentration range (µg/m^3)		
	2016	2025	2027
NO_2	12.3–23.3	6.9–15.1	6.7–14.7
PM_{10}	14–19.4	13.2–18.6	14–19.4
NO_x	16.6–35.5	8.8–21.1	8.6–20.4

6.7.17 Figure 6.3 shows the spatial distribution of the NO_2 background concentrations for the year 2019, for consistency with the latest available monitoring data. The spatial overview indicates that background NO_2 concentrations in 2019 were highest in the regions of Chelmsford, Witham and Colchester.

Pollution Climate Mapping baseline

6.7.18 The PCM model is a collection of models provided by Defra (Defra, 2020c). These were developed to report on compliance with the Ambient Air Quality Directive (2008/50/EC)) and are run by Ricardo Energy & Environment (on behalf of Defra).

6.7.19 In accordance with DMRB LA 105, four PCM Census IDs that correspond with the ARN have been identified: the A12 (ID 802006208), A131 (ID 802008615), A138 (ID 802048769) and A130 (ID 802058301). The locations of the PCM Census IDs are shown on Figure 6.2. Table 6.8 shows the projected (2018-based) PCM annual mean NO_2 concentrations at these Census IDs (i.e. roadside concentrations) for 2018 (the closest year in the 2018-based dataset to the 2016 base year), the construction year and opening year.

Table 6.8 PCM Census ID projected annual mean roadside NO_2 concentrations (Defra, 2020c)

PCM Census ID	Projected annual mean roadside NO_2 concentration ($\mu g/m^3$)		
	Base year (2018*)	Construction year (2025)	Opening year (2027)
802006208 (A12)	38.2	24.8	22.1
802008615 (A131)	23.7	15.7	14.0
802048769 (A138)	31.9	22.2	20.0
802058301 (A130)	26.2	17.5	15.7

* 2018 is the closest year in the 2018-based PCM dataset to the 2016 base year for the proposed scheme.

6.7.20 The projected concentrations in Table 6.8 from the PCM model indicate that roads in the ARN that are coincident with these PCM Census IDs are not likely to have compliance issues in the construction year and opening year. The PCM Census IDs were observed to have qualifying features that meet Defra's interpretation of the Ambient Air Quality Directive.

Human health receptors

6.7.21 Locations that are sensitive to air quality include residential properties and buildings used by the young, elderly and other susceptible populations, such as schools and hospitals (DMRB LA 105).

6.7.22 Sensitive human health receptors were identified within 200m of the ARN. The locations of human health receptors are shown on Figure 6.2. A total of 217 worst-case human health receptor locations were modelled in this assessment, 137 of which were assessed owing to their proximity to the construction traffic ARN, and 212 of which were assessed in relation to the operational traffic ARN. The placement of human health receptors was focused on areas near the ARN, where traffic modelling indicated that emissions were likely to increase and/or where the highest concentrations were expected to occur, i.e. on the nearest façade of the building to the road.

6.7.23 The modelling included 31 receptors representing 22 consented planning applications within 200m of the ARN. The planning application receptors were modelled at the nearest point of the planning application boundary to the ARN unless information was made available as to the actual location and use of buildings.

Ecological receptors

6.7.24 Nitrogen deposition can damage vegetation directly or affect plant health and productivity.

6.7.25 Table 6.9 shows a summary of the designated habitats within 200m of the construction and/or operational traffic ARN which were deemed to contain nitrogen sensitive habitats. The ecological transect locations modelled in this assessment are shown on Figure 6.7. Transects were modelled within all nitrogen sensitive habitats within 200m of the ARN, regardless of whether traffic modelling indicated increases or decreases in traffic in their vicinity.

6.7.26 There are two Sites of Special Scientific Interest (SSSIs) within 200m of the ARN; Tiptree Heath SSSI and Marks Tey Brickpit SSSI. However, as a geological feature, Marks Tey Brickpit is not susceptible to nitrogen deposition effects. Nitrogen sensitive habitats were identified in Tiptree Heath SSSI (dry shrub heath, acid grassland and broadleaved woodland) and three ecological transects were modelled for the site in this assessment. Traffic modelling indicated that vehicle flows are likely to be reduced near Tiptree Heath SSSI as a result of the proposed scheme.

6.7.27 In addition to SSSIs, sites designated as a Local Nature Reserve (LNR), Local Wildlife Site (LWS) and ancient woodland were identified as outlined in Table 6.9. In addition, a total of 50 veteran trees were identified in the study area, the locations of which are shown on Figure 6.7. The veteran trees include 26 trees identified from the scheme-specific arboricultural survey, in addition to 24 identified from the Woodland Trust (2020) web-based inventory.

Table 6.9 Summary of designated habitats with nitrogen sensitive features/habitats modelled in this assessment

Site name	Site designation	Number of transects modelled
White Court Wood/Cuckoo Wood	LWS/LNR	1
Tiptree Heath	SSSI	3
Strowling Wood/Strowling/Crierswoods	LWS/ancient woodland	1
Bulls Lodge Lagoons	LWS	1
Stonage Wood	LWS	1
Inworth Grange Pits	LWS	1
West Hall Wood Complex/Strowling/Criers Woods	LWS/ancient woodland	1
Hill Wood	LWS	1
Sandon Riverside	LWS	1
Lexden Springs LNR/Spring Lane Meadows	LWS/LNR	1
Whetmead	LWS/LNR	2
Galleywood Common	LWS/LNR	4
Sandon Pit	LWS	1
Lady Grove	LWS/ancient woodland	3
West House Wood	LWS	1
Cook's Lane Lexden	LWS	1
Riverview Meadows	LWS	1

Site name	Site designation	Number of transects modelled
Mope Wood Complex/Chantrey/Mope Woods	LWS/ancient woodland	1
Chantry Wood/Chantrey/Mope Woods	LWS/ancient woodland	2
Bushy Wood/Bushy/Breams Woods	LWS/ancient woodland	1
Braxted Park	LWS	2
Perry's Wood	LWS/ancient woodland	1
Straw Brook Plantation	LWS	1
Mountains Grove	LWS/ancient woodland	1
Boreham Road Gravel Pits	LWS	1
Spring Grove	LWS	1
Seven Star Green	LWS	1
Templeborder Wood	LWS/ancient woodland	1
Tiptree Water Works	LWS	1
Sir Hughes' Woods	LWS	1
Shutheath Wood	LWS	1
Inworth Wood	LWS/ancient woodland	1
Bocking Blackwater	LNR	1
Tiptree Church	LWS	1

Future baseline

6.7.28 The opening year (2027) baseline conditions were established by following the methodology outlined in Section 6.4, based on a DM traffic scenario. The DM traffic scenario is representative of the predicted growth in traffic, accounting for local and regional development. Opening year vehicle emission estimates applied fleet proportions for 2027 as per the Highways England speed-banded emissions (Version 3.1; Highways England, 2020j).

6.7.29 Cumulative impacts from road traffic emissions are implicit in the future DM and DS scenarios for the opening year because committed developments were included in the traffic model. For the construction traffic assessment, information was provided based on various sources, including the opening year traffic model, and as such, cumulative effects from other developments were again assumed to be implicit. This aspect will be revisited for the Environmental Statement when all construction traffic will be provided by the 2019 base year traffic model.

6.7.30 As stated in Section 6.7 (under the 'human health receptors' subheading), 31 receptors were modelled to represent 22 consented planning applications. The considered planning applications are outlined in Table 6.10.

Table 6.10 Consented planning applications considered in the air quality assessment

Local authority	Application ID	Site location	Application status	Development status
Chelmsford City Council	09/01314/EIA	Greater Beaulieu Park, White Hart Lane, Springfield, Chelmsford	Approved	Under construction
Chelmsford City Council	20/00340/FUL	Land south of 124 Plantation Road, Boreham, Chelmsford, Essex	Approved	Full application
Chelmsford City Council	14/01552/OUT	Land east of Plantation Road Boreham, Chelmsford, Essex	Approved	Pre-construction
Chelmsford City Council	19/01881/FUL	Land rear of 431 Springfield Road, Chelmsford, Essex	Approved	Full application
Braintree District Council	16/02156/OUT	Land north-east of Gleneagles Way, Hatfield Peverel, Essex	Approved after appeal	Pre-construction
Braintree District Council	18/01089/FUL	Salvator, The Street, Hatfield Peverel, Essex, CM3 2EG	Approved	Full application
Braintree District Council	16/01813/OUT	Land south of Stone Path Drive, Hatfield Peverel, Essex	Approved after appeal	Pre-construction
Braintree District Council	15/00962/FUL	Land at St Andrew's Road, Hatfield Peverel, Essex	Approved	Pre-construction
Braintree District Council	17/00341/OUT	Bury Farm, Bury Lane, Hatfield Peverel, Essex, CM3 2DG	Approved	Pre-construction
Braintree District Council	17/00973/FUL	Land at Bury Lane, Hatfield Peverel, Essex	Approved	Pre-construction

Local authority	Application ID	Site location	Application status	Development status
Braintree District Council	12/01071/OUT	Land on the south side of Maltings Lane, Witham, Essex	Approved	Under construction
Braintree District Council	06/01143/OUT	Land on the south side of Maltings Lane, Witham, Essex	Approved	Construction completed
Braintree District Council	15/00430/OUT	Land adjacent to Lodge Farm, Hatfield Road, Witham, Essex	Approved	Pre-construction
Braintree District Council	18/00884/REM	Lodge Farm, Hatfield Road, Witham, Essex, CM8 1EJ	Approved	Reserved matters
Braintree District Council	14/00005/COUPA	1 Crittall Road, Witham, Essex, CM8 3AF	Permitted development	Construction completed
Braintree District Council	16/02096/OUT	Land at Station Road, Hatfield Peverel, Essex	Approved	Pre-construction
Braintree District Council	16/00569/OUT	Land north-east of Inworth Road, Feering, Essex	Approved	Pre-construction
Colchester Borough Council	81203	33-37 London Road, Marks Tey, Colchester	Approved	Under construction
Colchester Borough Council	90398	Swift Construction Group Ltd, North Lane, Marks Tey, Colchester, CO6 1EG	Approved	Under construction
Colchester Borough Council	181859	Land north of Wyvern Farm, London Road, Stanway, Colchester	Approved	Pre-construction

Local authority	Application ID	Site location	Application status	Development status
Colchester Borough Council	145494	Land north of Wyvern Farm, London Road, Stanway, Colchester	Approved	Under construction
Colchester Borough Council	172049	Land west of Chitts Hill, Stanway, Colchester	Approved	Full application

Value and sensitivity of receptors

6.7.31 All sensitive receptors included in this assessment were considered to be of equal (high) value, with respect to human exposure, effects on ecology or potential nuisance (dust).

6.8 Potential impacts

Construction

Construction dust

6.8.1 Construction activities (i.e. from within the provisional Order Limits and trackout) can give rise to emissions of dust, which could cause damage to vegetation or annoyance associated with the soiling of surfaces. Construction dust emissions can also elevate airborne particulate matter concentrations at off-site locations, which may affect human health if mitigation measures are not implemented. There could be adverse impacts from the deposition of construction dust at sensitive receptors. Therefore, a construction dust assessment was undertaken to determine the construction dust risk potential, as per DMRB LA 105.

6.8.2 There is the potential for dust nuisance during the construction phase of the proposed scheme at sensitive receptors within the distance bands outlined in DMRB LA 105 and displayed on Figure 6.4. The level and distribution of construction dust emissions would depend on where within the provisional Order Limits the dust raising activity takes place, the nature of the activity and controls, and weather conditions. Table 6.11 shows the number of receptors within the distance bands outlined in the DMRB LA 105, based on distance bands from the provisional Order Limits. Based on the number of receptors within the distance bands and the large potential for dust emissions from construction activities associated with the proposed scheme, the risk potential for dust emission effects is considered to be ‘large’. As outlined in Section 6.4, best practice mitigation measures in line with this level of risk will be proposed in the upcoming Environmental Statement and within the first iteration of the EMP.

Table 6.11 Distance-banded receptor counts within 200m of construction activities

Receptor type	Distance from construction activities		
	0–50m	50–100m	100–200m
Human health	1,217	874	1,722
Ecological: Local Wildlife Site	2	2	6
Ecological: Local Nature Reserve	1	2	2
Ecological: Sites of Special Scientific Interest	0	1	1
Ecological: Veteran trees	31	3	5
Total	1,251	882	1,736

6.8.3 The proposed phases of construction are detailed in Section 2.5 of Chapter 2: The scheme. This shows the proposed scheme having a construction start date of 2023 and the opening year being 2027. The programme does not include any geographic or task-specific phasing of works as it is assumed the proposed scheme would be constructed as a single project. The peak construction output is currently assumed to be in 2025.

Peak construction traffic

6.8.4 There is potential for the proposed scheme to adversely influence (i.e. increase) pollutant concentrations at sensitive human health receptors and designated ecological sites. This section presents the potential effects of the construction phase of the proposed scheme, at its peak (2025), on local air quality. Two scenarios were modelled: a 2025 DM scenario and a 2025 DS scenario.

Human health receptors

6.8.5 The results of the construction phase local air quality assessment for all human health receptors are shown in Figures 6.5 and 6.6.

6.8.6 In the 2025 DM and DS scenarios, R141 (a residential dwelling located off Halstead Road, Colchester, close to the A12) was the only modelled receptor that exceeded the annual mean NO_2 AQO (40µg/m^3), with modelled concentrations of 41.7 and 42.1µg/m^3 respectively. This represents an increase of 0.4µg/m^3, which is classed as an imperceptible change in DMRB LA 105. The increase in concentration was associated with an AADT increase on the adjacent A12 carriageways of approximately 800 vehicles (HGVs) per day between the 2025 DM and DS. The receptor is located 5.7m from the edge of the southbound carriageway of the A12 between junction 26 and junction 27. The concentration is highest at this receptor as a result of the proximity of the receptor to the road emission source (with > 100,000 AADT on the adjacent A12 carriageways), compounded by the application of LTT adjustment factors.

6.8.7 Other receptors in this area (i.e. R163 and R164) indicated increases of similar magnitude in modelled annual mean NO_2 concentrations, although resulting concentrations were all below the AQO (the maximum value was 39.0µg/m^3 in the 2025 DS). The elevated modelled concentrations and increases at these receptors are a result of the proximity of these properties to the A12.

6.8.8 The largest increase in modelled annual mean NO_2 concentration as a result of peak construction traffic was 0.6µg/m^3, which is classed as a small change in DMRB LA 105, and is predicted to occur at receptors R73 (a residential dwelling close to the A12 between Rivenhall End and Kelvedon) and R110 (a residential dwelling close to the A12 at Hatfield Peverel, between junctions 20a and 20b). The increases in concentrations were associated with AADT increases on the adjacent A12 carriageways of approximately 800 and 1,300 vehicles (HGVs) per day, respectively, between the 2025 DM and DS. Modelled concentrations at these receptors increased to 37.6 and 31.4µg/m^3 respectively, which are both below the AQO.

6.8.9 All other modelled increases in annual mean NO_2 concentrations associated with peak construction traffic were below 0.6µg/m^3 and did not occur at locations exceeding the AQO or result in new exceedances of the AQO.

6.8.10 An assessment of the impact of the peak construction traffic on PM_{10} concentrations was also undertaken. In both the 2025 DM and 2025 DS, all modelled concentrations were below 20µg/m^3 (i.e. well within the AQO of 40µg/m^3), and the largest increase was 0.2µg/m^3 (i.e. imperceptible).

Nutrient nitrogen deposition

6.8.11 Nitrogen deposition calculations were undertaken, in line with DMRB LA 105, for all modelled ecological receptors. Figure 6.7 shows the locations of all modelled ecological receptors for the construction and operational phase assessments. In the construction traffic assessment, the 2025 DS results show that none of the modelled receptors had a predicted total deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4 kg N/ha/year.

Compliance risk assessment

6.8.12 PCM receptors were modelled at positions 4m from the road edge at PCM Census ID locations. Figure 6.8 shows the PCM receptor locations representative of qualifying features modelled for the construction and operational phase assessments. None of these receptors were found to exceed the NO_2 EU Limit Values in the modelled 2025 DM and DS scenarios. It is therefore concluded that construction traffic associated with the proposed scheme is not likely to interfere with the UK's reported ability to meet the EU Limit Values in the shortest possible time.

Operation

6.8.13 There is potential for the proposed scheme to adversely influence (i.e. increase) pollutant concentrations at sensitive human health receptors, designated ecological sites and at PCM Census ID locations. This section presents the potential effects of the operational phase of the proposed scheme upon local air quality.

Human health receptors

6.8.14 Predicted annual mean pollutant concentrations at selected locations, i.e. with the highest modelled concentrations or with the largest change in pollutant concentrations between the DM and DS scenario, are included in Table 6.12.

The table shows all receptors with an opening year DS NO_2 concentration of over 36µg/m^3 or with a DM to DS increase in NO_2 of over 0.4µg/m^3. In contrast to receptors with disbenefits, Table 6.12 also shows a selection of receptors from areas with the largest predicted decreases in NO_2. All other receptors modelled were below the AQO thresholds for annual mean NO_2 and PM_{10} and a full results dataset will be provided in the Environmental Statement.

6.8.15 The predicted opening year NO_2 concentrations and the change in NO_2 concentration between the DM and the DS are shown for every modelled receptor on Figure 6.9 and Figure 6.10, respectively.

Table 6.12 NO_2 and PM_{10} concentrations at selected human health receptors (base 2016, DM 2027 and DS 2027)

Receptor	Location	Base 2016		DM 2027		DS 2027		Change in concentration (DS – DM)	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
R141	Off Halstead Road, Colchester	**50.5**	20.7	40.8	19.6	**41.7**	19.7	0.9	0.1
R164	Off Halstead Road, Colchester	**47.0**	20.0	37.8	18.9	38.5	19.0	0.7	0.1
R163	Off Halstead Road, Colchester	**46.5**	20.2	37.3	19.1	38.1	19.2	0.8	0.1
R16	Lucy Lane South, Stanway	**45.4**	19.6	36.3	18.6	37.1	18.7	0.8	0.1
R14	Lucy Lane North, Stanway	**44.5**	19.5	35.4	18.5	36.5	18.6	1.1	0.1
P22*	Residential Planning Application, Maltings Lane, Witham	**43.0**	18.9	33.6	17.7	38.1	18.0	4.5	0.3
P17*	Residential Planning Application, Maltings Lane, Witham	35.3	20.0	28.4	19.1	35.9	20.0	7.5	0.9
R75	Braxted Road, Rivenhall	22.2	17.2	16.8	16.5	23.2	17.4	6.4	0.9

Receptor	Location	Base 2016		DM 2027		DS 2027		Change in concentration (DS – DM)	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
P26	Residential Planning Application, London Road, Marks Tey	26.6	16.8	20.7	16.1	25.7	16.7	5.0	0.6
R37	Trunk Road off the A12 southbound, Marks Tey	19.0	18.2	14.2	17.6	19.2	18.3	5.0	0.7
R73	A12 London Road, Kelvedon	**45.7**	20.0	36.3	18.9	23.1	17.0	-13.2	-1.9
R32	Old London Road, Marks Tey	36.7	20.1	28.3	19.2	17.0	17.6	-11.3	-1.6
R36	Old London Road, Marks Tey	36.2	20.1	27.7	19.1	16.9	17.7	-10.8	-1.4
R46	A12 London Road, Feering	34.4	19.0	26.6	18.1	18.0	16.9	-8.6	-1.2

Note: Values in **bold** type denote modelled exceedances of AQOs.

* Receptors P22 and P17 were sensitive receptors to indicate the potential effects in Maltings Lane planning application, modelled at the closest planning boundary to the ARN. Evidence from the planning application website indicates that receptors are likely to be located further back from the A12 (Braintree District Council, 2020).

6.8.16 The maximum predicted NO_2 concentration in the 2027 DS scenario was 41.7µg/m^3 at receptor R141, off Halstead Road near the A12. The NO_2 concentration is modelled to increase by 0.9µg/m^3 in the DS at this receptor, from a DM concentration of 40.8µg/m^3, predominantly as a result of increased traffic flows on nearby roads. For example, AADT flows increased by approximately 4,400 vehicles on the adjacent A12 carriageways. Nearby receptors were included in the assessment modelling following the identification of this exceedance location, to confirm if other properties were likely to be in exceedance. The next highest DS NO_2 concentrations were modelled at receptors R164 (38.5µg/m^3) and R163 (38.1µg/m^3) which are within 70m of R141. These were not predicted to be in exceedance of the AQO; therefore, the exceedance was found to be limited to the one receptor location, representing one residential property.

6.8.17 At the worst-case receptor location in the Lucy Lane North AQMA (R14), the DS modelled concentration was 36.5µg/m^3 in the opening year, with an increase of 1.1µg/m^3 from the DM scenario owing to the proposed scheme. This change is

modelled to occur predominantly as a result of increased traffic flows on nearby roads. Despite the increase in modelled NO_2 concentration, the proposed scheme is not predicted to cause an exceedance of the AQO within the Lucy Lane North AQMA in the opening year.

6.8.18 The greatest increases in predicted NO_2 concentration with the proposed scheme were modelled at receptors between junction 22 and junction 25 (e.g. R75 and R37) and at planning application receptors to the north of the junction 21 and junction 25 improvements (e.g. P17, P22 and P26). The increased concentrations between junction 22 and junction 25 were predominantly due to the proposed realignment of the carriageway and therefore increased proximity of the receptors to traffic. For example, the distance from R75 to the A12 is decreased by approximately 200m. Elsewhere, the largest increases in NO_2 are attributable to increases in traffic flow (e.g. +14,500 AADT near P17 and P22) and the junction realignments.

6.8.19 Of the modelled receptors, the greatest benefits were modelled at receptors which are currently adjacent to the A12, where the proposed scheme realigns the A12 carriageway (by over 100m) as offline bypasses. This includes a number of receptors in the vicinity of Rivenhall End and between junctions 24 and 25. Receptors on Old London Road near junction 25 were also predicted to experience decreases in NO_2 concentration due to the realignment of the A12 carriageway by up to approximately 250m.

6.8.20 There are no predicted exceedances of the AQO for PM_{10} in any of the modelled scenarios.

6.8.21 Of the 212 receptors included in the operational traffic air quality modelling, 21 are predicted to experience a decrease (>0.4 µg/m^3) in NO_2 concentrations, with 147 receptors predicted to experience an increase (> 0.4 µg/m^3). In order to identify potential significant adverse effects, the placement of receptors was focused on locations adjacent to the ARN where traffic modelling indicated that road traffic emissions were likely to increase. There are therefore likely to be potential benefits at receptors that have not been modelled in this assessment at locations where traffic modelling indicated that emissions were likely to decrease as a result of the proposed scheme. However, any potential benefits are not likely to be significant relative to the AQO.

6.8.22 As can be seen in Table 6.13, the results of the local air quality assessment indicate that the magnitude of change at the modelled human health receptor (R141) in exceedance of the NO_2 AQO in the DS is predicted to be ‘small’. This has been assessed against the guideline number of properties provided in DMRB LA 105 (see Table 6.3 in Section 6.4) to inform the risk of significant effect (see Section 6.10).

Table 6.13 Magnitude of change in modelled annual mean NO_2

Magnitude of change in NO_2 concentration	Total number of properties with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4µg/m^3)	0	0
Medium (>2µg/m^3)	0	0
Small (>0.4µg/m^3)	1	0

6.8.23 In addition to the comments raised through the Scoping Opinion, stakeholders have raised concerns about the effect on air quality from the proposed scheme on Maldon Road, particularly the junction with the B1137 The Street. The concerns related to increases in traffic flows and congestion in this area as a result of traffic being attracted to the A12 via the new junction 21. Human health receptors were therefore modelled in this area where changes in NO_x emissions as a result of the proposed scheme were considered to have the potential to impact air quality.

6.8.24 According to traffic model outputs, road traffic flows and therefore emissions are likely to increase on The Street to the east of Maldon Road and decrease on The Street to the west of Maldon Road, as a result of the proposed scheme. Although included in the modelling undertaken at this location, changes in the traffic on Maldon Road itself did not exceed relevant traffic screening criteria. Therefore, worst-case human health receptors were not located adjacent to Maldon Road. The traffic model estimated that the proposed scheme would marginally reduce traffic flows on Maldon Road (the AADT flow in the DM scenario was estimated to be 12,940 reducing to 12,720 in the DS), with the average road speed remaining the same.

6.8.25 The highest annual mean NO_2 concentration in the opening year at a human health receptor in this location was estimated to be 29.6µg/m^3 to the east of Maldon Road on The Street (i.e. well within the AQO of 40µg/m^3). This was also the receptor where the largest change in NO_2 was modelled to occur in this area, at 3.1µg/m^3. This being caused by a combination of an increase in traffic on the A12 mainline combined with a change in traffic behaviour on the off-slip leading to The Street. Emission rates on the off-slip are characterised as 'free flowing' by the traffic model, as per the guidance in DMRB LA 105.

6.8.26 The highest estimated annual mean NO_2 concentration to the west of Maldon Road was 24.7µg/m^3. For this receptor, the NO_2 concentration decreased by 0.6µg/m^3. The annual mean NO_2 concentration at the nearest receptor to the junction with Maldon Road (the house opposite) was estimated to be 26.6µg/m^3 with the proposed scheme in place (i.e. well within the AQO of 40µg/m^3). The modelling in the Maldon Road area therefore indicates that:

- annual mean NO_2 concentrations would be well within the AQO in this area in both the DM and DS scenarios
- receptors to the east of Maldon Road junction are modelled to experience a worsening of air quality but to remain below the AQO, while receptors to the west of the Maldon Road junction are modelled to experience an improvement in air quality
- human health receptors adjacent to Maldon Road are expected to experience negligible changes in air quality as a result of the proposed scheme in the opening year.

Nutrient nitrogen deposition

6.8.27 Nitrogen deposition calculations were undertaken, in line with DMRB LA 105, for all modelled ecological receptors. Figure 6.7 shows the locations of the modelled ecological receptors. The results in the 2027 DS show that receptors in the Whetmead LWS/LNR, Perry's Wood LWS/ancient woodland and at four veteran tree locations had a predicted total deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4 kg N/ha/year. A summary of the ecological assessment results for these receptors is presented in Table 6.14. As these ecological receptors have the potential to be adversely affected by changes in nitrogen deposition, they will be assessed by the competent expert for biodiversity in the upcoming Environmental Statement.

Table 6.14 Summary of ecological receptors with potentially significant effects

Receptor ID	Distance to nearest modelled road (m)[a]	Priority habitat	Vegetation type (deposition velocity)[b]	Minimum critical load (CL) (kg N/ha/year)	Average Baseline N Deposition (kg N/ha/yr)	DM to DS Change [c] in Estimated Nutrient N Deposition (kg N/ha/yr)	Change/CL (%)
LWS/LNR Whetmead #1 - Transect	0 - 60	Broadleaved, Mixed and Yew Woodland	Tree	10	26.9	0.5 - 4.8	5 - 48.2
LWS/LNR Whetmead #2 - Transect	5 - 65	Broadleaved, Mixed and Yew Woodland	Tree	10	26.9	0.5 - 2.9	4.9 - 29.0
LWS/ancient woodland Perry's Wood - Transect	2	Broadleaved, Mixed and Yew Woodland	Tree	10	27.2	0.9	9.2
Tree T649 Elm (scheme-specific survey)	49	Broadleaved, Mixed and Yew Woodland	Tree	10	30.2	1.4	14.4
Tree T506 Elm (scheme-specific survey)	45	Broadleaved, Mixed and Yew Woodland	Tree	10	27.2	0.6	5.5
Tree T422 Willow (scheme-specific survey)	71	Broadleaved, Mixed and Yew Woodland	Tree	10	26.9	0.9	9.3

Receptor ID	Distance to nearest modelled road (m)[a]	Priority habitat	Vegetation type (deposition velocity)[b]	Minimum critical load (CL) (kg N/ha/year)	Average Baseline N Deposition (kg N/ha/yr)	DM to DS Change [c] in Estimated Nutrient N Deposition (kg N/ha/yr)	Change/CL (%)
Tree T316 Oak (scheme-specific survey)	19	Broadleaved, Mixed and Yew Woodland	Tree	10	26.9	1.0	9.7

[a] Range over which modelled receptors were found to have potentially significant effects.

[b] The vegetation type determines the conversion rate that is applied to calculate the change in N deposition from the NO_2 concentration. E.g. for trees, a conversion factor for forests of 1µg/m^3 of NO_2 = 0.29 kg N/ha/yr is applied.

[c] The DM to DS change is also referred to as the process contribution.

Compliance risk assessment

6.8.28 PCM receptors were modelled at positions 4m from the road edge at PCM Census ID locations. None of these receptors were found to exceed the NO_2 EU Limit Value of 40µg/m^3 in the modelled DM opening year. The PCM receptors that are representative of qualifying features are shown in Figure 6.8.

6.8.29 It is therefore concluded that the proposed scheme is not likely to interfere with the UK's reported ability to meet the EU Limit Value for NO_2 in the shortest possible time.

6.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

6.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

6.9.2 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

6.9.3 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices.

6.9.4 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 contractor would enter into pre-works discussions with affected local authorities to agree the method of works and appropriate dust mitigation measures outlined within the EMP. 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, erecting screens or barriers around the dust-causing activities or the site boundary and the minimising, covering or dampening down of stockpiles to prevent entrainment by wind.

6.9.5 Standard mitigation will be included in a first iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5: Environmental assessment methodology).

Additional mitigation

6.9.6 No additional mitigation is deemed necessary at this stage. However, if significant effects are confirmed for ecological receptors by the competent expert for biodiversity in the upcoming Environmental Statement, a Project Air Quality Action Plan will be required.

Enhancement

6.9.7 There are no opportunities for enhancement identified in this assessment.

6.10 Assessment of likely significant effects

Construction

6.10.1 With standard construction phase mitigation measures in place, there are unlikely to be significant air quality effects resulting from construction dust.

6.10.2 In Section 6.8, one human health receptor (R141) was shown to be at risk of exceeding the NO_2 AQO (40µg/m^3) in the construction year 2025, in both the 2025 DM and DS scenarios. However, the change in concentration at this receptor was 0.4µg/m^3 which is classed as imperceptible in DMRB LA 105.

6.10.3 There were no ecological sites found to have potentially significant effects by the proposed scheme in relation to nitrogen deposition.

6.10.4 The assessment of construction traffic effects concluded that construction traffic associated with the proposed scheme would be unlikely to interfere with the UK's reported ability to meet the EU Limit Value for NO_2 in the shortest possible time.

6.10.5 As a consequence, in accordance with DMRB LA 105 criteria on significance, the effect of the proposed scheme on air quality at human health and ecological receptors and on compliance with EU Limit Values during construction is considered to be 'not significant'.

Operation

6.10.6 In Section 6.8, it was again shown that one human health receptor (R141) was found to be at risk of exceeding the NO_2 AQO (40µg/m^3) in the opening year 2027. The receptor was in exceedance of the AQO in both the DM and the DS scenarios. In accordance with DMRB LA 105, the magnitude of the change in concentration at this single receptor was deemed to be 'small'.

6.10.7 The nitrogen deposition calculations undertaken showed that ecological receptors within two designated sites (Whetmead LWS/LNR and Perry's Wood LWS/ancient woodland) and at four veteran tree locations had a predicted total deposition rate above the minimum critical load with a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4 kg N/ha/year. These results are deemed to be potentially significant in terms of the change in nitrogen deposition and therefore warrant further data collection by a biodiversity expert. The significance for biodiversity will be assessed by the competent expert for biodiversity in the upcoming Environmental Statement.

6.10.8 The assessment of operational traffic effects concluded that the proposed scheme would not be likely to interfere with the UK's reported ability to meet the EU Limit Value for NO_2 in the shortest possible time.

6.10.9 As a consequence, in accordance with DMRB LA 105 criteria on significance, the effect of the proposed scheme on air quality at human health receptors and on compliance with EU Limit Values during operation is considered to be 'not significant'. Changes in nitrogen deposition as a result of the proposed scheme have the potential to impact sensitive habitats within designated ecological sites, the potential significance of which will be considered further within the biodiversity chapter of the Environmental Statement.

7 Cultural heritage

7.1 Topic introduction

7.1.1 This chapter addresses the likely significant effects of the proposed scheme on cultural heritage. The chapter considers the known heritage baseline, alongside a consideration of changes ('impacts') on heritage assets that may occur due to the construction and operation of the proposed scheme and the resultant potential effects.

7.1.2 Cultural heritage includes archaeological remains, built heritage and the historic landscape. This chapter considers the historic evolution of the landscape and the potential effects to the settings of heritage assets. The likely change to the 'present day' landscape and to people's views and visual amenity is addressed within Chapter 8: Landscape and visual.

7.1.3 This chapter is supported by the following figures (see Appendix A):

- Figure 7.1 Cultural Heritage Archaeological Remains
- Figure 7.2 Cultural Heritage Built Heritage and Historic Landscape

7.1.4 A gazetteer was included in the Environmental Scoping Report (Highways England, 2020d), and is not duplicated in this Preliminary Environmental Information Report (PEIR), but will be included in the Environmental Statement.

7.2 Stakeholder engagement

7.2.1 In addition to the statutory consultation process, there is ongoing engagement with stakeholders to steer the development of the proposed scheme in terms of heritage considerations.

7.2.2 A number of online meetings and workshops have already been held with archaeological stakeholders and the topics and outcomes are summarised in Table 7.1.

Table 7.1 Stakeholder engagement workshops for cultural heritage aspect

Date	Stakeholder	Format	Subject
October 2019	Historic England, Essex County Council, Colchester Borough Council	Meeting	To discuss the offline section of the proposed scheme at Rivenhall End and a proposed realignment to reduce the impact on the setting of the Rivenhall long mortuary enclosure scheduled monument.

Date	Stakeholder	Format	Subject
14/10/2020	Historic England, Essex County Council, Colchester Borough Council	Teleconference	To provide an update on general project progress and an overview of archaeological progress (geophysical survey results). To set out the outline approach and programme to agreeing the scope of the archaeological evaluation (trial trenching and test-pitting) in advance of drafting the Written Scheme of Investigation (WSI).
25/11/2020	Historic England, Essex County Council, Colchester Borough Council	Teleconference	To discuss stakeholder comments on the draft Archaeological Trial Trenching Scope Technical Note.
3/2/2021	Historic England, Essex County Council, Colchester Borough Council., Chelmsford City Council	Teleconference	To discuss the approach and proposed methodology for the built heritage aspect of the PEIR. To address stakeholder comments received in the Planning Inspectorate's Scoping Opinion (2020, republished with errata sheet in March 2021).

7.2.3 A summary of the key stakeholder feedback and key requirements from the Planning Inspectorate's Scoping Opinion (2021) relevant to cultural heritage is provided in Table 7.2.

Table 7.2 Key stakeholder feedback for cultural heritage aspect

Stakeholder	Comment	Response
Planning Inspectorate	The assessment needs to take into account Boreham House's setting including the grade II listed registered park and garden.	The Environmental Impact Assessment will consider the impact to the setting of Boreham House, and this will be reported in the Environmental Statement.
Planning Inspectorate	The two historic greens, Easthorpe Green and Potts Green, which form the landscape settings of Easthorpe Green Farmhouse grade II listed building, and the junction of two Roman roads (where the A12 meets Easthorpe Road) should be included within the non-designated archaeological assets assessment.	Easthorpe Green and Potts Green have been included in the baseline for assessment.

Stakeholder	Comment	Response
Planning Inspectorate Historic England	Taking into consideration the nature of the proposed scheme is to replace the existing A12, it is unlikely that the scheme would result in significant operational effects to the historic landscape. Therefore, the Inspectorate agrees that this matter can be scoped out of the Environmental Statement. Historic England advised that operational effects should be scoped in to the Environmental Statement due to the proposed scheme potentially having a harmful impact on the value of historic landscapes, in terms of the impact of the views, lighting and noise on setting, and the way in which the historic landscape is experienced.	Operational phase impacts on the historic landscape have been scoped into the assessment and will be included in the Environmental Statement.
Planning Inspectorate	The Environmental Statement should provide a detailed archaeological baseline including summaries of the results of archaeological investigations undertaken, and these investigations should be appended to the Environmental Statement to support its conclusions. Furthermore, where additional data is available, such as within the Colchester Historic Environment Record (HER), the desk based assessment should be updated with this information.	Data from the Colchester HER have been obtained and included in the baseline for this assessment, as have the results of geophysical surveys and an Aerial Investigation and Mapping Report. The results of the upcoming archaeological trial trenching will be used to inform assessments in the Environmental Statement when they become available.
Planning Inspectorate	The nature and scope of specialist palaeolithic survey and assessment ahead of the preparation of the Environmental Statement should be devised in consultation with relevant statutory heritage consultees. An initial deposit model for the proposed scheme should be prepared that could be enhanced following later specialist geoarchaeological sampling. Geophysical and geoarchaeological techniques that can investigate deeper deposits of archaeological interest should be considered.	A programme of archaeological evaluation is proposed, and an Archaeological WSI has been prepared in consultation with stakeholders, incorporating palaeolithic survey and a deposit model. The results of the archaeological evaluation will inform the Environmental Statement.

Stakeholder	Comment	Response
Planning Inspectorate Historic England Colchester Borough Council Essex County Council	The Planning Inspectorate stated that the extent of the study area should be informed by the nature of the heritage assets in addition to the type and extent of likely impacts on them, rather than an arbitrary pre-determined distance. Historic England state that the study area for designated heritage assets should extend to 2km based on the preliminary zone of theoretical visibility (ZTV). If significant effects on the heritage assets beyond 1km are scoped out, this needs to be evidence-based. The assessment study area should be based on the sensitivity of the receiving environment and the potential impacts of the scheme. Colchester Borough Council and Essex County Council agreed that a 300m study area for designated and non-designated heritage assets and a 1km study area for designated heritage assets is reasonable apart from assets of the greatest sensitivity where a greater catchment area should be considered.	A study area extending 1km from the provisional Order Limits has been used for this PEIR to identify designated cultural heritage assets where impacts from the proposed scheme could occur to their setting. For the Environmental Statement, a selection of assets for assessment for potential significant effects beyond 1km will be undertaken and informed by professional judgement guided by the final ZTV when it becomes available.
Planning Inspectorate	The Environmental Statement should avoid a generalised approach as no systematic archaeological investigation has been undertaken at this stage and it is difficult to establish the value of the majority of below-ground archaeological remains along the proposed route.	Although some non-designated archaeological sites are currently still assessed as being of low or negligible value based on their morphology and the absence of associated surface finds, the proposed programme of archaeological evaluation will address this by providing a more detailed understanding of the nature, date and state of preservation of such sites.
Colchester Borough Council	The Colchester 'local list' should be integrated into the assessment.	The Colchester ‘local list’ has been integrated into the assessment.
Essex County Council	Updated conservation area boundaries for Braintree District Council and Colchester Borough Council should be used for the assessment.	Updated conservation area boundaries have been obtained and used in this PEIR.

Stakeholder	Comment	Response
Historic England	There are concerns about the impacts of the route between junction 24 (Kelvedon North interchange) and junction 25 (Marks Tey interchange). The proposed bypass would impact the grade II listed buildings at Easthorpe Green Farm (Easthorpe Green Farmhouse and Church View/Flispes). There would also be impacts on the grade II* listed barn at Marks Tey Hall. Associations with historic Easthorpe Green and Potts Green, which form their settings, require detailed assessment in the Environmental Statement. The Environmental Statement should clearly cross-reference to the baseline landscape chapter data. The landscape and visual assessment should include heritage specific viewpoints (photographs, photomontages and wirelines) to illustrate and support the results of the heritage assessment. Setting impacts on heritage assets should not be restricted to visual impacts and should include other factors during construction and operation.	A preliminary assessment of effects on these assets, including their settings and group value, has been undertaken for this PEIR. A preliminary assessment of visual effects on receptors from representative viewpoints, which includes these heritage assets, is presented in Chapter 8: Landscape and visual, of this PEIR. Historic England have also recently been consulted on these representative viewpoints. A detailed assessment and development of appropriate mitigation will be undertaken in consultation with Historic England and reported in the Environmental Statement.

7.2.4 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment and draft Development Consent Order (DCO), will be included within the Environmental Statement.

7.3 Legislative and policy framework

7.3.1 The National Networks National Policy Statement (NNNPS) 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.

7.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 5.120 of the NNNPS states that the construction and operation of national networks infrastructure has the potential to result in adverse impacts on the historic environment.
- Paragraph 5.122 defines heritage assets as those elements of the historic environment that hold value to current and future generations because of their historic, archaeological, architectural or artistic interest. The sum of the heritage interests that a heritage asset holds is referred to as its significance (heritage value). Significance derives not only from a heritage asset's physical presence, but also from its setting.

- Paragraph 5.124 requires that non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments should be considered subject to the policies for designated heritage assets.
- Paragraph 5.127 states that the applicant should describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum, the relevant HER should be consulted and the heritage assets assessed using appropriate expertise. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, the applicant should include an appropriate desk-based assessment and, where necessary, a field evaluation.
- Paragraph 5.129 requires that, in considering the impact of a proposed development on any heritage asset, the Secretary of State should take into account the particular nature of the significance of the heritage asset.
- Paragraph 5.130 states that the Secretary of State should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution that their conservation can make to sustainable communities, including their economic vitality.
- Paragraph 5.131 states that substantial harm to or loss of grade II listed buildings and grade II registered parks and gardens should be exceptional and that substantial harm to or loss of scheduled monuments, grade I and II* listed buildings and grade I and II* registered parks and gardens should be wholly exceptional.
- Paragraph 5.132 states that any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater the harm to the significance of the heritage asset, the greater the justification that will be needed for any loss.

7.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

7.4 Assessment methodology

7.4.1 A scoping exercise was undertaken in 2020 to establish the form and nature of the cultural heritage assessment, and the approach and methods to be followed.

7.4.2 The Environmental Scoping Report (Highways England, 2020d) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the proposed scheme on cultural heritage. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

7.4.3 All further assessment will be undertaken in accordance with the relevant sections of Design Manual for Roads and Bridges (DMRB) LA 106 Cultural Heritage Assessment (Highways England, 2020k) with consideration of guidance such as the National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2019) and The Setting of Heritage Assets (Historic England, 2017). The assessment of value (sensitivity) of assets will be undertaken based on the assessment criteria in Table 7.5 (see Section 7.7). The magnitude of impact and significance of effects will be assessed in accordance with DMRB LA 104 (Highways England, 2020c) (see Chapter 5: Environmental assessment methodology).

7.4.4 The current programme of archaeological evaluation (geophysical survey and aerial investigation and mapping have already been completed) will continue with a programme of archaeological trial trenching and test-pitting undertaken within the proposed scheme footprint in spring/summer 2021. This will establish the nature, extent and survival of known and unknown subsurface archaeological remains and geoarchaeological potential.

7.4.5 The cultural heritage desk-based assessment (DBA) (Jacobs, 2018, currently being updated), in conjunction with results from archaeological geophysical surveys and archaeological evaluation (subject to programme confirmation), will inform the detailed assessment of potential impacts on cultural heritage assets that will be undertaken within the cultural heritage chapter of the Environmental Statement. These will form appendices to the Environmental Statement.

7.4.6 Hedgerows within the provisional Order Limits that qualify as 'important' under the Hedgerows Regulations 1997, Schedule 1, Part II criteria (archaeology and history) will be identified to inform the detailed assessment of potential impacts on cultural heritage assets within the cultural heritage chapter of the Environmental Statement.

7.5 Assessment assumptions and limitations

7.5.1 The information presented in this assessment reflects that obtained and evaluated at the time of reporting, and is based on an emerging design for the proposed scheme and the maximum likely extents of land required for its construction and operation.

7.5.2 It is assumed that data provided by third parties are accurate and up to date at the time of reporting.

7.5.3 As the HERs consulted as part of the assessment only list known archaeological sites or significant historic landscape features, the potential exists for previously unrecorded archaeological remains to be present within the provisional Order Limits.

7.5.4 The findings of this preliminary assessment may be subject to change as the design of the proposed scheme is developed and refined further through the assessment and consultation processes, and as further research and investigative surveys are completed to fully understand its potential effects.

7.5.5 The assessment of effects on built heritage assets presented in this PEIR does not account for potential mitigation. Mitigation, such as landscape planting, will be developed as the proposed scheme proceeds and would likely reduce the effects on some receptors. The Environmental Statement will present the full assessment on built heritage taking into consideration the final landscape design and planting proposals.

7.6 Study area

7.6.1 DMRB LA 106 (Highways England, 2020k) states that a study area for new roads 'shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected' and that should include 'the settings of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence or potentially affected by noise'.

7.6.2 The PEIR assessment has considered a study area of 1km from the provisional Order Limits for designated assets, comprising scheduled monuments, registered battlefields, registered parks and gardens, and grade I, II* and II listed buildings, all of which are assessed as high value.

7.6.3 A 300m study area has been used for all other heritage assets. This is considered appropriate to assess the potential physical and setting impacts on medium value and lower value designated and non-designated assets.

7.6.4 For the Environmental Statement, the selection of assets for assessment for potential significant effects beyond 1km will be undertaken and informed by professional judgement, guided by the final ZTV when it becomes available.

7.7 Baseline conditions

Baseline sources

7.7.1 To inform the cultural heritage baseline the following sources of information were consulted:

- The National Heritage List for England for information on designated heritage assets (scheduled monuments, listed buildings, registered parks and gardens, registered battlefields, World Heritage Sites, and protected wrecks).
- Heritage assets recorded on the Essex HER were provided by Essex County Council in January 2021.

- Essex Historic Landscape Characterisation Project (Dyson-Bruce and Bennett, 2013).
- Heritage assets recorded on the Colchester HER were provided by Colchester Borough Council in January 2021.
- Information on conservation areas and locally listed buildings from Braintree District Council and Colchester Borough Council websites.
- A DBA has been completed which sets out the known assets within the study area (Jacobs, 2018). The DBA is currently being updated to align with the provisional Order Limits and updated datasets and will be appended to the Environmental Statement.
- A Palaeolithic DBA (Wenban-Smith, 2020). This will be appended to the Environmental Statement.
- Geophysical (magnetometer) surveys undertaken between 6 December 2019 and 6 March 2020 (Headland Archaeology, 2020a and 2020b). Survey reports will be appended to the Environmental Statement.
- An Aerial Investigation and Mapping Report prepared by Place Services (2021).

Baseline conditions

7.7.2 There are 913 designated and non-designated cultural heritage assets within 1km of the proposed scheme comprising 420 archaeological remains assets, 474 built heritage assets and 19 historic landscape assets. Of this baseline, 159 cultural heritage assets are located within the provisional Order Limits comprising 132 archaeological remains assets, 21 built heritage assets and six historic landscape assets. All archaeological remains assets are illustrated in Figure 7.1 and built heritage assets and historic landscapes in Figure 7.2. Each cultural heritage asset has been given an individual number. A summary gazetteer of all assets was included in the Environmental Scoping Report (Highways England, 2020d), and is not duplicated in this PEIR but will be included in the Environmental Statement. Cultural heritage assets discussed in this PEIR are also numbered on Figures 7.1 and 7.2. Table 7.3 provides a summary of the designated heritage assets within the 1km study area.

7.7.3 There are a total of 414 listed buildings within 1km of the proposed scheme, and none within the provisional Order Limits. Given the high number of listed buildings in the study area, only grade I and II* listed buildings are included in Table 7.3.

7.7.4 There are no World Heritage Sites, registered battlefields or protected military remains within 1km of the proposed scheme.

Table 7.3 Designated cultural heritage assets within the 1km study area

Asset no.	Study area	Asset name	Designation
165	1km	Hatfield Priory	Scheduled monument
399	1km	Rivenhall long mortuary enclosure	Scheduled monument
646	1km	Anglo-Saxon Cemetery 150m east of Easterford Mill	Scheduled monument
737	1km	Long Mortuary Enclosure and Round Barrow 160m south of Frame Farm	Scheduled monument
804	1km	Circular Brick Kilns at the WH Collier Brick and Tile Works	Scheduled monument
290	1km	Wickham Bishops Timber Trestle Railway Viaduct	Scheduled monument
10	1km	New Hall, Boreham	Grade I listed building
69	300m	Boreham House	Grade I listed building
89	1km	Parish Church of St Andrew at Boreham	Grade I listed building
358	1km	Church of St Nicholas, Little Braxted	Grade I listed building
477	1km	Parish Church of St Mary at Kelvedon	Grade I listed building
499	1km	1-5 High Street, Kelvedon	Grade I listed building
708	300m	Parish Church of All Saints at Inworth	Grade I listed building
746	1km	Parish Church of All Saints at Feering	Grade I listed building
796	1km	Parish Church of St Andrew at Marks Tey	Grade I listed building
801	1km	Church of St Mary at Copford	Grade I listed building
139	300m	Hatfield Place	Grade II* listed building
140	300m	The Crown Public House, Hatfield Peverel	Grade II* listed building
151	300m	Termitts Farmhouse	Grade II* listed building
332	300m	Blue Mills	Grade II* listed building
334	300m	Mathyns	Grade II* listed building
420	300m	Hole Farmhouse	Grade II* listed building
551	300m	Bridgefoot House	Grade II* listed building
816	300m	The Barn south of Marks Tey Hall	Grade II* listed building
480	1km	Braxted Park	Grade II* registered park and garden

Asset no.	Study area	Asset name	Designation
7	300m	New Hall, Boreham	Grade II registered park and garden
67	300m	Boreham House	Grade II registered park and garden
162	1km	Hatfield Priory	Grade II registered park and garden
68	300m	Chelmer and Blackwater Navigation	Conservation area
91	1km	Boreham: Church Road	Conservation area
101	300m	Boreham: Roman Road/Plantation Road	Conservation area
195	1km	Witham (Chipping Hill)	Conservation area
251	1km	Witham Town Centre (Newland Street)	Conservation area
566	300m	Kelvedon	Conservation area
666	1km	Feering	Conservation area

7.7.5 There are 15 non-designated historic landscape types (HLTs) within 300m of the proposed scheme. These are described in Table 7.4 and shown on Figure 7.2.

Table 7.4 Historic landscape types and a summary of key features

Historic landscape type	Key characteristics of relevance
HLT 1: Settlement	This type has been applied to modern and historic built-up or urban areas, and ranges from cities, towns, villages and hamlets to large farms.
HLT 2: Communications	This type covers major roads and railway lines, road interchanges and railway sidings, which have had a significant impact on the landscape. Although roads have a long history, this type is concerned with the modern infrastructure of the 20th and 21st centuries.
HLT 3: Industry	No description available.
HLT 4: Mineral extraction	No description available.
HLT 5: Horticulture	This type covers nurseries and greenhouses for market gardening. The main distribution of this type is in the Lea Valley in the west of Essex. Greenhouses used to be constructed of glass but have mostly been replaced with other materials or polytunnels. They may sit within an earlier field boundary pattern or may have replaced it. These date from the late 19th/early 20th centuries.

Historic landscape type	Key characteristics of relevance
HLT 6: Recreation	This type includes country parks, golf courses, caravan parks, camping grounds, playing fields and other areas of land used for recreation and leisure. This type may have completely reworked and destroyed previous elements of the landscape, or may retain elements of its previous use, such as former parkland, or of the surrounding character of the landscape, such as field boundaries, trees and woodland. Golf initially became popular in the 19th century. The main development of this type is from the 20th century and is continuing.
HLT 7: Post-medieval designed landscape	Designed ornamental landscapes laid out around the 'great' or 'grand' house in the post-medieval period, many by designers of national repute, such as Lancelot 'Capability' Brown at Audley End and Thorndon, Brentwood; and Humphry Repton at Hylands Park, Chelmsford, and Gosfield Place, Halstead. The parks may include a formal garden, lakes, woodland, avenues, rides, vistas, and architectural features such as a ha-ha, terrace, folly or grotto. There may be remains of greenhouses and icehouses. Four registered parks and gardens are reflected in this type within the study area: New Hall, Boreham (Asset 10); Boreham House (Asset 67); Hatfield Priory (Asset 162) (all grade II); and Braxted Park (Asset 480) (grade II*). The occurrence of this type at Boreham House reflects the extent of what is labelled 'deer park' on the first edition Ordnance Survey six-inch map. Apart from field boundaries reflecting the outline of this area, few if any traces of the field arrangement and plantations survive today. Much of this land is now either farmland or used for car boot sales and other events. The north-west corner has been severed by the existing A12 and is now part of an industrial estate.
HLT 8: Ancient woodland	Ancient woodland is defined by Natural England as '*land that has had a continuous woodland cover since at least 1600 AD and may be ancient semi-natural woodland, which retains a native tree and shrub cover that has not been planted, although it may have been managed by coppicing or felling and allowed to regenerate naturally*…' The predominant species are deciduous, broad-leaf trees and shrubs. In the Essex Historic Landscape Characterisation Project (Dyson-Bruce and Bennett, 2013), this category also includes traditional wood-pasture, such as seen at Hatfield Forest, where single or small groups of pollarded trees occur in pasture alongside small coppice-with-standards managed woodlands. Ancient woodland can preserve features which are natural such as an uneven land surface, or which predate the woodland such as prehistoric earthworks or medieval cultivation ridges where woodland has regenerated, or which relate to the woodland itself such as coppiced trees and wood banks.

Historic landscape type	Key characteristics of relevance
HLT 9: Post-medieval plantation	This includes all managed and planted woodland which post-date ancient woodland. These may be planted as commercial concerns or as ornamental woodland in association with informal parkland. These woodlands can be replanting of cleared woodland, inter-planting within existing woodland, or new planting within former fields. Some plantations may have been planted and felled between the Ordnance Survey first edition mapping and modern mapping. Many plantations are comprised of a single or couple of species of deciduous or coniferous tree, though some may have been designed with a mixed composition to imitate traditional woodland, such as plantations encouraged as part of Thames Chase or under agri-environmental schemes.
HLT 10: Unenclosed heath	These are open areas, marked up as 'heath'. Originally termed 'waste' in medieval times, they comprise areas of natural or semi-natural vegetation (particularly grass and heather) on dry, acidic soils. Historically these were too dry and impoverished for arable cultivation and were managed mainly as areas for pasturage of livestock, with management for woodland products. Some areas of heathland have experienced intermittent arable cultivation or small-scale quarrying. This can leave earthworks of archaeological interest. Lack of grazing in the 20th century has resulted in the growth of scrub and bracken on many heaths.
HLT 11: Enclosed meadow pasture	These are sinuous fields that border rivers, often forming part of the floodplain/regime of the river, where the river floods naturally. They may be marked as areas of rough pasture. The traditional use from medieval times up to the 1950s was to produce a hay crop for winter fodder and for grazing. Some have been subsequently wooded or alternate with wooded areas along the river's course.
HLT 12: Pre-18th century enclosure	Irregular enclosures vary considerably in size and shape, forming both arable and pasture, and are widespread though more common to the north and west of the county. They are probably the result of piecemeal enclosure and may originate from the medieval period or earlier. Morphologically they tend to have sinuous edges and offset corners.
HLT 13: 18th and 19th century enclosure	These fields were created, by informal agreement, to subdivide a pre-existing earlier field system. They are characterised by straighter boundaries. This is a difficult form to consistently identify, as it may also comprise the enclosure of former waste, common, common arable or subdivision of various earlier enclosure patterns. Dating their origin is difficult, but they usually predate the introduction of the later formal Parliamentary Enclosure Acts, and thus may relate in certain parishes to the earlier acts of enclosure.

Historic landscape type	Key characteristics of relevance
HLT 14: Modern agriculture	These represent field boundary loss since the 1950s due to mechanisation and changes in agricultural practices. This may range from the loss of a single boundary merging two fields into one, or many field boundaries being removed to form a single field (over 36 fields merged into one have been recorded). The resultant field is a hybrid and palimpsest (something reused or altered but still bearing visible traces of its earlier form), with edges that may have several periods of origin. The surviving edges of these fields are of historic importance.
HLT 15: Artificial water bodies	This type covers a wide range of water bodies, including public water supply reservoirs, flooded mineral extraction pits, and farm reservoirs and ponds for irrigation and livestock use. Most were created in the 20th century, but farm ponds may go back, predating the earliest map sources.

7.7.6 Within the 300m study area, there are 417 known non-designated archaeological remains. These are illustrated on Figure 7.1 and further details can be found in the DBA (Jacobs, 2018). Assets mentioned in the text are labelled on Figure 7.1.

7.7.7 There is high potential for the presence of unknown archaeological remains of prehistoric, Roman and medieval date throughout the study area. In particular, the area around junction 19 (Boreham interchange), the fringes of Witham and Kelvedon, the section between Feering and Marks Tey, and the area between Coleman's Farm and Rivenhall End have high potential for the presence of unknown buried archaeological remains. Additionally, the study area has high potential for Palaeolithic remains, in particular artefacts and palaeoenvironmental remains from Hoxnian lake and Blackwater Terrace Deposits near Witham and Marks Tey. The planned archaeological evaluation has been designed to confirm the presence or absence of complex Palaeolithic archaeological remains.

Future baseline

7.7.8 Future development, such as proposed additional phases of the Beaulieu Park Development, may lead to changes to the baseline environment due to severance of historical associations between cultural heritage assets or through changes to the setting of cultural heritage assets. The proposed A120 Braintree to A12 scheme, which may tie in with the A12 south-west of Kelvedon, would also potentially lead to changes to the baseline environment (although this is not yet a committed development). Ongoing development of Coleman's Farm Quarry, south-west of Rivenhall End and near junction 22, may also lead to changes to the baseline environment.

Value and sensitivity of receptors

7.7.9 The value of a cultural heritage asset is based on its qualities, including intrinsic, contextual and associative characteristics, such as age, state of preservation and level of supporting knowledge. These characteristics are independent of the various potential impacts on the cultural heritage asset from the proposed scheme.

7.7.10 All receptors within the baseline have been assigned a value based on typical descriptions in DMRB LA 104 (Highways England, 2020c) and using professional judgement. Table 7.5 provides examples of the value of receptors in the cultural heritage baseline.

Table 7.5 Guidance for the value of cultural heritage receptors

Value (sensitivity) of cultural heritage asset	Typical description (from DMRB LA 104)	Examples within the study area
Very high	Very high importance and rarity, international scale and very limited potential for substitution	None in the cultural heritage baseline
High	High importance and rarity, national scale, and limited potential for substitution	• Grade I listed building Boreham House • Grade II* registered park and garden at Braxted Park • Grade II* listed buildings (all) • Grade II listed buildings (all) • Scheduled monuments (all) • Potential archaeological remains of Palaeolithic date
Medium	Medium or high importance and rarity, regional scale	• Conservation areas (all) • Grade II registered parks and gardens (all) • Non-designated archaeological remains including two potential long barrows, hengiform monument (a prehistoric monument consisting of a circle of stone or wooden upright sometimes surrounded by a ditch and/or bank) and two cropmark sites with a range of identified features
Low	Low or medium importance and rarity, local scale	• Non-designated built heritage assets including the Cold War Nuclear Monitoring Post at Hatfield Peverel and the Inworth Boundary Post • Archaeological remains including possible ring ditches, enclosures or trackways identified through aerial photographs and geophysical survey • Partially excavated archaeological sites recorded during development

Value (sensitivity) of cultural heritage asset	Typical description (from DMRB LA 104)	Examples within the study area
Negligible	Very low importance and rarity, local scale	• Non-designated archaeological remains such as field boundaries, undated cropmark features • Sites of non-designated archaeological assets that have now been removed • Non-designated built heritage assets including Inworth Pumping Station

7.8 Potential impacts

Construction

7.8.1 The preliminary assessment has identified that construction of the proposed scheme would potentially result in the following adverse impacts on cultural heritage assets:

- partial or total removal of archaeological remains and historic landscape components
- compaction of archaeological deposits by construction traffic and structures
- changes in groundwater levels leading to the desiccation of waterlogged archaeological deposits
- impacts on the setting of heritage assets including visual and noise intrusion, severance and adverse impacts on amenity as a result of construction works

Operation

7.8.2 The preliminary assessment has identified that operation of the proposed scheme would potentially result in the following adverse impacts on cultural heritage assets:

- visual and noise intrusion on the setting of built heritage assets and historic landscapes
- severance and adverse impacts on the amenity of built heritage assets and historic landscapes

7.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

7.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

7.9.2 Embedded mitigation relevant to this aspect includes the following:

- Realigning the bypass between junctions 22 and 23 has reduced the impact on the setting of the Rivenhall long mortuary enclosure scheduled monument.
- Infrastructure has been avoided in locations with sensitive built heritage assets as far as practicable, such as realigning the offline section of road between junctions 22 and 23 which has reduced the impact on the setting of the grade II* listed Hole Farm (Asset 420).
- Reduction in the number of borrow pits has reduced the number of non-designated archaeological sites potentially removed during construction.
- Junction locations have been revised to reduce impacts on the setting of heritage assets; for example, the proposed new junction 24 was moved from a position just south of the existing junction 24 to a new location to the west of Inworth Road, thereby reducing potential impacts on the grade II listed Prested Hall (Asset 730).
- Junctions have been designed to reduce the effects on landform, field pattern, landscape features and views, and to retain vegetation.
- Visual impacts have been reduced through retaining as much of the existing vegetation as practicable within the proposed scheme boundary and within temporary works areas. Particular attention would be given to the retention of mature vegetation including specimen trees and woodlands.
- Major structures, signage and gantries have been carefully designed to limit visual intrusion and to help integrate these into the wider landscape.
- Planting to reduce adverse landscape and visual effects, including native hedgerows, shrubs and trees. Consideration of the species, pattern and distribution of proposed hedgerows, shrubs and trees along the proposed scheme to reflect the distinctive local character of vegetation of the adjacent landscape and provide screening for visual receptors.
- Use of planting to link into existing field boundary vegetation to provide screening and integration into the local pattern and character.
- Use of locally native plants as appropriate to reflect the distinctive local character, such as parkland and avenue near registered parks and gardens.

7.9.3 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

7.9.4 In the first instance, archaeological evaluation will be undertaken across the route of the proposed scheme to determine the presence or absence of archaeological assets site by site, their character, age and the significance of the resource. This will be followed by a programme of assessment and reporting.

7.9.5 Based on these results, further mitigation may be required where significant and substantial archaeological evidence is encountered. This will be followed by a further phase of post-excavation assessment, analysis, reporting and, where appropriate, publication.

7.9.6 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect include the following:

- Archaeological earthwork survey and photography in advance of construction to record upstanding earthwork features.
- Archaeological excavation or strip, map and sample excavation as appropriate and targeted around data gathered using DBA and non-intrusive surveys, to record archaeological remains before their removal during construction, followed by a programme of assessment, analysis and publication. The decision on the requirement for further works will be based on the nature and significance of the archaeological assets encountered and liaison with the relevant stakeholders.
- The type and form of site security fencing near large construction compounds, proposed structures and listed buildings would be considered, where practicable, to provide an additional temporary screening function.
- Temporary lighting required to ensure safe working conditions and to maintain security during construction would be kept to a minimum and have sharp cut-off properties to reduce light spill as far as practicable. Night-time working to be kept to a minimum as far as reasonably practicable.

7.9.7 Standard mitigation will be included in a first iteration of the Environmental Management Plan which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5: Environmental assessment methodology).

Additional mitigation

7.9.8 It is unlikely that any additional mitigation would be required to mitigate cultural heritage effects in addition to the embedded and standard mitigation presented above. However, requirements for additional mitigation will be considered during the development of the proposed scheme preliminary design.

Enhancement

7.9.9 The proposed scheme is likely to generate considerable archaeological information and provide an opportunity for communicating such finds to the wider public. Interpretation of archaeological information will be informed by the reported fieldwork results. Appropriate outreach and engagement opportunities

would be identified throughout the construction and operational phases of the project and could include activities such as presentations, STEM and scientific outreach activities at local schools, volunteering programmes, media coverage, web-based initiatives, information and progress signage at appropriate locations, and permanent heritage interpretation at relevant sites, such as the Kelvedon Warrior (Asset 657), Rivenhall long mortuary enclosure scheduled monument (Asset 399) and Prested Hall (Asset 730).

7.10 Assessment of likely significant effects

Construction

Archaeological remains

7.10.1 A total of two residual significant effects have been assessed for archaeological remains. Only impacts on archaeological remains with the potential to result in significant effects are described below and summarised in Table 7.6.

7.10.2 No impacts have been predicted for the six scheduled monuments identified in the archaeological remains baseline, all of which are located outside the provisional Order Limits. The two scheduled monuments located within 300m of the provisional Order Limits (Assets 399 and 646) are funerary sites of prehistoric or early medieval date with no surface remains. Their value is derived principally from their evidential and historical value. Their setting within the modern arable landscape does not contribute to their value and would **not be significantly affected** by construction of the proposed scheme.

7.10.3 No impacts due to changes in setting of non-designated archaeological remains have been predicted during construction of the proposed scheme.

7.10.4 Construction of the proposed scheme would result in removal of non-designated archaeological remains associated with the entirety of Geophysics at Coleman's Farm (Asset 339) and Geophysical Anomaly: Circular enclosure and field system (Asset 407), both of which are apparently complex archaeological sites identified as geophysical survey anomalies and assessed as medium value. The magnitude of this impact has been assessed to be major. Mitigation for this impact would include archaeological excavation of the affected area of each asset. The significance of this residual effect has been assessed to be **moderate adverse** for both cultural heritage assets.

7.10.5 Bulls Lodge Farm dam (Asset 55) is a non-designated earthwork causeway believed to have once formed part of a large fish pond constructed in the 15th or 16th century and which may possibly have been related to nearby New Hall (Asset 10). The value of Asset 55 has been assessed to be low derived from its archaeological and historic interest. Construction of the proposed scheme would potentially remove archaeological remains associated with most of the known extent of this asset, and the magnitude of this impact has been assessed to be major. Mitigation for this impact would include historic landscape survey and photographic survey, and archaeological excavation of the affected area. The significance of residual effect would be **slight adverse**.

7.10.6 Construction of the proposed scheme would result in the removal of archaeological remains associated with a possible Neolithic long barrow at Colemans Farm, Rivenhall (Asset 391), assessed to be of medium value. This is one of a number of assets believed to be contemporary with the nearby Rivenhall long mortuary enclosure scheduled monument (Asset 399), and there are extensive cropmarks of apparently archaeological origin in this area. Construction would remove archaeological remains associated with approximately 30% of the total extent of Asset 391. The magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include archaeological excavation of the affected area. The significance of residual effect would be **slight adverse**.

7.10.7 Asset 383 is a prehistoric and Roman funerary site north of Appleford Farm, Rivenhall End, identified through a combination of surface artefact finds, cropmarks and geophysical anomalies, and has been assessed to be of medium value. Construction of the proposed scheme would remove archaeological remains associated with a number of linear and discrete features close to the findspot of a cremation burial and Roman pottery. The magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include archaeological excavation of the affected area. The significance of this residual effect would be **slight adverse**.

7.10.8 Hole Farm Cropmarks (Asset 411) is a group of linear cropmarks and geophysical anomalies representing the traces of a field system which has been interpreted as being contemporary with the nearby circular enclosure at Asset 407. Its value has been assessed to be medium. Construction of the proposed scheme would remove archaeological remains associated with the entirety of this asset within the provisional Order Limits. The magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include archaeological excavation of the affected area. The significance of this residual effect would be **slight adverse**.

7.10.9 Asset 647 is the Kelvedon Enclosure, a pair of rectilinear enclosures (an area of land enclosed within a boundary with straight or near straight sides and may be defined by a ditch, bank or wall or similar) identified from aerial photographic sources of possible late prehistoric or Roman date. Asset 647 appears to be of low complexity with no obvious internal features, and taking this into account its value has been assessed to be negligible. Construction of the proposed scheme would remove archaeological remains associated with the entirety of this asset within the provisional Order Limits. The magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include archaeological excavation of the affected area. The significance of this residual effect would be **slight adverse**.

7.10.10 The Kelvedon Iron Age Warrior (Asset 657) was a chance discovery in 1982 of a high status grave with goods, including an iron sword and spear that had been ritually bent at the time of burial, a bronze scabbard and the remains of a shield (Sealey, 2007). It is believed to be related to a contemporary settlement at Kelvedon 1.2km to the north-west. Although the asset is not designated, it has been assessed to be of high value because warrior burials from this period are rare in Britain. Although the warrior burial was discovered approximately 40m outside the provisional Order Limits to the south-west, construction of the

proposed scheme would affect a portion of the area of potential interest around it, potentially removing any associated archaeological remains. Although no evidence for further remains associated with the asset have been found to date, specific measures to identify their presence or absence have been included in the forthcoming archaeological evaluation for the proposed scheme. Based on the evidence currently available, the magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include archaeological excavation of the affected area. The significance of residual effect would be **slight adverse**.

7.10.11 Construction of the proposed scheme would potentially remove archaeological remains associated with six Roman roads identified either from historic sources or as cropmarks (Assets 1, 111, 112, 736, 774 and 780). Although the alignment of some of these assets coincides with existing highways, archaeological remains associated with Roman roads are frequently found preserved *in situ* beneath them. The magnitude of this impact has been assessed to be major for Assets 1 and 780, where lengths of approximately 1.2km and 3km respectively would be affected. Because of their location beneath the existing highway, archaeological watching brief during construction is proposed in mitigation. The significance of residual effect would be **slight adverse**.

7.10.12 Church Field at Hatfield Peverel (Asset 133) is believed to be the location of a church demolished during the Dissolution in the 16th century. Surface finds of medieval brick and tile appear to confirm this, and the value of this asset has been assessed to be low. A temporary site compound/laydown area is proposed in this area. Construction works and deconstruction/removal of the temporary compound/laydown area (drainage, services etc.) would remove archaeological remains associated with the whole extent of this asset. The magnitude of impact has been assessed to be major. Mitigation for this impact would include archaeological excavation of the affected area. The significance of residual effect would be **slight adverse**.

7.10.13 Assets 337, 385, 688, 775, 776, 949, 950, 951, 953, 954 and 955 are all either cropmarks or geophysical anomalies identified as being possible traces of prehistoric settlement and represent elements such as ring ditches, trackways and enclosure and field boundaries. The value of all 11 assets has been assessed to be low based on their apparent low complexity. Construction of the proposed scheme would result in removal of archaeological remains associated with the full extent of each asset, and the magnitude of this impact has been assessed to be major for all 11. Mitigation for this impact would include archaeological excavation of the affected area of all 11 cultural heritage assets. The significance of residual effects would be **slight adverse**.

7.10.14 The Terrace (Site of), Hatfield Peverel (Asset 167) and New Barn, Copford (Site of) (Asset 900) are locations of demolished rural buildings assessed to be of negligible value. Construction of the proposed scheme would remove all archaeological remains associated with both assets. The magnitude of this impact has been assessed to be major. Mitigation for this impact would include archaeological excavation of the affected area of both cultural heritage assets. The significance of the residual effect would be **slight adverse**.

7.10.15 Construction of the proposed scheme would remove archaeological remains associated with Assets 72, 228, 277, 368 and 779, all of which are cropmarks or geophysical anomalies associated with field boundaries of uncertain date. The value of all five assets has been assessed to be negligible based on their apparent lack of complexity or associated finds. The magnitude of impact has been assessed to be major for all five assets. Mitigation for this impact would include archaeological excavation of the affected area of all five cultural heritage assets. The significance of this residual effect would be **neutral**.

7.10.16 Asset 43 is a water feeder ditch associated with the Chelmer and Backwater Navigation (Asset 152), assessed to be of negligible value. This is a simple earth-cut ditch for most of its length but has been culverted in places such as where it passes beneath the A12. Construction of the proposed scheme would remove archaeological remains associated with a short length of this asset. The magnitude of this impact has been assessed to be slight. Mitigation would include photographic survey of the affected section of the asset before construction of the proposed scheme. The significance of the residual effect would be **neutral**.

Table 7.6 Archaeological remains likely significance of residual effects during construction

Archaeological remains	Very large adverse	Large adverse	Moderate adverse	Slight adverse	Neutral
Scheduled monuments	No impacts identified on six scheduled monuments				
Non-designated	-	-	2 (Asset 339 is an area of complex archaeological remains identified through geophysical survey at Coleman's Farm; and Asset 407 a circular enclosure and field system identified through geophysical survey)	26	6

Built heritage

7.10.17 A total of 13 significant effects have been identified for built heritage assets during construction activities. Only impacts on built heritage with the potential to result in significant effects are described below and summarised in Table 7.7. The built heritage impact assessment is ongoing and will be reported in full in the Environmental Statement, taking into account the mitigation measures which are currently being developed. Accordingly, the information presented below provides a preliminary assessment (without mitigation) of the potential effects of the proposed scheme.

7.10.18 The setting of the grade I listed Boreham House (Asset 69), a large country house designed by the nationally renowned architect James Gibbs, would be impacted during the construction of the new junction 19 layout and alterations to the B1137 Main Road. The house is set in its own grounds which encompass the impressive northern entrance from Main Road, with a clear view of around 370m to the principal elevation of the listed building. The surrounding gardens form part of an associated grade II registered park and garden (Asset 67).

7.10.19 The site occupies generally level ground, screened from its surroundings by planting along the boundaries of the immediate gardens. The formal approach to Boreham House is from the B1137 Main Road, through gates which lead to twin parallel carriage drives flanking a 250m long formal canal. The drives lead directly to the entrance forecourt below the north-west front of the house, with the entrance front facing north-west and were laid out when the house was first built in the early 18th century. The elms lining the drives were lost to Dutch elm disease in the 1960s and have since been replaced by a collection of flowering cherry trees, shrubs and roses on the canal sides. Along the south-west side of the lawn is a larger concentration of trees, many of them later 20th century additions to the area of the pleasure-ground shrubbery. These setting elements contribute strongly to the aesthetic value of the house as well as having a functional relationship with it, which contributes to its historic and communal values. To the immediate south-west of the main house is a truck repair business and there are large industrial sheds located to the west which are visually intrusive.

7.10.20 The construction works would include large-scale changes to the roundabout and junction arrangement including additional lanes on the overbridge. There would be some minor land-take along Main Road, plus associated earthworks and landscaping which would affect the entrance to Boreham House and the associated registered park and garden (Asset 67). A temporary site compound would be located to the west of Boreham House within approximately 150m which would be visually intrusive, affecting vistas from the house. The construction impact from activities within the setting of the house would include noise, vibration and dust plus visual intrusion from construction traffic. The magnitude of impact from visual intrusion and construction traffic would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.21 The grade II listed ‘Generals’ (Asset 57), formerly the General's Head Inn and originally a 17th century timber-framed and plastered house with cross-wings, is now a private residence. It is located adjacent to the Premier Inn, with an associated large guest accommodation block and car-parking, immediately adjacent to the existing junction 19. The setting makes a limited contribution to the aesthetic value of the Generals but does have a functional relationship with it which contributes to its historic value.

7.10.22 There would be large-scale construction works to the north, west and south of the Generals. These construction activities would include changes to the roundabout and junction arrangement, the demolition and replacement of the overbridge, plus some minor land-take along the pavement and verge and the entrance from Main Road. The proposed construction works within the setting are predicted to result in noise, vibration and dust plus visual intrusion from

construction machinery and traffic. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.23 The grade II listed Nos. 12 and 14 (Asset 141) are located along the B1137 'The Street', adjacent to the existing Bury Road overbridge and approximately 40m south of the existing A12 which is located in a cutting at this point. The setting is currently formed by historic ribbon development along Main Road (B1137) which is relatively tranquil and contributes to the aesthetic, communal and historic value of the buildings. The main construction impacts on its setting would result from the demolition of the Bury Lane overbridge together with earthworks for cutting and landscaping for the road widening with associated noise, dust and vibration plus visual intrusion from construction traffic and machinery during construction. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.24 The grade II listed former Post Office Stores (Asset 146) is located adjacent to the existing Bury Road overbridge and approximately 55m south of the existing A12. The setting is also currently formed by historic ribbon development along Main Road (B1137) which is relatively tranquil and contributes to the aesthetic, communal and historic value of the building. Again, the main impact would be the demolition of the Bury Lane overbridge together with earthworks for cutting and landscaping for the road widening with associated traffic, noise and vibration plus visual intrusion from construction traffic and machinery. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.25 The non-designated Model Farm (Asset 372) at Rivenhall End is located along the existing A12 and would be affected by construction of the offline section of the new A12 at Rivenhall End, together with a new interchange and overbridge to the south of the A12 and with borrow pits approximately 260m to the north-east. The magnitude of impact would be moderate on a low value asset resulting in a **moderate adverse** significance of effect.

7.10.26 The grade II* listed Hole Farmhouse (Asset 420) has a two-bay hall dating from the 15th century and built-in timber framing with a roughcast render. The house is located approximately 65m south of the A12 with an entrance directly onto the road. To the south of the farmhouse are uninterrupted views over farmland with views to the north partly screened by vegetation along the A12. Although interrupted by existing road noise, the setting contributes to the aesthetic, communal and historic value of the farmhouse.

7.10.27 The setting of Hole Farmhouse would be affected by construction of the offline section of road at Rivenhall End, to the north of the existing A12. There would also be impacts from the conversion of the existing A12 into a new local access road for the Essex County Fire and Rescue Service headquarters. There would be impacts from associated earthworks, landscaping and visual intrusion from construction traffic and machinery plus borrow pits approximately 290m to the north. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.28 The grade II listed Church View House (Asset 784), formerly known as Flispes in Copford, is a late 16th century three-bay, cross-passage house, located approximately 360m to the south of the existing A12. The house is surrounded by mature trees but with open fields to the east and part of its setting is formed by the historic Easthorpe Village Green (Asset 902). The construction works near the house would consist of an offline section of raised road, located approximately 230m to the north and north-east of the house, plus a new side road and Doggets Lane overbridge.

7.10.29 The construction activities within the setting from associated earthworks and landscaping approximately 230m to the north would result in noise and dust plus visual intrusion from construction machinery and traffic. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.30 The grade II listed Easthorpe Green Farmhouse (Asset 785) is a 17th century timber-frame and brick house, located approximately 230m to the south of the A12. It has some mature trees surrounding it to the south, but with open fields to the east. Like Church View House (Asset 784), it is associated with Easthorpe Village Green (Asset 902) which forms part of its setting.

7.10.31 The potential construction works affecting Easthorpe Green Farmhouse (Asset 785) would consist of the construction of an offline section of raised road located approximately 100m to the north and north-east together with a new side road and Doggets Lane overbridge to the east. The magnitude of impact would be moderate on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.32 The grade II listed Doggets Hammer Farm (Asset 795), near Marks Tey, is located approximately 200m to the south of the existing A12, with open fields to the south and east which contribute to the aesthetic value of the building as well as having an historic functional relationship. The house is a 16th century timber-frame building with jettied north and south bays and a cross-wing. It would potentially be affected by construction activities for an offline section of new road at Marks Tey, located approximately 100m to the south and south-east of the farm.

7.10.33 The predicted impact from construction activities including associated earthworks, landscaping, noise and dust plus visual intrusion from construction machinery would be a moderate adverse magnitude of impact on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.34 The grade II listed No. 172 London Road, Marks Tey (Asset 805) is located on the old London Road, which is directly north of the existing A12 and parallel to it. The setting of the house is compromised by the visual intrusiveness of its views towards the A12, but it retains some views of open fields beyond. The construction activities for the proposed upgraded junction 25 at Marks Tey and new offline section of new road to the south would include construction of a roundabout and the reconfiguration of the existing interchange to the north-east at Marks Tey plus demolition and replacement of footbridges.

7.10.35 The impacts of the construction activities within the setting would include visual intrusion from construction machinery and traffic for the associated earthworks and landscaping together with associated noise and dust. This would result in a moderate magnitude of impact on a high value asset resulting in a **moderate adverse** significance of effect.

7.10.36 The grade II listed Marks Tey Hall (Asset 819) is a 16th century timber-framed house, located approximately 330m to the south of the existing A12. It forms a group with the associated grade II* listed barn (Asset 816), with 15th century origins, and a grade II listed 17th century barn (Asset 817). Marks Tey Hall (Asset 819) has largely uninterrupted views to the south and west of agricultural land and some mature trees and vegetation surrounding it, giving the setting a semi-rural character. It is associated with Marks Tey moated site (Asset 922) which forms part of the setting and contributes to the building's historic and communal values.

7.10.37 However, the historic character of this group is somewhat compromised by the existing A12, approximately 330m to the north, the location of a caravan sales lot to the north-east, and outbuildings used as industrial units to the west. These elements have eroded some of the contribution of the setting to the aesthetic value of the hall (Asset 819).

7.10.38 The historic farm group is accessed from the A12 by Hall Chase. It is surrounded by mature trees and vegetation and would be subject to impacts from construction activities within its setting. The construction activities would result from the new offline section of A12 road at junction 25. A small roundabout, to the south of the A12, would link it to Hall Chase Road by an access road, within approximately 250m of Marks Tey Hall. Further construction activities would consist of the reconfiguration of the existing interchange to the north-east at Marks Tey and the demolition and replacement of the existing footbridges.

7.10.39 The proposed construction activities are predicted to result in setting impacts from the visual intrusion of construction machinery and traffic together with associated noise and dust. This would result in a moderate magnitude of impact on these three high value assets and a **moderate adverse** significance of effect on each.

Table 7.7 Built heritage likely significance of effects pre-mitigation during construction

Name	Asset no.	Designation	Value	Significance of effect
Boreham House	69	Grade I listed	High	Moderate adverse
Hole Farmhouse	420	Grade II* listed	High	Moderate adverse
Barn south of Marks Tey Hall	816	Grade II* listed	High	Moderate adverse
The 'Generals'	57	Grade II listed	High	Moderate adverse
Nos. 12 and 14	141	Grade II listed	High	Moderate adverse

Name	Asset no.	Designation	Value	Significance of effect
Post Office Stores	146	Grade II listed	High	Moderate adverse
Marks Tey Hall	819	Grade II listed	High	Moderate adverse
Church View House (Flispes)	784	Grade II listed	High	Moderate adverse
Easthorpe Green Farmhouse	785	Grade II listed	High	Moderate adverse
Doggets Hammer Farm	795	Grade II listed	High	Moderate adverse
No. 172 London Road, Marks Tey	805	Grade II listed	High	Moderate adverse
Barn south of Marks Tey Hall	817	Grade II listed	High	Moderate adverse
Model Farm	372	Non-designated	Low	Moderate adverse

Historic landscape

7.10.40 The preliminary assessment of historic landscape has not identified any significant residual effects on historic landscapes during construction. Only impacts on historic landscape with the potential to result in significant effects are described below and summarised in Table 7.8.

7.10.41 HLT 7 reflects four occurrences of post-medieval designed landscapes within the study area. All four occurrences coincide with registered parks and gardens or land parcels associated with them but not included in the designated area: New Hall, Boreham (Asset 7); Boreham House (Asset 67); Hatfield Priory (Asset 162) (all grade II); and Braxted Park (Asset 480) (grade II*).

7.10.42 Construction of the proposed realignment of the B1137 at junction 19 would remove vegetation from a strip of land approximately 20m wide at the northern boundary of Boreham House (Asset 67), a grade II registered park and garden assessed to be of medium value. The operation of construction plant in this area would create a visual impact affecting the understanding of the design and intended function of the park when viewed from inside the asset. The magnitude of this impact has been assessed to be moderate. Mitigation for this impact would include photographic survey and historic landscape survey to make a record of the asset's condition and setting before construction, and an archaeological watching brief during construction to identify and record any buried garden features which could be present in the affected area of the asset. The significance of residual effect would be **slight adverse**.

7.10.43 Construction and operation of a temporary compound and laydown area, and the creation of landscape mitigation areas, would be within a non-designated area of post-medieval designed landscape (HLT 7) associated with Boreham House grade II registered park and garden (Asset 67). Although this land was once part of the extent of the park, apart from its external boundary almost all traces of its former function have been removed and it is now occupied by a mixture of farming and commercial use and has been assessed to be of low

value. The magnitude of this impact has been assessed to be minor. Mitigation of this impact would include historic landscape survey to make a record of the condition of the asset before construction. The significance of residual effect would be **slight adverse**.

7.10.44 Construction of junction 19 (Boreham interchange) would be within approximately 50m of the southern end of the 800m long double avenue of mature trees which marks the approach to the grade II registered park and garden at New Hall, Boreham (Asset 7). Dense mature plantation shelter belts screen views from the house within. Distant glimpses of moving machinery during construction of the proposed scheme would not affect the understanding of the HLT at this location, and a negligible impact has been predicted. No mitigation is proposed for impacts on this HLT, and the residual significance of effect would be **neutral**.

7.10.45 A single occurrence of post-medieval plantation (HLT 9) between Easthorpe Road and Potts Green, assessed to be of low value, would have approximately 25% of its total area removed by construction of the proposed scheme. The magnitude of this impact has been assessed to be minor. No mitigation is proposed for impacts on this HLT, and the residual significance of effect would be **neutral**.

7.10.46 The pre-18th century enclosure (HLT 12) and 18th and 19th century enclosure (HLT 13) are both relatively common at a county scale, and the value of both has been assessed to be low. Field boundaries and land parcels associated with both types would be severed or removed at six and five locations respectively, resulting in impacts of minor magnitude. The residual significance of effects would be **neutral**.

7.10.47 Construction of the proposed scheme would result in removal or severance of land parcels and field boundaries associated with the modern agriculture type (HLT 14), which has been assessed to be of negligible value. The magnitude of this impact has been assessed to be negligible. No mitigation is proposed for impacts on this HLT, and the residual significance of effect would be **neutral**.

Table 7.8 Historic landscape likely significance of residual effects during construction

Historic landscape	Very large adverse	Large adverse	Moderate adverse	Slight adverse	Neutral
HLTs	-	-	-	2	5

Operation

Archaeological remains

7.10.48 No operational effects upon the recorded or unrecorded archaeological remains are envisaged. During the operation of the proposed scheme, no further earthworks are anticipated. As such, there would be no further physical impacts on archaeological remains arising from the operation of the proposed scheme.

Built heritage

7.10.49 A total of six significant operational effects have been identified for built heritage receptors as described below and summarised in Table 7.9. The built heritage impact assessment is ongoing and will be reported in full in the Environmental Statement, taking into account the mitigation measures which are currently being developed. Accordingly, the information presented below provides a preliminary assessment (without mitigation) of the potential effects of the proposed scheme.

7.10.50 The grade II listed Church View House (Asset 784), formerly known as Flispes, in Copford, is a late 16th century three-bay, cross-passage plan house, located approximately 360m to the south of the existing A12. The house is surrounded by mature trees but with open fields to the east and part of its setting is formed by the historic Easthorpe Village Green (Asset 902). The potential operation of the new offline section of raised road located approximately 230m to the north and north-east of the house plus new side road and Doggets Lane overbridge would result in long-term visual impacts on views from the house. The visual impact from the road's presence within its setting, including lighting, signage plus noise from additional road traffic, is predicted to result in harm to the aesthetic value of the listed building, resulting in a moderate magnitude of impact on a high value asset; this would result in a **moderate adverse** significance of effect.

7.10.51 Similarly, the nearby grade II listed Easthorpe Green Farmhouse (Asset 785), which is a 17th century timber-frame and brick house, located approximately 230m to the south of the existing A12, would be impacted by the operation of the new road. Whilst it has some mature trees surrounding it to the south, there are open fields to the east. Like Church View House (Asset 784), it is associated with Easthorpe Village Green (Asset 902) which forms part of its setting.

7.10.52 The operation of the proposed offline section of raised road located approximately 100m to the north and north-east of Easthorpe Green Farmhouse, plus Doggets Lane overbridge and a new side road to the east, would result in visual intrusion on the setting from the presence of the new road, including lighting, signage plus noise from additional road traffic. This would impact its aesthetic value and erode what remains of its historic setting. The visual impacts are predicted to result in harm to the aesthetic value of the listed building with a moderate magnitude of impact on a high value asset, resulting in a **moderate adverse** significance of effect.

7.10.53 Doggets Hammer Farm (Asset 795), a grade II listed building near Marks Tey, is located approximately 200m to the south of the existing A12, with open fields to the south and east. The house is a 16th century timber-frame building which would potentially be affected by the presence in the landscape of the new offline section of road at Marks Tey located approximately 100m to the south and south-east of the farm, isolating the farm between two roads.

7.10.54 The visual impact from the presence of the road within its setting, including lighting, signage plus noise from additional road traffic, is predicted to result in harm to the aesthetic value of the listed building. This would be a moderate magnitude of impact on a high value asset, resulting in a **moderate adverse** significance of effect.

7.10.55 The Marks Tey Hall (Asset 819) farm group is centred around a 16th century timber-framed house, located approximately 330m to the south of the A12. The hall is associated with a grade II* listed 15th century barn (Asset 816) and a grade II listed 17th century barn (Asset 817). Marks Tey Hall (Asset 819) has largely uninterrupted views to the south and west of agricultural land and some mature tree and vegetation surrounding it, giving the setting a semi-rural character. It is associated with Marks Tey moated site (Asset 922) which forms part of the setting and contributes to the building's historic and communal values.

7.10.56 However, this character is compromised by the existing A12, approximately 330m to the north, the location of a caravan sales lot to the north-east and outbuildings used as industrial units to the west which have eroded some of the contribution of the setting to the aesthetic value of the hall.

7.10.57 This historic farm group would be subject to impacts from the visual intrusion of the new offline section of A12 road within its setting, including lighting, signage plus noise from additional road traffic. Within approximately 250m of Marks Tey Hall (Asset 819), a new offline access road from a roundabout at junction 25 with the A12 would join the existing Hall Chase Road.

7.10.58 The operation of the road would result in an impact from the presence of the road within its landscape which is predicted to result in harm to the aesthetic value of the listed building. This would be a moderate magnitude of impact on a high value asset, resulting in a **moderate adverse** significance of effect.

Table 7.9 Built heritage likely significance of effects pre-mitigation during operation

Name	Asset no.	Designation	Value	Significance of effect
Barn south of Marks Tey Hall	816	Grade II* listed	High	Moderate adverse
Marks Tey Hall	819	Grade II listed	High	Moderate adverse
Church View House (Flispes)	784	Grade II listed	High	Moderate adverse
Easthorpe Green Farmhouse	785	Grade II listed	High	Moderate adverse
Doggets Hammer Farm	795	Grade II listed	High	Moderate adverse
Barn south of Marks Tey Hall	817	Grade II listed	High	Moderate adverse

Historic landscape

7.10.59 The preliminary assessment of historic landscape has not identified any significant residual effects on historic landscapes during operation. Only operational impacts on historic landscape with the potential to result in significant effects are described below.

7.10.60 Retained mature vegetation and buildings north-west of Boreham House landscape park (Asset 67) would continue to screen views from the entrance driveway and canal towards the A12 north of junction 19. Once mature, the proposed tree planting east of junction 19 would screen more oblique views towards it from Asset 67. The magnitude of impact from operation of the proposed scheme on Asset 67 has been assessed to be minor, resulting in a **slight adverse** significance of effect.

7.10.61 Proposed hedgerow planting would strengthen existing field boundaries where they would be severed by the proposed scheme, and landscape mitigation including tree planting would help to integrate the proposed scheme into the surrounding landscape as it matures. **No significant effects** on the historic landscape are predicted during operation of the proposed scheme.

8 Landscape and visual

8.1 Topic introduction

8.1.1 Potential landscape and visual effects likely to arise because of the proposed scheme are considered within this chapter. Landscape and visual impact assessment (LVIA) is defined in the Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013) as a tool to identify and assess the significance of change resulting from a proposed development. LVIA addresses two separate but related matters as defined by GLVIA3, namely:

- Landscape effects: effects on the landscape as a resource in its own right
- Visual effects: effects on specific views and on the general visual amenity experienced by people

8.1.2 This chapter provides a summary of the landscape-related stakeholder engagement carried out to date, legislative and policy framework relevant to landscape, and the assessment methodology for the landscape and visual assessment within this Preliminary Environmental Information Report (PEIR). This chapter also presents baseline conditions relevant to landscape and visual effects; an outline of potential landscape and visual impacts; design, mitigation and enhancement measures; and an assessment of likely significant effects that would be caused by the proposed scheme.

8.1.3 This chapter is supported by the following figures (see Appendix A):

- Figure 8.1 Key Landscape Constraints
- Figure 8.2 Local Landscape Character Areas
- Figure 8.3 Zone of Theoretical Visibility and Viewpoints

8.1.4 Scheme specific design principles relating to landscape are included in Chapter 2: The scheme.

8.2 Stakeholder engagement

8.2.1 Landscape planning officers at the following local planning authorities were consulted in October 2020 on the location of proposed representative viewpoints for the assessment of visual effects, and the location of proposed viewpoints for photomontages, for inclusion within the Environmental Statement:

- Braintree District Council
- Chelmsford City Council
- Colchester Borough Council
- Essex County Council
- Maldon District Council

8.2.2 The locations of viewpoints presented to the local authorities were consistent with those presented within the Environmental Scoping Report (Highways England, 2020d).

8.2.3 The locations of viewpoints for inclusion within the Environmental Statement were reviewed following feedback received from local planning authorities, both as a direct result of the consultation carried out as well as responses included within the Scoping Opinion (Planning Inspectorate, 2021).

8.2.4 A revised set of viewpoints, taking account of the feedback received, was issued for consultation with the local planning authorities as well as with Historic England (as requested within the Scoping Opinion) in February 2021. Consultation included requests for feedback on the proposed study area and the proposed photomontage methodology to be applied to the LVIA within the Environmental Statement. No responses have been received regarding the location of viewpoints, or that will affect the proposed scope and methodology of the LVIA. Any further changes to viewpoints resulting from refinement of the proposed scheme or site verification will be agreed through ongoing consultation with local planning authorities and Historic England.

8.2.5 Arboricultural consultation took place in September and October 2020 with the respective local planning authorities with responses received from Chelmsford City Council and Colchester Borough Council. The approach to undertaking the arboricultural surveys was discussed and it was agreed that tree data should be collected following the guidance of BS 5837:2012 (Trees in relation to design, demolition and construction – Recommendations) with a focus on notable tree features. At the time of consultation, Braintree District Council confirmed they had no tree officer in residence, and Maldon Borough Council replied that no planning officer was available to comment.

8.2.6 The key findings of this PEIR assessment were presented to local planning authorities in April 2021.

8.2.7 Table 8.1 provides a summary of the key stakeholder feedback and key requirements from the Planning Inspectorate as identified within the Scoping Opinion (Planning Inspectorate, 2021) relevant to the assessment of landscape and visual effects.

Table 8.1 Key stakeholder feedback for landscape aspect

Stakeholder	Comment	Response
Planning Inspectorate	The study area for the landscape assessment has a buffer of approximately 2km from the proposed scheme, and a minimum of 1km from the provisional Order Limits. The Planning Inspectorate considers that the study area should be informed by the type of visual receptors and the nature, extent and severity of likely impacts on them, rather than pre-determined distances. The Scoping Report lacks evidence to support the assumption that visual effects beyond 1km are unlikely to be significant. The Environmental Statement should provide further evidence to support this assumption and also take into account viewpoints from further afield that look onto the location of the scheme. The Applicant should make effort to agree the landscape assessment study and viewpoints with the relevant statutory bodies.	The study area is considered an appropriate and proportionate extent to ascertain the wider landscape context surrounding the proposed scheme and to focus on the likely significant landscape and visual effects. Five additional longer distance illustrative viewpoints in excess of 1km from the provisional Order Limits have been identified to demonstrate within the LVIA that visual effects beyond 1km are unlikely to be significant due to distance and intervening blocking features. The location of these viewpoints was included within the landscape consultation with local planning authorities and Historic England in February 2021. This landscape consultation also included reference to the proposed study area for the LVIA for agreement.
Planning Inspectorate	The Environmental Statement should consider how veteran, ancient, and notable trees contribute to landscape character and setting.	The assessment of impacts on landscape components, such as trees and woodland, and perceptual and aesthetic aspects will be considered within the assessment of impacts on landscape character. A concise section will be included within the LVIA of the Environmental Statement to consider the impacts on veteran, ancient and notable trees as defined by the Woodland Trust, and further potential veteran and ancient trees identified from a scheme-specific arboricultural survey.

Stakeholder	Comment	Response
Essex County Council	EIA can help identify appropriate measures for avoiding or reducing significant adverse effects on the functionality of green infrastructure assets (trees, watercourses, public rights of way, hedges, open spaces etc) and for compensating/off-setting unavoidable significant adverse effects to protect the overall integrity of the surrounding wider landscape network. It is recommended that a detailed landscaping and ecology/green infrastructure strategy should be prepared as part of the LVIA, and where the assessment and the other supporting documents indicates potentially significant effects on landscape character (including existing trees), visual amenity, biodiversity net gain value and health and wellbeing of the community (i.e. access to open spaces, encouraging active travel and recreation and reduce air pollution etc.) that may require mitigation.	Design principles, which will consider green infrastructure objectives, will be presented in a design principles document and project design report. Mitigation for green infrastructure assets will be identified within the landscape and biodiversity chapters of the Environmental Statement. A Preliminary Environmental Masterplan will illustrate how green infrastructure would be addressed in terms of landscape and biodiversity mitigation, and public rights of way and access provision. The Environmental Management Plan will present how natural assets would be protected during construction. The Landscape and Ecological Management Plan will present how the landscape and ecological mitigation would be reinstated and maintained.
Colchester Borough Council	Feedback on the location of proposed representative viewpoints as presented within the consultation with local planning authorities in October 2020 and within the Environmental Scoping Report (Highways England, 2020d).	Viewpoints have been reviewed in accordance with suggestions and incorporated within further landscape consultation with local planning authorities and Historic England in February 2021.
Colchester Borough Council	Visualisation types should be in compliance with the Landscape Institute's Technical Guidance Note 06/19, i.e. viewpoint types agreed with the local planning authority.	Photography and photomontages will be in accordance with the Visual Representation of Development Proposals Technical Guidance Note 06/19 (Landscape Institute, 2019). The proposed methodology for the production of photomontages was included within landscape consultation with local planning authorities and Historic England in February 2021.

8.2.8 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

8.3 Legislative and policy framework

8.3.1 The National Networks National Policy Statement (NNNPS) 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.

8.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 5.144 of the NNNPS states that where the development is subject to EIA, the applicant should undertake an assessment of any likely significant landscape and visual impacts in the environmental impact assessment and describe these in the environmental assessment. A number of guides have been produced to assist in addressing landscape issues. The landscape and visual assessment should include reference to any landscape character assessment and associated studies, as a means of assessing landscape impacts relevant to the proposed project. The applicant's assessment should also take account of any relevant policies based on these assessments in local development documents in England.
- Paragraph 5.145 states that the applicant's assessment should include any significant effects during construction of the project and/or the significant effects of the completed development and its operation on landscape components and landscape character (including historic landscape characterisation).
- Paragraph 5.146 states that the assessment should include the visibility and conspicuousness of the project during construction and of the presence and operation of the project and potential impacts on views and visual amenity. This should include any noise and light pollution effects, including effects on local amenity, tranquillity and nature conservation.
- Paragraph 5.149 states that landscape effects depend on the nature of the existing landscape likely to be affected and the nature of the effect likely to occur. Both of these factors need to be considered in judging the impact of a project on landscape. Projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints, the aim should be to avoid or minimise harm to the landscape, providing reasonable mitigation where practicable and appropriate.
- Paragraph 5.160 states that adverse landscape and visual effects may be minimised through appropriate siting of infrastructure, design (including choice of materials), and landscaping schemes, depending on the size and type of proposed project. Materials and designs for infrastructure should always be given careful consideration.
- Paragraph 5.161 states that depending on the topography of the surrounding terrain and areas of population it may be appropriate to undertake landscaping off-site, although if such landscaping was proposed to be consented by the development consent order, it would have to be included within the order limits for that application. For example, filling in

gaps in existing tree and hedge lines would mitigate the impact when viewed from a more distant vista.

8.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

8.4 Assessment methodology

Introduction

8.4.1 The methodology used to assess landscape and visual effects within this PEIR is based on the principles set out within the Design Manual for Roads and Bridges (DMRB) LA 107 Landscape and Visual Effects (Highways England, 2020l) (hereafter referred to as 'DMRB LA 107'), and GLVIA3 which has influenced the development of DMRB LA 107.

8.4.2 Arboricultural surveys have been carried out, and a draft arboricultural impact assessment and associated figures have been produced, to inform the design and PEIR assessment. Tree data have been collected following the guidance of BS 5837:2012 (Trees in relation to design, demolition and construction – Recommendations) with a focus on ancient, veteran and notable tree features.

8.4.3 The landscape and visual assessment within this PEIR comprises a high level assessment to identify likely significant effects, based on the design and survey information available to date. Differences between the assessment approach for this PEIR and the forthcoming LVIA (within the Environmental Statement) are presented within the 'Assessment at PEIR and Environmental Statement' section below.

Landscape assessment

8.4.4 The assessment of landscape effects has been made on the local landscape character areas (LCAs) defined within the Braintree, Brentwood, Chelmsford, Maldon and Uttlesford Landscape Character Assessment (Chris Blandford Associates, 2006) and Colchester Borough Landscape Character Assessment (Chris Blandford Associates, 2005). These published landscape character assessments are informed by historic landscape characterisation. The local LCAs assessed are those which were identified as being potentially affected within Chapter 8 of the Environmental Scoping Report (Highways England, 2020d) within the extent of the 2km study area. Local LCAs are presented within Table 8.2 and Table 8.3 (in Section 8.7) and illustrated on Figure 8.2.

8.4.5 The assessment of impacts on landscape components such as trees and woodland, and perceptual and aesthetic aspects, is considered within the assessment of impacts on landscape character. The assessment of impacts on historic environment features in the study area, such as registered parks and gardens and conservation areas, as well as historic landscape character, is addressed in Chapter 7: Cultural heritage.

Visual assessment

8.4.6 The assessment of visual effects is based on a selection of representative viewpoints for different receptor groups within the study area. To demonstrate that landscape and visual effects beyond 1km from the provisional Order Limits are unlikely to be significant, five longer distance 'illustrative viewpoints' have also been included for assessment. Viewpoints have been selected within a digitally generated 'bare earth' zone of theoretical visibility (ZTV) based on the proposed scheme.

8.4.7 The proposed scheme design is undergoing refinement, and consultation with local planning authorities and Historic England regarding the location of representative and illustrative viewpoints and locations for photomontages is ongoing (refer to Section 8.2).Therefore, the location of viewpoints for assessment within the Environmental Statement is potentially subject to change.

8.4.8 Viewpoint locations considered within this PEIR are consistent with the latest information provided during landscape consultation with local planning authorities and Historic England in February 2021. The viewpoints considered within this PEIR are presented in Table 8.4 (in Section 8.7), along with supporting justification, and illustrated on Figure 8.3 in the context of the ZTV.

Assessment criteria and assessment timeframes

8.4.9 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which are used to assess significance for this aspect. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

8.4.10 The criteria identified in DMRB LA 107 have been used to determine the sensitivity of landscape and visual receptors, and as a guide to determine the likely magnitude of effect. The matrix in Chapter 5: Environmental assessment methodology (Plate 5.1), has been used to assist professional judgement when determining the likely significance of landscape and visual effects. Significance of effect categories (replicated from DMRB LA 104) and the definition of what constitutes a significant effect, are included within Chapter 5.

8.4.11 This PEIR considers whether landscape and visual effects are likely to be significant at the following timeframes, in accordance with DMRB LA 107:

- Construction phase: Considers construction activities, temporary works (including compounds and haul roads) and construction traffic during the construction period. Assessments for each landscape and visual receptor during the construction period have been made at a time during construction when impacts are likely to be most significant for the individual receptor.

- Operation year 1 (opening year): Considers impacts on a winter's day during year 1 following completion of all construction, when planted mitigation would not yet have taken effect. Both the completed scheme and the traffic using it have been considered.
- Operation year 15 (design year): Considers the impacts on a summer's day in the fifteenth year after opening, when planted mitigation would have taken effect. Both the completed scheme and the traffic using it have been considered.

8.4.12 In accordance with DMRB LA 107, the magnitude of impact and significance of effect are assessed taking into consideration the proposed mitigation. Proposed mitigation is illustrated on Figure 2.1 Preliminary Environmental Masterplan.

Assessment at PEIR and Environmental Statement

PEIR

8.4.13 This PEIR provides a high-level summary of the likely landscape and visual effects at each assessment timeframe based on the design and survey information available to date. Conclusions have been reached on whether landscape and visual effects are likely to be significant or not. This PEIR considers visual effects from the viewpoints presented in Table 8.4, which are subject to ongoing consultation with local planning authorities and Historic England. No photographs or photomontages are included within this PEIR because these will be based on the final viewpoints agreed through ongoing consultation and photomontages will be based on the final design fix for assessment.

Environmental Statement

8.4.14 Winter and summer site survey results will be used to inform the assessment of impacts within the LVIA. The LVIA within the Environmental Statement will review the assessment of landscape and visual effects carried out during this PEIR, and will assess the magnitude and significance of effect on landscape and visual receptors at each assessment timeframe based on the final design fix for assessment, including the mitigation presented on the final Preliminary Environmental Masterplan. An overall statement of landscape and visual significance will be included in accordance with DMRB LA 107.

8.4.15 The final arboricultural impact assessment (which will include a tree retention and removal plan) will be included as an appendix to the Environmental Statement. A concise section will be included within the LVIA to consider the impacts on veteran, ancient and notable trees as defined by the Woodland Trust, and further potential veteran and ancient trees identified within the scheme-specific arboricultural survey.

8.4.16 A ZTV will be run based on the design fix for assessment, and final viewpoints for assessment within the LVIA will be confirmed through consultation with local planning authorities and Historic England. Baseline photographs and photomontages will be included.

8.5 Assessment assumptions and limitations

8.5.1 For simplicity, the term 'landscape' has been used throughout this PEIR to describe areas of landscape and townscape, in line with DMRB LA 107, which states that the *'LVIA process does not differentiate between 'landscape' and 'townscape', as it is applicable to any landscape - urban, rural or a combination of both...'*. Therefore, the assessment methodology for impacts on landscape and townscape does not differ.

8.5.2 The assessment in this PEIR comprises a high-level assessment of whether landscape and visual effects would likely be significant or not at each assessment timeframe. This is based on the design and survey information available to date and using the tools described in the next paragraph, alongside professional judgement. Further design refinements and fieldwork verification could potentially change the conclusions drawn.

8.5.3 Tools including aerial photography and Google Street View have been used to inform professional judgement for this PEIR assessment. However, these tools cannot be relied upon because they do not provide up-to-date information and often present summer images, which do not illustrate the worst-case visibility because trees are in leaf. The LVIA will be informed by fieldwork carried out during winter and summer, therefore the Environmental Statement will incorporate up-to-date information and will consider worst-case visibility when trees would not be in leaf.

8.5.4 A winter familiarisation site visit was undertaken in February 2017 which informed the Environmental Scoping Report (Highways England, 2020d) and this PEIR. Consultation on viewpoint locations was ongoing at the time this PEIR was being produced, therefore field surveys to assess visual effects from the viewpoints identified in this chapter had not been carried out at the time of writing.

8.5.5 For the purpose of this PEIR assessment, assumptions regarding vegetation loss have been based on professional judgement and knowledge of similar highway schemes, alongside design development and the arboricultural assessments carried out. The extent of proposed planting has been based on the information illustrated on Figure 2.1 Preliminary Environmental Masterplan.

8.5.6 The screening or filtering effect of existing vegetation outside the proposed scheme boundary has been taken into account within the assessment in its current condition. Growth or other changes to this vegetation would potentially affect impacts caused by the proposed scheme, but the management and retention of such vegetation is outside the control of Highways England.

8.5.7 Viewpoint locations considered within this chapter are consistent with the latest information provided during landscape consultation with local planning authorities and Historic England in February 2021. The Environmental Statement will assess views from final viewpoints confirmed with local planning authorities and Historic England. All viewpoints will be checked and refined on site to assess the most open views towards the proposed scheme, close to the locations of the viewpoints indicated.

8.5.8 Proposed developments surrounding the proposed scheme are considered in Chapter 16: Cumulative effects assessment. The future baseline of this PEIR landscape and visual assessment does not include all proposed developments. This is because proposed developments are not guaranteed to be built and the date at which potential future development would be completed is often unknown. Details are often in outline so that the design, form and layout of future development is unknown, which makes it difficult to accurately incorporate within the assessment of landscape and visual effects.

8.5.9 Major committed developments are considered as part of the future baseline within this PEIR landscape and visual assessment. Of particular relevance to the location of representative viewpoints (illustrated on Figure 8.3) and assessment of visual effects are the Beaulieu Park development (relevant to representative viewpoint 1) and Coleman's Farm Quarry (relevant to representative viewpoint 11). Where committed future development has the potential to block views of the proposed scheme, viewpoints will be refined on site to assess the most open view towards the proposed scheme within close proximity to the viewpoint. Representative viewpoint 5 has been selected to be representative of views from future housing north-east of Gleneagles Way, Hatfield Peverel. Representative viewpoint 26 has been selected to be representative of views from future housing north of Wyvern Farm, London Road, Stanway. The LVIA within the Environmental Statement will review and confirm major committed developments that will be considered within the detailed assessment of landscape and visual effects.

8.6 Study area

8.6.1 The study area incorporates a buffer of approximately 2km from the proposed alignment, and a minimum of 1km from the provisional Order Limits (illustrated on Figure 8.1). This is based on the ZTV, baseline context and field surveys carried out to date. The ZTV illustrates the extent of theoretical visibility, which extends in some areas to several kilometres from the proposed scheme. However, the ZTV is based upon a bare earth ground model and therefore only takes account of the visual screening provided by existing topography. The ZTV does not take account of surface features, such as buildings and vegetation, which could also provide screening. Landscape and visual effects beyond 1km distance are unlikely to be significant due to distance and intervening blocking features such as built development, trees and woodland. Therefore, the study area is considered an appropriate extent to ascertain the wider landscape context surrounding the proposed scheme and to focus on the likely significant landscape and visual effects.

8.6.2 This approach is in accordance with DMRB LA 107.

8.7 Baseline conditions

Baseline sources

8.7.1 The baseline conditions have been established through a review of existing desktop studies. The following sources have been used to inform the baseline:

- Ancient Tree Inventory (Woodland Trust, 2020)

- Arboricultural survey data (potential veteran and potential ancient trees, 2020)
- Draft arboricultural impact assessment prepared by Jacobs, 2020 (final arboricultural impact assessment will be made available within the Environmental Statement)
- Braintree, Brentwood, Chelmsford, Maldon and Uttlesford Landscape Character Assessments (Chris Blandford Associates, 2006)
- Braintree District Core Strategy 2011 – 2026 (Braintree District Council, 2011)
- Braintree District Local Plan Review 2005 (Braintree District Council, 2005)
- Chelmsford Local Plan and Adopted Policies Map 2013 – 2036 (Chelmsford City Council, 2020c)
- Braintree Publication Draft Local Plan Section 2 (Braintree District Council, 2017)
- Colchester Adopted Local Plan 2001 – 2021 including Core Strategy, Development Policies DPD and Proposals Maps (Colchester Borough Council, 2014a; 2014b)
- Colchester Borough Landscape Character Assessment (Chris Blandford Associates, 2005)
- England's Light Pollution and Dark Skies (Campaign to Protect Rural England, 2019)
- Essex Green Infrastructure Strategy (Essex County Council, 2020a)
- MAGIC Map application (Defra, 2021)
- Maldon District Approved Local Development Plan and Policies Map 2014 – 2029 (Maldon District Council, 2017)
- North Essex Authorities' Local Plan Shared Strategic Section 1 Plan (Braintree Borough Council, Colchester Borough Council, Tendring District Council, 2021)
- OS Open Greenspace Technical Specification (Ordnance Survey, 2018)
- Publication Draft Colchester Borough Local Plan 2017 – 2033 Section 2 (Colchester Borough Council, 2017)
- Tranquillity Map England (Campaign to Protect Rural England, 2007)

Baseline conditions

Landscape constraints

8.7.2 The key baseline constraints relevant to landscape are illustrated on Figure 8.1.

8.7.3 There are no Areas of Outstanding Beauty or National Parks within the study area.

8.7.4 A local landscape designation, i.e. an area of landscape predominantly defined by landscape distinctiveness, is identified within the Chelmsford Local Plan (Chelmsford City Council, 2020c) as the 'Green Wedge' under Strategic Policy S11 The Role of the Countryside. The policy states that '*The Green Wedge has an identified intrinsic character and beauty and is a multi-faceted distinctive landscape providing important open green networks, which have been instrumental in shaping the City's growth, character and appearance… Development which materially harms the role, function and intrinsic character and beauty of the Green Wedge will not be approved*'. The Green Wedge falls within a localised part of the study area, to the east of Chelmsford and west of the A12.

8.7.5 The study area includes open greenspace, identified by the Ordnance Survey, which illustrates open space such as parks, allotments, churchyards, golf courses and other sports facilities that are likely to be open to the public. Similarly, local plans identify areas of open space, which are incorporated within the Essex Green Infrastructure Strategy (Essex County Council, 2020a). Braintree District Council also identifies green buffers in the emerging Braintree Publication Draft Local Plan Section 2 (Braintree District Council, 2017), including between Witham, Rivenhall and Rivenhall End, to prevent coalescence of built up areas. Whilst identified areas of open space and green buffers are not landscape designations, open space is relevant in terms of informing landscape value, impacts on 'openness' and effects on visual receptors.

8.7.6 Blocks of ancient woodland located within the study area include Toppinghoehall Wood, north-east of Boreham; Sparkey, Mope and Chantry Woods, east of Witham; and Kelvedon Hall Wood, south of Kelvedon. However, there are no areas of ancient woodland within the provisional Order Limits. Trees with Tree Preservation Order status within the study area include some of the trees within the grounds of Boreham House, some of the trees within Hatfield Peverel, Witham and Kelvedon, and scattered specimens within rural areas.

8.7.7 There are veteran, ancient and notable trees (as defined by the Woodland Trust) within the study area. Within the provisional Order Limits, there are three veteran elms, one located south-west of Witham along the B1389, one south of Easthorpe Road and another along the A12 south of Marks Tey. These veteran trees are set within the context of existing highway infrastructure. Arboricultural surveys carried out by Jacobs have identified potential veteran and potential ancient trees that have not been defined by the Woodland Trust.

8.7.8 Pockets of registered common land are also distributed within the study area, although there is no registered common land within the provisional Order Limits.

The Blackwater Rail Trail Country Park runs south from Witham, passing beneath the existing A12. A network of public rights of way (PRoWs) runs throughout the landscape, crossing the existing A12 in places.

8.7.9 Heritage features help inform the sensitivity of the landscape and are relevant to the assessment of landscape and visual effects. As such, a brief summary of key cultural heritage assets relevant to the landscape assessment is described in this section (for a full description of the cultural heritage baseline, refer to Chapter 7: Cultural heritage).

8.7.10 Four registered parks and gardens are located within the study area. Boreham House and New Hall Boreham (both grade II) are both close to the A12 at the western extent of the study area and within 100m of the proposed scheme. A localised part of the northern periphery of Boreham House Registered Park and Garden south of the B1137 Main Road falls within the provisional Order Limits. Hatfield Priory (grade II), south of Hatfield Peverel, is over 500m south of the provisional Order Limits, and Braxted Park (grade II*) is located east of Rivenhall End and over 600m east of the provisional Order Limits. The southern extent of Terling Place registered park and garden (grade II) also lies within the study area, north-west of Hatfield Peverel and over 1km from the provisional Order Limits.

8.7.11 There are numerous conservation areas within the study area, including the Chelmer and Blackwater Navigation, and parts of Boreham, Witham, Kelvedon and Feering. There are several scheduled monuments within the study area, including the Rivenhall End Long Mortuary Enclosure (which is not publicly accessible and is not visible at ground level). Listed buildings are particularly concentrated within the historic core of settlements such as Boreham, Hatfield Peverel, Witham, Little Braxted, Kelvedon, Inworth and Feering. Several isolated listed buildings lie throughout the rural landscape surrounding the existing A12. Some of these, such as Prested Hall and Marks Tey Hall (both grade II listed) to the south of the existing A12 at the eastern extent of the study area, lie within large associated grounds and are accessed by long and distinctive driveways. Protected lanes, identified within local plans as non-designated heritage assets, are located within the study area.

Landscape character

8.7.12 At a local scale, the landscape within Chelmsford, Braintree and Maldon districts has been assessed within the Braintree, Brentwood, Chelmsford, Maldon and Uttlesford Landscape Character Assessment (Chris Blandford Associates, 2006). At the eastern extent of the study area, around Marks Tey, the local landscape is assessed within the Colchester Borough Landscape Character Assessment (Chris Blandford Associates 2005). These published landscape character assessments are informed by historic landscape characterisation. The Environmental Scoping Report (Highways England, 2020d) identified the local LCAs that fall within the study area and defined which would potentially be affected by the proposed scheme. These local LCAs are presented along with their key characteristics (minor typos within original documents corrected) in Table 8.2 and Table 8.3 and are illustrated on Figure 8.2.

Table 8.2 Local landscape character areas (Chelmsford, Braintree, Maldon)

Landscape Character Area	Key characteristics
A7 Lower Chelmer River Valley (potentially directly affected)	• Shallow valley • Predominantly arable farmland on the valley slopes • The Lower Chelmer where it meets the River Blackwater has gentle valley sides • Overall strong sense of place and tranquillity away from Maldon and the A12 and the railway line Whilst not assessed within the publication, the adjoining urban edge of Chelmsford is relevant to the proposed scheme. Key characteristics of the urban edge character were defined within the Environmental Scoping Report (Highways England, 2020d) as follows: • Commercial and industrial area west of the A12 on the eastern periphery of Chelmsford, with large-scale buildings and areas of car parking • Strong vegetation belt between the A12 and eastern edge of Chelmsford restricts intervisibility **Published sensitivity to change: high**
A9 Blackwater River Valley (potentially directly affected)	• Shallow valley • The valley sides slope gently up from the valley floor • Predominantly arable farmland on the valley slopes • The Lower Blackwater near the confluence with the River Chelmer has gentle valley slopes • Overall strong sense of place and tranquillity away from the settlements of Braintree, Witham and Maldon and the A120, A12 and the railway line Whilst not assessed within the publication, the adjoining urban edge of Witham is relevant to the proposed scheme. Key characteristics of the urban edge character were defined within the Environmental Scoping Report (Highways England, 2020d) as follows: • Commercial and industrial area west of the A12 on the eastern periphery of Witham (north of Blackwater Lane and the River Brain), with large-scale buildings and areas of car parking • Southern residential edge of Witham (south of Blackwater Lane and the River Brain), comprising typical twentieth century housing • Strong vegetation belt between the A12 and eastern and southern edges of Witham restricts intervisibility **Sensitivity to change not published**

Landscape Character Area	Key characteristics
Landscape sub-area A9A (potentially directly affected)	• Mixture of arable and pastoral land use on the valley floor • The River Blackwater Valley floor north of the A120 is narrow • The River Blackwater near the confluence with the River Chelmer has a wide flat valley floor Whilst not assessed within the publication, the adjoining urban edge of Witham is relevant to the proposed scheme. Key characteristics of the urban edge character were defined within the Environmental Scoping Report (Highways England, 2020d) as above, under A9. **Sensitivity to change not published**
B17 Terling Farmland Plateau (potentially indirectly affected)	• Rolling arable farmland • Irregular pattern of medium to large-scale fields • Scattered settlement pattern, with frequent small hamlets, typically with greens and ponds • Network of narrow winding lanes • Mostly tranquil away from the A12 and A131 **Published sensitivity to change: moderate**
B18 Silver End Farmland Plateau (potentially indirectly affected)	• Gently undulating farmland • Irregular predominantly large arable fields marked by sinuous hedgerows • Many small woods and copses provide structure and edges in the landscape • Scattered settlement pattern, with frequent small villages • Network of narrow winding lanes • Mostly tranquil character away from the major roads **Published sensitivity to change: moderate to high**
B19 Langley Green Farmland Plateau (potentially directly affected)	• Flat to gently sloping landform • Dominated by large arable fields • Generally gappy and fragmented field boundaries especially adjacent to roads • Settlement pattern consists of small villages with scattered farmsteads amongst predominantly arable land • The houses are predominantly modern constructed from brick • Overall strong sense of place and tranquillity away from the A120, A12 and the railway line **Published sensitivity to change: low to moderate**

Landscape Character Area	Key characteristics
B21 Boreham Farmland Plateau (potentially directly affected)	• Irregular field pattern of mainly medium size arable and pastoral fields, marked by hedgerows, banks and ditches • Small woods and copses provide structure and edges in the landscape • Scattered settlement pattern, with frequent small villages • A concentration of isolated farmsteads • Network of narrow winding lanes **Published sensitivity to change: low to moderate**
F3 Totham Wooded Farmland (potentially directly affected)	• Wooded ridges and hillsides to the east of the River Blackwater • Predominantly agricultural fields enclosed by woodland patches or hedgerows with mature trees • Field boundaries vary; some thickly enclosed, as at Beacon Hill; some more open with gappy hedges • Interest created by colourwashed buildings both in villages and scattered in the landscape **Published sensitivity to change: high**

Table 8.3 Local landscape character areas (Colchester)

Landscape Character Area	Key characteristics (sensitivity to change not published)
A2 Wooded Roman River Valley (potentially indirectly affected)	• Relatively steep and wooded slopes of narrow V-shaped Roman River valley (tributary of the Colne River) • Large areas of deciduous and coniferous (mixed) woodland on the valley slopes (e.g. Donyland Wood, Friday Wood and Chest Wood) • Small patches of ancient woodland on the valley sides • Large regular fields on northern valley slopes with a concentration of smaller irregular fields at High Park Corner • Several areas of historic parkland, often associated with halls, overlooking the valley floor • Views across and within the valley restricted by large woodland areas

Landscape Character Area	Key characteristics (sensitivity to change not published)
A5 Colne River Valley Slopes (potentially indirectly affected)	• Relatively steep V-shaped valley slopes facilitate attractive and open views across and along the river corridor • Principal road network consisting of narrow tree-lined (sometimes sunken) lanes traversing the valley sides to the north and south • A mosaic of medium to large-sized irregular and regular, predominantly arable fields with medium hedgerows containing semi-mature/mature hedgerow trees • Some larger semi-enclosed arable fields to the west of Wakes Colne; and concentrations of smaller fields with intact hedge boundaries adjacent to settlements • Settlement pattern consists of small linear village settlements such as Wakes Colne and Eight Ash Green, adjacent to the north-south roads, which cross the River Valley; and small hamlets and farmsteads
B2 Easthorpe Farmland Plateau (potentially directly affected)	• Raised farmland plateau, dissected by the wooded Roman River valley in the east • A mixture of small, medium and large, irregular, predominantly arable fields • Small patches of deciduous woodland and several ponds/reservoirs • Area crossed by a network of narrow, sometimes winding lanes • Airfield, surrounded by large open fields, has a dominant influence on the landscape character in the south of the character area • Settlement pattern consists of small villages and hamlets with scattered farmsteads amongst predominantly arable agricultural land
Landscape sub-area B2A (potentially directly affected)	• Linear settlement corridor extending from the western edge of Colchester urban area, including the western edges of Stanway, Copford village and Marks Tey in the west • Northern boundary delineated by main A12 and railway corridor which is a dominant visual feature within the character area • Visually dominant major road junctions/roundabouts within the character area • Landscape character is disturbed by the visual movement and noise intrusion of cars on the A12 and also by frequent trains on the main railway line

Landscape Character Area	Key characteristics (sensitivity to change not published)
B3 Southern Colchester Farmland Plateau (potentially indirectly affected)	• An area of sloping farmland plateau (with a mixture of small, medium and large predominantly arable fields) bordered by Colchester settlement fringes to the north and the wooded Roman River Valley to the south • Influence of the military (East Donyland military training area and Middlewick Rifle Ranges) – disturbs tranquillity whilst firing practice is taking place • Several large patches of woodland extend from the northern slopes of the Roman River valley onto the plateau • Several small lakes and ponds within disused sand and gravel works • Character area provides physical and visual separation between Colchester urban area and the Roman River Valley • Fragmented and sometimes chaotic landscape structure with numerous unrelated land uses
B4 Great Tey Farmland Plateau (potentially indirectly affected)	• Gently sloping farmland plateau consisting of a mixture of medium to large-scale enclosed, predominantly arable fields • Linear belts and small patches of predominantly deciduous woodland • Small nucleated settlements and scattered farmsteads • Comprehensive network of footpaths and winding lanes • Peaceful and tranquil atmosphere
F1 Messing Wooded Farmland (potentially directly affected)	• Sparse settlement pattern consisting of the small village of Messing, and a number of small isolated farmsteads • Elevated plateau landform which is situated on a broad ridge and dissected by small streams, providing undulations in topography • Large areas of mixed woodland (for example Layer Wood and Pods Wood). • Number of small ponds and lakes • Single mature trees at field boundaries or standing within fields

8.7.13 Landscape planning and land management guidelines for the local landscape of relevance to the proposed scheme include:

- ensuring new built development is in keeping with landscape character
- conserving the mostly rural character
- conserving and enhancing the landscape setting of settlements
- enhancing the screening of the A12 and the railway line
- conserving and restoring the existing hedgerow pattern
- conserving, managing and enhancing areas of woodland

Perceptual qualities

8.7.14 The Campaign to Protect Rural England (CPRE) has undertaken a study of tranquillity in England and has mapped and published the results. CPRE highlights new roads as one of the greatest threats to remaining levels of tranquillity. The Tranquillity Map for England (CPRE, 2007) identifies tranquillity zones based on sources of noise and visual intrusion and the zones over which intrusion may be felt. Within the study area, Chelmsford urban area is indicated to be one of the least tranquil areas, whilst the rural parts of the study area are indicated to be more tranquil.

8.7.15 The CPRE mapping of England's light pollution and dark skies illustrates the influence of light pollution on the night skies within the study area. The study area is affected by night-time light pollution, especially associated with the urban areas of Chelmsford and Witham, as well as the A12 corridor. The night skies within more rural parts of the study area between key settlements are generally darker. However, there are no dark skies located within the study area, quantified as night skies with lighting levels of less than a quarter pixel.

Visibility and potential visual receptors

8.7.16 The landscape within the study area is generally low-lying and relatively flat, with very gentle undulations. While there are open views across agricultural fields, hedgerows, tree belts and woodlands restrict the distance of such views. Built development also limits the distance of views from within settlements. As such, the range of available views is generally local or middle-distance.

8.7.17 Potential visual receptors within the study area include:

- residents within residential properties on the peripheries of settlements including Boreham, Hatfield Peverel, Witham, Inworth, Rivenhall End, Kelvedon, Feering, Messing, Easthorpe, Marks Tey, Copford Green and Copford
- residents within residential properties scattered throughout the rural landscape
- users of PRoWs including long-distance paths, Sustrans national cycle routes 1 and 16 and regional cycle route 50
- users of public open space, such as the Blackwater Rail Trail Country Park in Witham, Whetmead Local Nature Reserve (east of Whitham) and Brockwell Meadows Local Nature Reserve (Kelvedon)
- users of private open space, such as registered parks and gardens and golf courses
- people at their places of work, such as on the peripheries of Chelmsford and Witham
- users of the road network, including the A12

8.7.18 Representative viewpoints for consideration within this PEIR are presented in Table 8.4 and illustrated on Figure 8.3. Photomontage locations are identified in Table 8.4 for information, although these will be completed for the Environmental Statement based on the final design fix for assessment.

Table 8.4 Viewpoints for assessment

Viewpoint	Justification
Representative viewpoint	
1.	View from New Hall registered park and garden taken from Centenary Circle Long Distance Path towards junction 19 (Boreham interchange)
2.	View west from junction of Main Road, Boreham with Paynes Lane (PRoW). **Proposed photomontage location**
3.	View from the Chelmer and Blackwater Navigation Conservation Area where the Centenary Circle Long Distance Path meets the eastbound towpath (PRoW) looking towards J19 and Boreham House Registered Park and Garden
4.	View to show pinch point at Station Road, Hatfield Peverel
5.	View east from new development towards junction 21 (Witham South interchange)
6.	View from overbridge looking east to show widening and borrow pit in arable field to the right beyond hedgerow
7.	View from residential properties north along Maldon Road towards A12 crossing. **Proposed photomontage location**
8.	View north-east along Blackwater Rail Trail Country Park to show A12 crossing
9.	View west of A12 from Whetmead Local Nature Reserve
10.	View south-west from Little Braxted Lane/National Cycle Route
11.	View north-east across Coleman's Farm Quarry **Proposed photomontage location**
12.	View looking west from Braxted Park Registered Park and Garden over Blackwater Valley towards the A12
13.	View west from Henry Dixon Road/Braxted Road, Rivenhall End
14.	View south-west from residential properties in Cranes Lane, Kelvedon
15.	View south from Ewell Hall Lane/Kelvedon Conservation Area across proposed attenuation pond towards the A12
16.	View south-east from Brockwell Meadows Local Nature Reserve or PRoW along World's End Lane, Kelvedon
17.	View north-west from Inworth Lane (or nearby PRoW), near Inworth Hall (grade II listed) across borrow pit towards the A12
18.	View north-west along Prested Hall drive from PRoW towards the A12.
19.	View west from PRoW, Easthorpe Road
20.	View from PRoW near Easthorpe Green Farm

Viewpoint	Justification
21.	View north from PRoW, Easthorpe village
22.	View south-east from PRoW near Doggets Hammer Farm (grade II listed), Potts Green. **Proposed photomontage location**
23.	View south-east from PRoW at Marks Tey recreation ground
24.	View west from PRoW next to Marks Tey Hall (grade II* listed building)
25.	View north-west from residential area London Road, Marks Tey
26.	View west from new housing Oakwood Meadows, Stanway towards A12 junction 25 (Marks Tey interchange)
27.	View north from PRoW, near Inworth Hall (grade II listed) across borrow pit towards the A12 and junction 24 (Kelvedon North interchange)
28.	View west at junction of PRoW and Easthorpe Road
29.	View north along PRoW towards junction 25
30.	View east along PRoW on periphery of Feering
31.	View south along PRoW on periphery of Feering
32.	View south-west from PRoW on periphery of Prested Hall grounds. **Proposed photomontage location**
Illustrative viewpoint	
A.	View north-west towards junction 19 from PRoW within Chelmer and Blackwater Navigation Conservation Area
B.	View north from PRoW alongside Hatfield Priory Registered Park and Garden
C.	View north-west from PRoW alongside Braxted Park Registered Park and Garden
D.	View south-east from PRoW south of Terling Place Registered Park and Garden.
E.	View north-west from PRoW north of Copford Green Conservation Area

Future baseline

8.7.19 Future development, such as proposed additional phases of the Beaulieu Park development, the Channels development, and Chelmsford North East Bypass Phase 1 (north-east of Chelmsford and within the western extent of the study area) may lead to changes to the baseline environment. The proposed A120 Braintree to A12 scheme, which may tie in with the A12 south-west of Kelvedon, would potentially lead to changes to the baseline environment (although, this is not yet a committed development). Ongoing development of Coleman's Farm Quarry, south-west of Rivenhall End and near junction 22 (Colemans interchange), may also lead to changes to the baseline environment. A proposed country park at Hanson's Bulls Lodge Quarry, north-east of

Chelmsford, defined within the Chelmsford Local Plan (Chelmsford City Council, 2020c) Strategic Growth Site Policy 6 – North East Chelmsford, is situated over 1.4km north of the proposed scheme. Other small to medium-scale developments, such as ongoing developments at Hatfield Peverel, south of Feering and at Stanway, may change the baseline environment.

8.7.20 Future development that has been included within the assessment of landscape and visual effects at this PEIR stage is presented in Section 8.5.

8.7.21 Potential climate effects are considered within Chapter 15: Climate. Future assessment of landscape and visual effects is based on years 1 (opening year) and 15 (design year) during operation, and it is not anticipated that climate change would substantially affect the baseline landscape or the establishment of mitigation planting within this timeframe. However, rising temperatures could potentially affect future vegetation in the longer term both directly through drought or flooding, and indirectly through resilience and susceptibility to pests and disease. Consideration would be given to the use of appropriate species in the event of extreme conditions caused by climate change, such as flooding or drought, at the detailed design stage.

Value and sensitivity of receptors

8.7.22 DMRB LA 107 considers landscape and visual ‘sensitivity’ which incorporates judgements on ‘value’ and ‘susceptibility’. Landscape and visual sensitivity are established by assessing the value attached to a receptor and its susceptibility to the particular form of change likely to result from the individual development.

8.7.23 Local LCAs and representative viewpoints identified for assessment within this PEIR have been assigned a sensitivity based on criteria in DMRB LA 107 and using professional judgement.

8.7.24 Landscape constraints identified within the baseline have been used to inform the value and the overall landscape sensitivity of each local LCA in accordance with DMRB LA 107. It is recognised that localised areas of landscape are of high sensitivity, including registered parks and gardens, the Blackwater Rail Trail Country Park and the proposed country park at Hanson’s Bulls Lodge Quarry, north-east of Chelmsford. These localised areas of high sensitivity have been taken into account when assessing the overall landscape sensitivity of local LCAs.

8.7.25 Table 8.5 and Table 8.6 summarise the value of landscape and visual receptors identified within the study area.

Table 8.5 Value of receptors in the study area for landscape

Value / sensitivity	Description (from DMRB LA 107)	Examples within the study area
Very high	Landscapes of very high international/national importance and rarity or value with no or very limited ability to accommodate change without substantial loss/gain (i.e. national parks, internationally acclaimed landscapes - UNESCO World Heritage Sites).	None of the local LCAs are assessed as being of very high sensitivity
High	Landscapes of high national importance containing distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain (i.e. designated areas, areas of strong sense of place - registered parks and gardens, country parks).	Localised areas of high sensitivity include: • New Hall Boreham Registered Park and Garden • Boreham House Registered Park and Garden • Hatfield Priory Registered Park and Garden • Braxted Park Registered Park and Garden • Terling Place Registered Park and Garden • Blackwater Rail Trail Country Park • Proposed country park at Hanson's Bulls Lodge Quarry, north-east of Chelmsford None of the local LCAs are assessed as being of high sensitivity.

Value / sensitivity	Description (from DMRB LA 107)	Examples within the study area
Medium	Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of conservation, some sense of place or value through use/perception)	The following local LCAs are assessed as being of medium sensitivity: • A2 Wooded Roman River Valley • A5 Colne River Valley Slopes • A7 Lower Chelmer River Valley • A9 Blackwater River Valley • Landscape sub-area A9A • B3 Southern Colchester Farmland • B2 Easthorpe Farmland Plateau • B4 Great Tey Farmland Plateau • B17 Terling Farmland Plateau • B18 Silver End Farmland Plateau • B19 Langley Green Farmland Plateau • B21 Boreham Farmland Plateau • F1 Messing Wooded Farmland • F3 Totham Wooded Farmland Medium sensitivity reflects that there is no national recognition of these landscapes, with the exception of localised heritage assets (including registered parks and gardens and listed buildings) and country parks. Local recognition is evidenced through designation of the Green Wedge and other locally sensitive landscapes such as the Blackwater Valley and conservation areas. Medium sensitivity also reflects the ability to accommodate the nature of the proposed scheme to some extent due to presence of the existing A12 and other existing development within the landscape.

Value / sensitivity	Description (from DMRB LA 107)	Examples within the study area
Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change (i.e. non-designated or designated areas of local recognition or areas of little sense of place).	Landscape sub-area B2A is assessed as being of low sensitivity. Low sensitivity reflects there is no national or local recognition of this landscape, with the exception of heritage assets (listed buildings), and the ability to accommodate the nature of the proposed scheme in the context of the existing A12 and other existing development within the landscape including Marks Tey, Copford and the railway line.
Negligible	Landscapes of very low importance and rarity able to accommodate change.	None of the local LCAs are assessed as being of negligible sensitivity

Table 8.6 Value of visual receptors in the study area

Value / sensitivity	Description	Examples within the study area
Very high	• Static views from and of major tourist attractions • Views from and of very important national/ international landscapes, cultural/historical sites (e.g. National Parks, UNESCO World Heritage sites) • Receptors engaged in specific activities for enjoyment of dark skies	None of the viewpoints are assessed as being of very high sensitivity.

Value / sensitivity	Description	Examples within the study area
High	• Views by users of nationally important PRoW / recreational trails (e.g. national trails, long distance footpaths) • Views by users of public open spaces for enjoyment of the countryside (e.g. country parks) • Static views from dense residential areas, longer transient views from designated public open space, recreational areas • Views from and of rare designated landscapes of national importance	Views from residential properties, users of PRoWs (including long-distance paths and promoted cycle routes), public open space such as Blackwater Rail Trail Country Park, the proposed country park at Hanson's Bulls Lodge Quarry north-east of Chelmsford, local nature reserves, and registered parks and gardens are considered to have high sensitivity. This reflects their high susceptibility to the nature of the proposed scheme and the high value of their views. Visitors to Prested Hall (listed building, wedding venue and hotel) are considered to have high sensitivity given their proximity to the proposed scheme, their high susceptibility to the nature of the proposed scheme and the high value of their views. The following viewpoints are assessed as being of high sensitivity: • Representative viewpoints 1 – 5, 7 – 32, which are representative of views from residential properties, registered parks and gardens, local nature reserves, Blackwater Rail Trail Country Park and from PRoWs including national cycle trails. • Illustrative viewpoints A – E, which account for views from PRoWs.
Medium	• Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas • Views by outdoor workers • Transient views from local/regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance • Views from and of landscapes of regional importance	Views experienced by users of locally identified open space allocations associated with schools and other institutional buildings, such as school playing fields and playgrounds. This reflects their medium susceptibility to the nature of the proposed scheme due to the generally urban context of these spaces and/or the medium value of their views due to the recreational amenity value of these spaces. Transient views experienced by users of rural roads formally recognised by planning policy to be of landscape value, such as those defined as having 'protected lane' status where this is partially underpinned by landscape value. This reflects their medium susceptibility to the nature of the proposed scheme and the medium value of their views, due to the landscape and historic value attached to these lanes. None of the viewpoints are assessed as being of medium sensitivity.

Value / sensitivity	Description	Examples within the study area
Low	• Views by users of main roads or passengers in public transport on main arterial routes • Views by indoor workers • Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport • Views by users of local public open spaces of limited importance with limited variety or distinctiveness	Transient views experienced by users of the A12 as well as minor roads within the local road network, are considered to have low sensitivity to the proposed scheme. This reflects their low susceptibility to the nature of the proposed scheme due to the relatively fleeting views from roads, and their low to medium value of views. Views experienced by users of locally identified open space allocations such as sports facilities are considered to have low sensitivity, reflecting their low susceptibility to the nature of the proposed scheme and low value of views, due to their urban context and/or views being secondary to enjoyment of the sports. Views experienced by indoor workers are considered to have low sensitivity, reflecting their low susceptibility to the nature of the proposed scheme and low value of views, due to views being secondary to their purpose at work. Representative viewpoint 6 is assessed as being of low sensitivity because it is representative of views from users of a public highway, which is not formally recognised by planning policy to be of landscape value.
Negligible	• Quick transient views such as from fast-moving vehicles • Views from industrial areas or land awaiting redevelopment • Views from landscapes of no importance with no variety or distinctiveness	Transient views experienced by railway travellers have negligible sensitivity, reflecting their negligible susceptibility to the nature of the proposed scheme and negligible value of views, due to views being transient and partly in the context of urban areas and the existing A12. Views experienced by indoor workers and visitors to commercial and industrial areas on the eastern periphery of Chelmsford (west of junction 19) and on the eastern edge of Witham (south and west of junction 22) have negligible sensitivity, reflecting their negligible susceptibility to the nature of the proposed scheme and negligible value of views, due to their urban context and views being secondary to the purpose of work/visiting commercial and industrial areas. None of the viewpoints are assessed as being of negligible sensitivity.

8.8 Potential impacts

Construction

8.8.1 The potential temporary landscape and visual impacts during construction are likely to be associated with:

- construction of the proposed scheme, including construction of the offline bypasses, widening of the existing A12, new and improved junctions, overbridges for realigned local roads and walkers, cyclists and horse riders, retaining walls, cuttings, embankments, attenuation ponds and access tracks
- movement of construction plant and delivery vehicles
- excavation and earthworks across extensive areas in association with borrow pit construction
- contractors' compounds
- vehicle haul routes
- any temporary lighting and signage needed for the works
- stockpiled soil and materials
- loss of vegetation to facilitate construction, including vegetation removal associated with widening the existing A12

8.8.2 Construction activity would be phased, therefore potential landscape and visual impacts would not necessarily occur simultaneously. Further details relating to construction activity, including information relating to the construction programme and phasing, is included within Chapter 2: The scheme. Programme and phasing details will be refined and included within the Environmental Statement and Environmental Management Plan.

Operation

8.8.3 The proposed scheme has the potential to increase the prominence of major highway infrastructure within the landscape, particularly as extensive established vegetation that helps to integrate the existing A12 into the landscape is likely to be removed along the online sections. The scale of the infrastructure, including major new and improved junctions, and the elevated position of some elements would be at odds with the scale and character of the surrounding landscape. The offline bypasses and major junctions are likely to have particularly adverse effects on landscape character and quality, with a loss of vegetation, disruption to field pattern and reduced tranquillity. Borrow pits would also potentially cause vegetation loss, changes to land use and landscape character.

8.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

8.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

8.9.2 Embedded mitigation relevant to this aspect aims to integrate the road into the local context and minimise the impact of the proposed scheme on the landscape in line with DMRB LD 117 Landscape Design (Highways England, 2020f). Embedded mitigation relevant to this aspect includes:

- Alignment of the proposed scheme and location of junctions and borrow pits designed to reduce landscape and visual effects
- Junctions designed to reduce the effects on landform, retain vegetation, field pattern, and landscape features; and reduce the effects on views
- Careful design of major structures, signage and gantries to limit visual intrusion and to help integrate these into the wider landscape
- Refinement of the design of earthworks to create natural gradients and slopes that achieve better integration with the surrounding landform, where space and material are available
- Sensitive design of borrow pits and attenuation ponds, to integrate these features into the landscape and reduce visual intrusion
- Sensitive location of main road signs to limit visual intrusion within the landscape
- Integration of roadside barriers, fences and retaining walls within the landscape
- Use of sensitive lighting design such as the use of horizontally mounted flat glass lanterns, the use of modern dimmable light-emitting diodes (LEDs) with cut-off properties, together with dynamic systems of operation to provide the minimum amount of light required at different times
- Planting to reduce adverse landscape and visual effects, including native hedgerows, shrubs and trees. Consideration of the species, pattern and distribution of proposed hedgerows, shrubs and trees along the proposed scheme to reflect the distinctive local character of vegetation within the adjacent landscape and provide screening for visual receptors
- Dense native tree and shrub planting on and adjacent to highway earthworks to create woodlands, copses and shelterbelts in order to break up the scale of the road, screen structures, traffic, and lighting and help integrate the proposed scheme into the existing landscape pattern

- Support green infrastructure objectives through use of planting to link into existing field boundary vegetation to provide screening and integration into the local pattern and character, as well as connection of existing wildlife corridors
- Use of locally indigenous native and non-native plants as appropriate to reflect the distinctive local character, such as the replication of willow plantation on valley floors, and parkland and avenue planting near registered parks and gardens
- Consideration of balance between screening the proposed scheme, and retention of views out from the highway through breaks in the planting to help create a sense of place and stimulating visual experience for road users where practicable

8.9.3 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

8.9.4 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect include:

- Topsoil and subsoil to be stripped from temporary works areas such as sites proposed for construction compounds and areas allocated for the stockpiling of materials. Where practicable, stripped soil to be stored in bunds around the perimeter of the temporary works and construction areas to provide temporary screening
- The type and form of site security fencing near large construction compounds, proposed structures and listed buildings would be considered, where practicable, to provide an additional temporary screening function.
- Existing vegetation within the proposed scheme boundary and within temporary works areas would be retained as far as practicable. Particular attention would be given to the retention of mature vegetation including specimen trees and woodlands
- All trees to be retained would be protected throughout the construction period in accordance with BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations
- Where it would be necessary to remove trees or hedgerows within temporary works areas, such as construction compounds, haul routes and regrading areas, these would be replanted on completion of construction and the areas would be restored and returned to their original uses wherever practicable and appropriate, including the ripping, minor regrading and re-spreading of topsoil

- No topsoil to be incorporated within new grassland areas to create low nutrient grassland and increase local biodiversity where reasonably practicable
- Temporary lighting required to ensure safe working conditions and to maintain security during construction would be kept to a minimum and have sharp cut-off properties to reduce light spill as far as practicable. Night-time working to be kept to a minimum as far as reasonably practicable.

8.9.5 Standard mitigation will be included in a first iteration of the Environmental Management Plan which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5: Environmental assessment methodology). The Landscape and Ecological Management Plan (LEMP) will present how the landscape and ecological mitigation would be reinstated and maintained. This will be submitted in outline at DCO and detailed prior to construction.

Additional mitigation

8.9.6 Within this PEIR, landscape and visual mitigation is categorised as embedded or standard. Requirements for additional mitigation will be considered during the progression of the proposed scheme preliminary design.

Enhancement

8.9.7 Opportunities for enhancement will be explored, such as the potential to connect with wider environmental initiatives, for example the Essex Green Infrastructure Strategy (Essex County Council, 2020a).

8.10 Assessment of likely significant effects

Construction

Landscape effects

8.10.1 Standard mitigation would be applied during construction. It is likely that there would be significant landscape effects on the following local LCAs (identified on Figure 8.2) during construction, which have been assessed as being of medium sensitivity:

- A7 Lower Chelmer River Valley
- A9 Blackwater River Valley
- Landscape sub-area A9A
- B19 Langley Green Farmland Plateau
- B21 Boreham Farmland Plateau
- F3 Totham Wooded Farmland
- B2 Easthorpe Farmland Plateau
- F1 Messing Wooded Farmland

8.10.2 These local LCAs would be directly affected by construction activity, including the presence of construction compounds and haul routes, movement of construction plant, removal of vegetation, excavation of borrow pits, attenuation ponds and flood compensation areas, and construction of access tracks. Major construction works would occur within these areas, such as the excavation of borrow pits and major earthworks associated with the construction of and improvements to junctions, construction of the offline bypasses, online widening, the construction of overbridges and works on the existing A12 including de-trunking, roundabouts and where the new construction ties-in with existing roads and features. The physical disruption and the presence of numerous uncharacteristic elements within these local LCAs would cause significant damage to the existing landscape character and affect tranquillity during construction.

8.10.3 Whilst landscape sub-area B2A would also be directly affected by construction activity, it has been assessed as being of low sensitivity. Combined with construction works (and the operational scheme) being set within the context of the transport corridor containing the A12 and the Great Eastern Main Line (GEML) railway line and the largely urban surrounding environment, the overall landscape effects during construction (and operation) are unlikely to be significant.

8.10.4 It is unlikely that there would be significant landscape effects during construction (and operation) on the remaining local LCAs identified within Table 8.2 and Table 8.3, which have been assessed as being of medium sensitivity. These local LCAs are located outside the provisional Order Limits and would not be directly affected by the proposed scheme. Intervening features such as vegetation, including field boundary vegetation, and vegetation along the GEML which runs to the north of the A12, and built development such as within Eight Ash Green and along London Road, Copford, would restrict inter-visibility between the proposed scheme and these local LCAs.

8.10.5 Table 8.7 summarises the likely significance of landscape effects on each local LCA during construction.

Table 8.7 Likely landscape effects during construction

Local landscape character area	Likely landscape effects during construction
A7 Lower Chelmer River Valley (directly affected)	Significant
A9 Blackwater River Valley (directly affected)	Significant
Landscape sub-area A9A (directly affected)	Significant
B17 Terling Farmland Plateau (indirectly affected)	Not significant
B18 Silver End Farmland Plateau (indirectly affected)	Not significant
B19 Langley Green Farmland Plateau (directly affected)	Significant
B21 Boreham Farmland Plateau (directly affected)	Significant

Local landscape character area	Likely landscape effects during construction
F3 Totham Wooded Farmland (directly affected)	Significant
A2 Wooded Roman River Valley (indirectly affected)	Not significant
A5 Colne River Valley Slopes (indirectly affected)	Not significant
B2 Easthorpe Farmland Plateau (directly affected)	Significant
Landscape sub-area B2A (directly affected)	Not significant
B3 Southern Colchester Farmland Plateau (indirectly affected)	Not significant
B4 Great Tey Farmland Plateau (indirectly affected)	Not significant
F1 Messing Wooded Farmland (directly affected)	Significant

Visual effects

8.10.6 Standard mitigation would be applied during construction. Whilst construction activity would largely be set within the context of the existing A12 infrastructure, the presence of construction elements such as construction compounds, temporary lighting, major earthworks for the construction of junctions, bypasses, overbridges and online widening, the movement of construction plant on haul routes, extensive extraction for borrow pits and attenuation ponds and removal of vegetation, would be dominant in open views within close proximity of the proposed scheme.

8.10.7 It is likely that there would be significant effects for visual receptors at the majority of the representative viewpoints during construction because the viewpoints have been selected to focus on highly sensitive visual receptors and/or those which would experience the most change in view as a result of the proposed scheme.

8.10.8 It is unlikely that there would be significant effects during construction (and operation) for visual receptors at representative viewpoints 1, 12, 21, 26 and 31. These viewpoints are slightly further away from the proposed scheme, and/or intervening vegetation would likely restrict the extent of visibility between the receptors and the proposed scheme. It is also unlikely that there would be significant effects during construction (and operation) for visual receptors at representative viewpoint 25, because views would be restricted by intervening built development, and construction activity (and the operational scheme) would be set within the context of existing highway infrastructure as well as the surrounding urban environment.

8.10.9 It is unlikely that visual receptors beyond 1km of the proposed scheme would experience significant visual effects due to the distant nature of the views combined with intervening features such as topography, vegetation and built development. It is therefore unlikely that there would be significant effects for visual receptors at longer distance illustrative viewpoints A – E during construction (and operation).

8.10.10 Table 8.8 summarises the likely significance of visual effects on each representative viewpoint during construction.

Table 8.8 Likely visual effects during construction

Viewpoint	Likely visual effects during construction
Representative viewpoint	
1. View from New Hall Registered Park and Garden taken from Centenary Circle Long Distance Path towards J19	Not significant
2. View west from junction of Main Road, Boreham with Paynes Lane (PRoW)	Significant
3. View from the Chelmer and Blackwater Navigation Conservation Area where the Centenary Circle Long Distance Path meets the eastbound towpath (PRoW) looking towards J19 and Boreham House Registered Park and Garden	Significant
4. View to show pinch point at Station Road, Hatfield Peverel	Significant
5. View east from new development towards J21	Significant
6. View from overbridge looking east to show widening and borrow pit in arable field to the right beyond hedgerow	Significant
7. View from residential properties north along Maldon Road towards the A12 crossing	Significant
8. View north-east along Blackwater Rail Trail Country Park to show the A12 crossing	Significant
9. View west of the A12 from Whetmead Local Nature Reserve	Significant
10. View south-west from Little Braxted Lane/National Cycle Route	Significant
11. View north-east across Coleman's Farm Quarry	Significant
12. View looking west from Braxted Park Registered Park and Garden over Blackwater Valley towards the A12	Not significant
13. View west from Henry Dixon Road/Braxted Road, Rivenhall End	Significant
14. View south-west from residential properties in Cranes Lane, Kelvedon	Significant
15. View south from Ewell Hall Lane/Kelvedon Conservation Area across proposed attenuation pond towards the A12	Significant
16. View south-east from Brockwell Meadows Local Nature Reserve or PRoW along World's End Lane, Kelvedon	Significant
17. View north-west from Inworth Lane (or nearby PRoW), near Inworth Hall (grade II listed) across borrow pit towards the A12	Significant
18. View north-west along Prested Hall drive from PRoW towards the A12	Significant
19. View west from PRoW, Easthorpe Road	Significant

Viewpoint	Likely visual effects during construction
20. View from PRoW near Easthorpe Green Farm	Significant
21. View north from PRoW, Easthorpe village	Not significant
22. View south-east from PRoW near Doggets Hammer Farm (grade II listed), Potts Green	Significant
23. View south-east from PRoW at Marks Tey recreation ground	Significant
24. View west from PRoW next to Marks Tey Hall (grade II* listed building).	Significant
25. View north-west from residential area London Road, Marks Tey	Not significant
26. View west from new housing Oakwood Meadows, Stanway towards A12 J25	Not significant
27. View north from PRoW, near Inworth Hall (grade II listed) across borrow pit towards the A12 and J24	Significant
28. View west at junction of PRoW and Easthorpe Road	Significant
29. View north along PRoW towards J25	Significant
30. View east along PRoW on periphery of Feering	Significant
31. View south along PRoW on periphery of Feering	Not significant
32. View south-west from PRoW on periphery of Prested Hall grounds	Significant
Illustrative viewpoint	
A. View north-west towards J19 from PRoW within Chelmer and Blackwater Navigation Conservation Area	Not significant
B. View north from PRoW alongside Hatfield Priory Registered Park and Garden	Not significant
C. View north-west from PRoW alongside Braxted Park Registered Park and Garden	Not significant
D. View south-east from PRoW south of Terling Place Registered Park and Garden	Not significant
E. View north-west from PRoW north of Copford Green Conservation Area	Not significant

Operation

Landscape impacts

Winter year 1

8.10.11 During operation in winter year 1, mitigation planting would be unestablished and ineffective in terms of reinstating the landscape and integrating the proposed scheme into the landscape. It is likely that there would be significant landscape effects on the following local LCAs of medium sensitivity during operation in winter year 1:

- A9 Blackwater River Valley
- Landscape sub-area A9A
- B19 Langley Green Farmland Plateau
- B21 Boreham Farmland Plateau
- F3 Totham Wooded Farmland
- B2 Easthorpe Farmland Plateau
- F1 Messing Wooded Farmland

8.10.12 Major new structures or borrow pits would be located within these local LCAs, including newly-lit junctions 21, 22 and 24, the bypasses between junctions 22 and 23 and junctions 24 and 25, and overbridges, as well as roundabouts and tie-ins on de-trunked sections of the existing A12. These structures would increase the extent of highway infrastructure and encroach on the surrounding landscape, as well as affecting land use, field pattern and tranquillity. Where elevated, structures would be at odds with the relatively flat and low-lying valley landscapes. Where present, borrow pits and/or flood compensation areas would cause large scale change to the character of the landscape. The presence of uncharacteristic elements within these local LCAs would cause significant damage to the existing landscape character during operation in winter year 1.

8.10.13 It is unlikely that there would be significant effects during operation in winter year 1 on local LCAs B17, B18, A2, A5, landscape sub-area B2A, B3 and B4 for the reasons described in the construction effects section. It is also unlikely that there would be significant effects during operation in winter year 1 on A7 Lower Chelmer River Valley.

8.10.14 Vegetation removed to accommodate online widening within A7 Lower Chelmer River Valley would exacerbate the prominence of the A12 corridor and traffic flow within the landscape. However, the proposed scheme would be set within the context of the existing A12 and the attenuation ponds would not be out of character within the low-lying Chelmer River Valley. It is therefore unlikely that landscape effects on A7 Lower Chelmer River Valley would be significant during operation in winter year 1.

Summer year 15

8.10.15 In summer year 15, mitigation planting would have established, to help integrate the proposed scheme into the landscape. Established mitigation planting in summer year 15 would likely reduce the significance of effects within the affected local LCAs.

8.10.16 It is likely that there would be residual significant landscape effects in summer year 15 on the following local LCAs:

- A9 Blackwater River Valley
- Landscape sub-area A9A
- B19 Langley Green Farmland Plateau
- B21 Boreham Farmland Plateau

- B2 Easthorpe Farmland Plateau
- F1 Messing Wooded Farmland

8.10.17 Whilst established mitigation planting would reduce effects, the presence of major structures would cause a permanent increase in the extent of highway infrastructure and encroach on the surrounding landscape, as well as affecting land use, field pattern and tranquillity. Lighting at junctions 21, 22 and 24 and headlights on the offline bypasses would exacerbate the prominence of highway infrastructure at night-time. Where elevated, structures would continue to be at odds with the relatively flat and low-lying valley landscapes, and the presence of uncharacteristic elements within these local LCAs would cause significant damage to the existing landscape character during operation in summer year 15.

8.10.18 The proposed scheme within F3 Totham Wooded Farmland would largely comprise a reinstated borrow pit and flood compensation areas. Once established, reinstatement vegetation would help to integrate the borrow pit and flood compensation areas into the surrounding landscape and it is unlikely that landscape effects on F3 Totham Wooded Farmland would be significant during operation in summer year 15.

8.10.19 Consistent with the likely landscape effects during winter year 1, it is also unlikely that landscape effects on all other local LCAs would be significant in summer year 15.

8.10.20 Table 8.9 summarises the likely significance of landscape effects on each local LCA during operation in winter year 1 and summer year 15.

Table 8.9 Likely landscape effects during operation

Local landscape character area	Likely landscape effects during operation in winter year 1 and summer year 15
A7 Lower Chelmer River Valley (directly affected)	Not significant
A9 Blackwater River Valley (directly affected)	Significant
Landscape sub-area A9A (directly affected)	Significant
B17 Terling Farmland Plateau (indirectly affected)	Not significant
B18 Silver End Farmland Plateau (indirectly affected)	Not significant
B19 Langley Green Farmland Plateau (directly affected)	Significant
B21 Boreham Farmland Plateau (directly affected)	Significant
F3 Totham Wooded Farmland (directly affected)	Winter year 1: Significant Summer year 15: Not significant
A2 Wooded Roman River Valley (indirectly affected)	Not significant

Local landscape character area	Likely landscape effects during operation in winter year 1 and summer year 15
A5 Colne River Valley Slopes (indirectly affected)	Not significant
B2 Easthorpe Farmland Plateau (directly affected)	Significant
Landscape sub-area B2A (directly affected)	Not significant
B3 Southern Colchester Farmland Plateau (indirectly affected)	Not significant
B4 Great Tey Farmland Plateau (indirectly affected)	Not significant
F1 Messing Wooded Farmland (directly affected)	Significant

Visual impacts

Winter year 1

8.10.21 During operation in winter year 1, mitigation planting would be unestablished and ineffective in terms of reinstating the landscape, integrating the proposed scheme into the landscape and providing visual screening.

8.10.22 Whilst the proposed scheme would largely be set within the context of the existing A12, vegetation loss would exacerbate the visual prominence of the new and existing highway infrastructure, including day and night-time effects from lighting, headlights and signage, as well as disruption from traffic flow. The extent of highway infrastructure would be increased and major new structures, such as new and improved junctions, the offline bypasses and realigned overbridges, would be prominent within the relatively flat and low-lying landscape, particularly where raised above ground level. Proposed scheme elements within the broader landscape surrounding the A12, including excavated borrow pits, flood compensation areas, attenuation ponds and access tracks, would also affect views.

8.10.23 It is likely that there would be significant visual effects during operation in winter year 1 for visual receptors at the majority of the representative viewpoints, because the viewpoints have been selected to focus on highly sensitive visual receptors and/or those which would experience the most change in view as a result of the proposed scheme.

8.10.24 It is unlikely that there would be significant effects during operation in winter year 1 for visual receptors at representative viewpoints 1, 12, 21, 25, 26 and 31, and illustrative viewpoints A – E, for the reasons described in the construction effects section. It is also unlikely that there would be significant effects during operation in winter year 1 for visual receptors at representative viewpoint 6. This is because road users are assessed to be of low sensitivity and the widened A12 would be viewed in the context of the existing A12.

Summer year 15

8.10.25 In summer year 15, mitigation planting would have established to help integrate the proposed scheme into the landscape and to help filter and screen views of the highway corridor, major new and improved junctions, the offline bypasses and realigned overbridges, borrow pits, flood compensation areas, attenuation ponds and access tracks. Established mitigation planting in summer year 15 would likely reduce the significance of effects at the majority of representative viewpoints.

8.10.26 It is likely that there would be residual significant visual effects in summer year 15 for visual receptors at representative viewpoints that are in very close proximity to the proposed scheme and where the presence of major new structures or borrow pits would remain a prominent feature of the view, or significantly change the character of the view, despite established mitigation planting.

8.10.27 However, it is unlikely that visual effects would be significant for visual receptors at the majority of the identified viewpoints in summer year 15, because of the effectiveness of established mitigation planting combined with other surrounding vegetation when in leaf.

8.10.28 Table 8.10 summarises the likely significance of visual effects on each representative viewpoint during operation in winter year 1 and summer year 15.

Table 8.10 Likely visual effects during operation

Viewpoint	Likely visual effects during operation in winter year 1	Likely visual effects during operation in summer year 15
Representative viewpoint		
1. View from New Hall Registered Park and Garden taken from Centenary Circle Long Distance Path towards J19	Not significant	Not significant
2. View west from junction of Main Road, Boreham with Paynes Lane (PRoW)	Significant	Not significant
3. View from the Chelmer and Blackwater Navigation Conservation Area where the Centenary Circle Long Distance Path meets the eastbound towpath (PRoW) looking towards J19 and Boreham House Registered Park and Garden	Significant	Not significant
4. View to show pinch point at Station Road, Hatfield Peverel	Significant	Not significant
5. View east from new development towards J21	Significant	Significant
6. View from overbridge looking east to show widening and borrow pit in arable field to the right beyond hedgerow	Not significant	Not significant

Viewpoint	Likely visual effects during operation in winter year 1	Likely visual effects during operation in summer year 15
7. View from residential properties north along Maldon Road towards the A12 crossing	Significant	Not significant
8. View north-east along Blackwater Rail Trail Country Park to show the A12 crossing	Significant	Not significant
9. View west of the A12 from Whetmead Local Nature Reserve	Significant	Not significant
10. View south-west from Little Braxted Lane/National Cycle Route	Significant	Significant
11. View north-east across Coleman's Farm Quarry	Significant	Significant
12. View looking west from Braxted Park Registered Park and Garden over Blackwater Valley towards the A12	Not significant	Not significant
13. View west from Henry Dixon Road/Braxted Road, Rivenhall End	Significant	Significant
14. View south-west from residential properties in Cranes Lane, Kelvedon	Significant	Not significant
15. View south from Ewell Hall Lane/Kelvedon Conservation Area across proposed attenuation pond towards the A12	Significant	Not significant
16. View south-east from Brockwell Meadows Local Nature Reserve or PRoW along World's End Lane, Kelvedon	Significant	Not significant
17. View north-west from Inworth Lane (or nearby PRoW), near Inworth Hall (grade II listed) across borrow pit towards the A12	Significant	Significant
18. View north-west along Prested Hall drive from PRoW towards the A12	Significant	Significant
19. View west from PRoW, Easthorpe Road	Significant	Not significant
20. View from PRoW near Easthorpe Green Farm	Significant	Not significant
21. View north from PRoW, Easthorpe village	Not significant	Not significant
22. View south-east from PRoW near Doggets Hammer Farm (grade II listed), Potts Green	Significant	Significant
23. View south-east from PRoW at Marks Tey recreation ground	Significant	Not significant
24. View west from PRoW next to Marks Tey Hall (grade II* listed building)	Significant	Significant

Viewpoint	Likely visual effects during operation in winter year 1	Likely visual effects during operation in summer year 15
25. View north-west from residential area London Road, Marks Tey	Not significant	Not significant
26. View west from new housing Oakwood Meadows, Stanway towards A12 J25	Not significant	Not significant
27. View north from PRoW, near Inworth Hall (grade II listed) across borrow pit towards the A12 and J24	Significant	Significant
28. View west at junction of PRoW and Easthorpe Road	Significant	Not significant
29. View north along PRoW towards J25	Significant	Not significant
30. View east along PRoW on periphery of Feering	Significant	Not significant
31. View south along PRoW on periphery of Feering	Not significant	Not significant
32. View south-west from PRoW on periphery of Prested Hall grounds	Significant	Significant
Illustrative viewpoint		
A. View north-west towards J19 from PRoW within Chelmer and Blackwater Navigation Conservation Area	Not significant	Not significant
B. View north from PRoW alongside Hatfield Priory Registered Park and Garden	Not significant	Not significant
C. View north-west from PRoW alongside Braxted Park Registered Park and Garden	Not significant	Not significant
D. View south-east from PRoW south of Terling Place Registered Park and Garden	Not significant	Not significant
E. View north-west from PRoW north of Copford Green Conservation Area	Not significant	Not significant

9 Biodiversity

9.1 Topic introduction

9.1.1 This chapter presents the preliminary environmental information relating to biodiversity for the proposed scheme.

9.1.2 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 comprise. In addition, biodiversity is the subject of a wide variety of legislation and policies; impacts to ecological receptors could constitute an offence under relevant legislation as well as comprising material considerations within the planning system.

9.1.3 This assessment comprises the following biodiversity matters:

- 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), Local Nature Reserves (LNRs), 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

9.1.4 This chapter is supported by the following figures (see Appendix A):

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

9.2 Stakeholder engagement

9.2.1 Details of stakeholder engagement undertaken as part of this assessment are shown in Table 9.1.

Table 9.1 Stakeholder engagement for biodiversity aspect

Stakeholder	Details
Natural England	Informal call 27/01/2020 • Call to discuss the district level licensing 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 and programme and summarise the findings of ecological assessments undertaken. Natural England confirmed the broad suitability of assessment and survey approach. A full written summary of methods, including any deviations from best practice, was issued to Natural England for review. • Additional information on the district level licensing approach was requested from Natural England (to be provided once developed). • Natural England advised that the Habitats Regulations Assessment should also 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 findings of surveys completed 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. • Natural England provided advice on monitoring an otter *Lutra lutra* holt to determine likely impacts. • Natural England submitted comments on the proposed survey methodologies. Key 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 16/02/2021 • Summarised findings of survey data analysis completed since the previous meeting. • Discussed key outcomes of the assessment to be reported in this Preliminary Environmental Information Report (PEIR). • Discussed Natural England's scoping opinion comments. • Further discussion on options for badger artificial sett locations. Further assessment will be undertaken in early 2021 to identify the most suitable locations. • Requested input to proposed river realignments and Natural England confirmed that there were no specific comments.
Essex Wildlife Trust	Meeting undertaken 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 Local Nature Reserve (LNR). • Presented 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 hazel dormice to the south of junction 19 – Boreham interchange. However, there is limited connectivity between recorded hazel dormouse population to the south of this junction and the proposed scheme. • A further meeting was planned to discuss mitigation relating to water voles *Arvicola amphibius*.
Essex Wildlife Trust	Meeting undertaken 25/02/2021 • Summarised findings of surveys completed since the previous meeting and key ecological issues. • Discussed water voles, including options for enhancements within the proposed scheme and surrounds, as well as any other potential improvements which the scheme could work with Essex Wildlife Trust to deliver. • The proposed scheme will investigate opportunities for enhancement.

Stakeholder	Details
Environment Agency	Meeting undertaken 19/01/2021 • Geomorphology and water quality specialists introduced aspects of the Environmental Impact Assessment in relation to the Water Framework Directive. It was agreed to arrange a follow up meeting to discuss aquatic ecology.
Environment Agency	Meeting undertaken 10/02/2021 • Presented findings of baseline surveys undertaken in 2020. The Environment Agency agreed with the baseline survey findings and agreed that white-clawed crayfish 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 biodiversity net gain 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, and where the latter are used justification should be provided.
Essex County Council	Meeting undertaken 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	PEIR warm-up session to present key findings of the PEIR to local planning authorities.

9.2.2 Table 9.2 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021).

Table 9.2 Key stakeholder feedback for biodiversity aspect

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, and sufficient evidence for this will be provided within the Environmental Statement.
Planning Inspectorate	Dormice can be scoped out of the Environmental Statement provided that sufficient evidence is provided to support this decision.	Dormice have been scoped out of the Environmental Statement.

Stakeholder	Comment	Response
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 age of baseline data from statutory consultees will be documented within the Environmental Statement.
Planning Inspectorate	The proposed scheme's provisional 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 which should be detailed within the Environmental Statement and secured through the Development Consent Order (DCO).	The Environmental Statement will include an explanation as to why it is necessary for the proposed scheme's Order Limits to encroach on and border LNR and LWS sites. The Environmental Statement will describe mitigation measures in detail, alongside evidence of agreement by relevant stakeholders and confirmation on how the mitigation will be secured.
Planning Inspectorate	The Environmental Statement should state specific locations and details of mitigation in order to assist with assessment of effectiveness.	Specific mitigation details for all receptors will be included in the Environmental Statement.
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.	The Environmental Statement will include an assessment of impacts from river realignments and evidence of consultation with stakeholders.
Planning Inspectorate	Any translocation of animals from the site should be described in the Environmental Statement including any identified receptor sites.	The Environmental Statement will describe activities related to reptile translocations and details of any receptor site locations.
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 lead contractor following consultation with stakeholders to reach an agreement on the approach. The ISMP will follow Department for Environment, Food and Rural Affairs (Defra) guidance, stating any risks associated with removal of Invasive Non-Native Species (INNS), and the Environmental Statement will describe how this is to be secured.

Stakeholder	Comment	Response
Environment Agency	Existing A12 infrastructure should be improved where possible to mitigate impacts to aquatic ecology as a result of unsympathetic design.	New culverts will be designed to allow safe passage by wildlife under all flow conditions. Assessments will be undertaken to determine options for improving culverts on the existing A12 where they will not be modified as part of the proposed scheme.
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.	New culverts will be designed to allow safe passage by wildlife under all flow conditions.
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 will be used to assess impacts to watercourses and develop mitigation and enhancement measures.
Environment Agency	Attenuation ponds should be designed to be wildlife-friendly, for example with shallow margins and marginal vegetation.	Attenuation ponds will be designed in a manner sympathetic to wildlife.
Environment Agency	Lighting design should be designed to prevent light pollution.	Lighting will be designed following standard mitigation guidelines to prevent light pollution.
Environment Agency	SSSIs with connectivity to the proposed scheme through hydrology should be considered in the assessment.	An assessment of SSSIs with connectivity to the proposed scheme through hydrology is included in this PEIR.
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 is achieved.	The Defra 2.0 metric is being applied to the proposed scheme. Net loss or gain figures will be summarised within the Environmental Statement; a separate net loss or gain report will be provided with the DCO application and the scheme will be seeking to secure net gains for biodiversity. It is noted that Essex County Council wishes to see like-for-like replacement of priority habitats. Principles of habitat creation have been provided within this PEIR and are shown on the Preliminary Environmental Masterplan (Figure 2.1). Detailed information will be documented within the Environmental Statement.

Stakeholder	Comment	Response
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 will be discussed with Essex County Council during forthcoming stakeholder meetings to gain agreement on what is proposed. It has been assumed 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 dormice survey methodology including habitat assessments and results will be documented in the dormouse technical report and provided to Essex County Council for review prior to submission of the Environmental Statement. Evidence of consultation and any agreement to scope out dormice will be recorded in the Environmental Statement.
Essex County Council	Deviation from the Bat Conservation Trust guidelines 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 a proposed scheme. There is a need for sufficient survey and assessment on bats and trees affected by the scheme. It needs to be evidence-led and therefore may not be appropriate for this scheme.	Applicant is confident that the data obtained will be sufficient to support a ghost European protected species mitigation (EPSM) licence for bats (and proposes to update that 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. Further discussions on the survey methodology will be held with Essex County Council in meetings prior to the submission of the Environmental Statement. Evidence of the consultation and any agreement will be provided within the Environmental Statement.

Stakeholder	Comment	Response
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 and Colne and Blackwater Estuaries SAC from both the construction works and the increased traffic use once the road is operational.	Impacts to the Essex Estuaries, Colne and Blackwater Estuaries will be fully assessed within the Habitats Regulations Assessment. Traffic modelling data will be used to assess changes in air pollution at these sites (see Chapter 6: Air quality). A comprehensive assessment will then be made on the likely impacts based on these results. Results of the assessment will be provided to Natural England in advance of DCO submission.
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.	The scheme will be seeking to secure net gains for biodiversity. Net loss or gain figures will be calculated using Defra 2.0 and summarised within the Environmental Statement; and a separate net loss or gain report will accompany the DCO application.
Braintree District Council	The Environmental Scoping Report sets out a range of potential ecological mitigation measures. The Council is in agreement that biodiversity mitigation and enhancement measures are of key 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.	The general principles of mitigation have been described in this PEIR. Details of mitigation and enhancement measures including location, justification and long-term management strategies will be included in the Environmental Statement.

Stakeholder	Comment	Response
Braintree District Council	The Environmental Scoping Report makes specific mention of tree and hedgerow planting to create linear habitats and provide new connectivity between existing green habitat areas. The 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.	Detailed information on the creation of linear habitats will be included in the Environmental Statement, and biodiversity across the scheme will be quantified using Defra 2.0.

9.2.3 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft DCO, will be included within the Environmental Statement.

9.3 Legislative and policy framework

9.3.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIPs) 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.

9.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 5.22 of the NNNPS states that 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.
- Paragraph 5.23 states that the applicant should describe how the project plans to conserve and enhance biodiversity conservation interests.
- Paragraph 5.25 states that development should avoid significant harm to biodiversity conservation interests, including through appropriate mitigation and consideration of alternatives.
- Paragraph 5.32 states that development should not result in the loss or deterioration of irreplaceable habitats including ancient woodland and veteran trees.

- Paragraph 5.35 states that other habitats and species identified as being of principal importance should be protected from the adverse effects of development.
- Paragraph 5.36 states that 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
  - opportunities will be taken to enhance existing habitats and create new habitats within the site landscaping proposals

9.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

9.4 Assessment methodology

9.4.1 The biodiversity assessment will be undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring (Highways England, 2020c) and DMRB LA 108 Biodiversity (Highways England, 2020m), which meet the NNNPS policy requirements set out in Section 9.3.

9.4.2 Assessment of effects on biodiversity resources will be informed by relevant information collated on other environmental factors, notably DMRB LA 105 Air Quality (Highways England, 2019d), DMRB LA 111 Noise and vibration (Highways England, 2020b) and DMRB LA 113 Road drainage and the water environment (Highways England, 2020a).

9.4.3 Assessment of the potential air quality impacts on designated sites and habitats which are sensitive to nitrogen deposition, including SACs, SPAs, Ramsar sites, SSSIs, LNRs, LWS, nature improvement areas, ancient woodland and veteran trees within 200m of ARN will be undertaken in accordance with DMRB LA 105 (Highways England, 2019d) (see Chapter 6: Air quality).

9.4.4 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for this aspect. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

9.4.5 The impact assessment work to be undertaken for the proposed scheme and reported in the Environmental Statement will be proportionate, focusing on potential significant adverse effects within the zone of influence (as defined in Section 9.6).

9.4.6 At the time of writing, field surveys for protected species are still ongoing, and therefore the baseline is not complete. The assessment undertaken for this PEIR is therefore based on available survey data at the time of writing.

9.4.7 Mitigation will be designed and implemented in line with Section 5.4 of Chapter 5: Environmental assessment methodology. In addition to mitigation, the proposed scheme is also investigating opportunities to deliver enhancement measures. At the time of writing, mitigation design is in a preliminary phase. As such, this chapter sets out the mitigation principles for the biodiversity aspect, which will be fully developed for the Environmental Statement in consultation with stakeholders.

9.4.8 The requirements of protected and controlled species legislation will be detailed in a separate report to allow the Environmental Statement chapter to focus on potential significant effects, in terms of EIA. It is anticipated that EPSM licences will likely be required for bats and badger, and potentially otter and water vole. A District Level Licence will be obtained for great crested newts (see Section 9.9). Ghost EPSM licences will be prepared and agreed with Natural England for these species alongside the EIA. A formal application to Natural England for EPSM licences would be required following the grant of the DCO application.

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

9.4.10 The Habitats Regulations Assessment (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.

9.5 Assessment assumptions and limitations

9.5.1 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 is being sought from key stakeholders.

9.5.2 Specific limitations for each survey, such as land access constraints, will be detailed in the relevant survey factual reports which will be presented as appendices to the Environmental Statement. The survey-specific constraints are unlikely to represent a limitation that would compromise the ecological impact assessment, especially when considering the proposed scheme's embedded mitigation and standard mitigation measures.

9.5.3 The assessment presented in this PEIR is based on the data available at the time of writing. Some data analysis and field work are incomplete at this stage, most notably:

- analysis of bat activity survey data from 2020 to determine key foraging and commuting habitats within the proposed scheme
- badger bait marking survey data of setts
- badger camera trap survey data of setts to determine numbers of badgers within each clan and inform sett design
- otter camera trap survey data for a holt on the River Blackwater to determine seasonal usage to inform the impact assessment and mitigation proposals
- bat hibernation surveys for buildings
- bat hibernation surveys for a small number of trees
- summer bat back-tracking surveys for a low number of buildings
- dawn and dusk summer bat surveys for a low number of buildings
- dawn and dusk summer bat surveys for a low number of trees
- summer tree-climbing surveys of a low number of trees for bat roost suitability

9.5.4 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 inform the development of mitigation proposals, and the identification of a small number of bat roosts in addition to those already identified, is anticipated. Mitigation for additional roosts will be achievable within the provisional Order Limits.

9.5.5 Assessment of changes in air quality on biodiversity matters is ongoing and will be completed prior to submission of the Environmental Statement. For this PEIR, a list of ecological receptors within 200m of the ARN with sensitivities to nitrogen deposition has been identified and these are detailed within Section 9.7. In the Environmental Statement, the air quality models will be used to determine the effects of changes in air quality on sensitive habitats at each site.

9.5.6 The areas of each habitat type to be lost as a result of the construction of the proposed scheme are presented in this chapter. In the Environmental Statement, information on the areas of new habitats will also be presented so that the net habitat loss and gain are clearly presented.

9.6 Study area

9.6.1 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 highway verges, which cannot be safely surveyed at this time; however, pre-construction surveys of these areas will be undertaken with traffic management in place.

9.6.2 The study area also excludes survey of buffers around the spur towards Tiptree where minor measures to improve traffic are proposed. This is due to the small scale of the works proposed in this area as impacts will be localised to the footprint of the provisional Order Limits.

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

- Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and Ramsar sites where the proposed scheme:
  - is within 2km of a Ramsar or European site or functionally linked land
  - 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 Ramsar or European site
  - has a potential hydrological or hydrogeological linkage to a Ramsar or European site containing a groundwater-dependent terrestrial ecosystem
  - has an ARN within 200m of a Ramsar or European site
  - will have a direct pathway to effects
- Sites of Special Scientific Interest (SSSIs) within 2km of the proposed scheme and 200m of the ARN, or which have hydrological connectivity to the proposed scheme
- Local Nature Reserves, Local Wildlife Sites, Local Road Verges, notable habitats such as ancient woodland and groundwater-dependent terrestrial ecosystems within 1km of the proposed scheme and 200m of the ARN
- Records of protected and notable species within 1km of the proposed scheme (1.5km for barn owls) requested from Essex Wildlife Trust Biological Records Centre (EWTBRC), the Barn Owl Conservation Network (BOCN), Essex Badger Group, Essex Bat Group, and Essex Field Club (EFC), obtained in 2017 and updated in 2020 where appropriate

9.6.4 The following field surveys were undertaken, are planned or are ongoing (as indicated):

- Phase 1 habitat survey, including invasive species, important hedgerow assessment and National Vegetation Classification of key areas within 600m of the proposed scheme undertaken between 2016 and 2020

- River Habitat Survey of water bodies within 500m of the proposed scheme in 2017 and 2020
- Predictive System for Multimetrics (PSYM) surveys of ponds that would be lost to the proposed scheme or those which are hydrologically connected in 2020
- The following surveys for bats up to 100m from the proposed scheme between 2017 and 2021 (some surveys ongoing):
  - ground-based assessments of trees, buildings and structures
  - emergence re-entry surveys of trees, buildings and structures
  - internal inspections of buildings including hibernation surveys
  - emergence re-entry surveys of buildings
  - tree-climbing surveys for bat roost suitability
- In addition, bat activity surveys including transects and static bat detector surveys were undertaken up to 1km from the proposed scheme in 2020. Bat back-tracking surveys will be undertaken in 2021
- Badger surveys within 250m of the proposed scheme in 2017, 2019 and 2020; and badger bait marking surveys will be undertaken in 2021
- Otter surveys of all water bodies within 200m of the online sections of the proposed scheme and up to 500m from offline sections in 2017 and 2020
- Water vole *Arvicola amphibius* surveys of all water bodies within 200m of the online sections of the proposed scheme and up to 500m from offline sections in 2017 and 2020
- Hazel dormouse surveys up to 250m from proposed scheme where habitat linkages exist in 2017 and 2020
- Barn owl *Tyto alba* surveys within 200m of the proposed scheme for online widening sections and 1.5km for offline sections, and within 50m of borrow pits for stage 1 (scoping) and 2 (field) surveys; and within 500m from offline sections for stage 3 (nest verification) surveys undertaken in 2017, 2019 and 2020
- Breeding bird surveys within 250m of the proposed scheme in 2017 and 2020
- Wintering bird surveys up to 500m from the proposed scheme depending on transect locations in 2017-2018 and 2019-2020
- Reptile surveys within the footprint of the proposed scheme in 2017

- Great crested newt *Triturus cristatus* (GCN) Habitat Suitability Index (HSI) assessments of water bodies within 500m of the proposed scheme in 2017 and 2020, and population surveys and environmental DNA (eDNA) surveys in 2017
- White-clawed crayfish *Austropotamobius pallipes* surveys of watercourses which cross the proposed scheme in 2017 and 2020
- Freshwater fish surveys of watercourses which cross the proposed scheme in 2017 and 2020
- Terrestrial invertebrate surveys of sites identified as having optimal habitats within 600m of the proposed scheme between 2016 and 2020
- Freshwater macro-invertebrate surveys of watercourses which cross the proposed scheme in 2020
- Freshwater macrophyte surveys of watercourses which cross the proposed scheme in 2020

9.6.5 Full survey methodologies for the above are shown in the Environmental Scoping Report (Highways England, 2020d) and will be detailed in survey reports which will be prepared for the Environmental Statement.

9.7 Baseline conditions

Baseline sources

9.7.1 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 Local Road Verges
- EFC provided data records in 2017 and 2020 for notable and protected species
- The Ancient Woodland Inventory (Natural England, 2020b) was reviewed to identify ancient woodland habitats
- BOCN were 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
- 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
- Dormice 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 (OS) maps were reviewed between 2016 and the present day
- 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, 2020c)
- Results of various detailed species and habitat surveys (reports in preparation and some surveys ongoing) conducted between 2016 and 2021, which included extended survey areas related to earlier stages of the proposed scheme (as described in Section 9.6)

Baseline conditions

Designated sites - desk study

9.7.2 There are no confirmed or potential SPAs, SACs, or Ramsar sites located within the 2km study area (Figure 9.1) around the provisional Order Limits or within 200m of the ARN, and no SACs designated for bats within the 30km study area.

9.7.3 There are three 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. There are eight sites where there is possible interaction of the proposed scheme with ranging bird species of designated sites: Blackwater Estuary (Mid-Essex Coast Phase 4, 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.

9.7.4 The Stage 1 HRA report provides details of these sites and has been submitted to Natural England for pre-application consultation.

9.7.5 Marks Tey Brickpit SSSI is located approximately 150m 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.

9.7.6 There is one SSSI with hydrological connectivity to the site; this is the River Ter SSSI which is located approximately 8km upstream of the proposed scheme to the north of Boreham.

9.7.7 One SSSI (Tiptree Heath SSSI) is located within 200m of the ARN (see Figure 9.1).

9.7.8 Two LNRs, Whetmead and Brockwell Meadows, are located within 2km of the proposed scheme (see Table 9.3 and Figure 9.1).

9.7.9 The proposed scheme encroaches approximately 15m across the western boundary of the Whetmead LNR between junctions 21 and 22; and Brockwell Meadows LNR is located approximately 55m west of the proposed scheme in Kelvedon.

Table 9.3 Local Nature Reserves within 2km of the proposed scheme

Site	Interest/designated features	Approximate distance and direction from proposed scheme and ARN
Whetmead LNR	Previous landfill site now comprising unimproved grassland and lagoons. Supports a range of butterflies and dragonflies, and seed-eating birds.	Partially within footprint, located between junction 21 (Witham South interchange) and junction 22 (Colemans interchange)
Brockwell Meadows LNR	Associated with the River Blackwater comprising a water meadow, woodland, a pond and hedgerows.	55m west, located immediately adjacent to Kelvedon between junction 23 (Kelvedon South interchange) and junction 24 (Kelvedon North interchange).

9.7.10 In addition to the above sites, a further four LNRs are located within 200m of the ARN. These are: Cuckoo Wood, Spring Lane Meadows, Bocking Blackwater and Galleywood Common. These are shown in Table 9.4.

Table 9.4 Local Nature Reserves within 200m of the ARN

Site	Interest/designated features	Approximate distance from ARN (m)
Cuckoo Wood LNR	Important woodland with very good habitat for fungi including large amount of dead wood.	16
Spring Lane Meadows LNR	Wildflower meadow and riverside habitats supporting a variety of wildlife including otters, kingfisher *Alcedo atthis* and snipe *Gallinago gallinago*.	77
Bocking Blackwater LNR	Wildflower meadows, amenity grassland, scrub and wetland habitats.	90
Galleywood Common LNR	Areas of scrub, heathers, grasses, bare ground and wetlands.	50

9.7.11 There are 32 LWSs within 1km of the proposed scheme (Table 9.5 and Figure 9.1). The closest of these are Brockwell Meadows LWS, River Chelmer LWS, and Whetmead LWS which are all adjacent to the proposed Order Limits. Whetmead LWS and Brockwell Meadows LWS both overlap the LNRs of the same name. Marks Tey Brickpit LWS also overlaps with Marks Tey Brickpit SSSI. There are also 34 LWS within 200m of the ARN.

9.7.12 There are no Local Road Verges within 1km of the proposed scheme.

Table 9.5 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 ARN (m)
Boreham Road Gravel Pits (Ch113)	141	156
Braxted Park (Ma44)	613	1
Brockwell Meadows (Bra229)	0	n/a, over 200m
Bulls Lodge Lagoons (Ch176)	254	31
Bushy Wood (Ch98)	n/a, over 1km	81
Chantry Wood (Ma37)	823	6
Coggeshall Hall Farm (Bra225)	498	n/a, over 200m
Cook's Lane, Lexden	n/a, over 1km	28
Copford Hall Wood North (Co49)	809	n/a, over 200m
Daisy Green Grove (Co47)	994	n/a, over 200m
Domsey Brook Pasture (Co20)	741	n/a, over 200m
Feering Marsh (Bra234)	341	n/a, over 200m
Galleywood Common (Ch61)	n/a, over 1km	28
Hatfield Peverel Special Roadside Verge (Bra152)	850	n/a, over 200m
Hill Wood (Co4)	n/a, over 1km	0
Hoo Hall Meadow (Bra188)	486	n/a, over 200m
Inworth Grange Pits (Co10)	n/a, over 1km	189
Inworth Wood (Co6)	401	195

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the ARN (m)
Keeper's Cottage Wood (Co51)	691	n/a, over 200m
Kelvedon Hall Wood (Ma52)	401	n/a, over 200m
Lady Grove (Ch60)	n/a, over 1km	20
Lexden Springs LNR (Co91)	n/a, over 1km	77
Long Wood Complex (Bra114)	363	n/a, over 200m
Lost Wood (Bra94)	990	n/a, over 200m
Marks Tey Brickpit (Co31)	542	n/a, over 200m
Mope Wood Complex (Ma30)	737	0
Mountains Grove (Ma54)	n/a, over 1km	4
Perry's Wood (Co5)	n/a, over 1km	4
Pits Wood (Co44)	479	n/a, over 200m
River Chelmer (Ch109)	0	0
Riverview Meadows (Bra174)	153	103
Sandon Pit (Ch104)	n/a, over 1km	3
Sandon Riverside (Potential LWS) (Ch101)	169	16
Seven Star Green (Co55)	753	12
Sheepcoates Wood (Ch77)	n/a, over 1km	124
Shut Heath Wood (Ma43)	n/a, over 1km	193
Sir Hughes' Woods (Ch174)	n/a, over 1km	17
Sparkey Wood (Ma23)	510	n/a, over 200m

Site	Approximate distance from the proposed scheme (m)	Approximate distance from the ARN (m)
Spring Grove (Co87)	n/a, over 1km	126
Stanway Pit (Co62)	924	n/a, over 200m
Stonage Wood (Ch171)	n/a, over 1km	42
Straw Brook Plantation (Ch86)	n/a, over 1km	28
Strowling Wood (Ma53)	n/a, over 1km	172
Templeborder Wood (Bra110)	n/a, over 1km	144
The Grove (Ch107)	173	n/a, over 200m
The Old Rectory Meadows (Bra175)	703	n/a, over 200m
Tiptree Church (Co16)	n/a, over 1km	77
Tiptree Water Works (Co7)	n/a, over 1km	8
Titbeech Wood (Bra118)	324	n/a, over 200m
Toppinghoehall Wood (Ch120)	669	n/a, over 200m
Toppinghoehall Wood (Bra87)	498	n/a, over 200m
West Hall Wood Complex (Ma48)	n/a, over 1km	164
West House Wood (Co82)	n/a, over 1km	11
Whetmead LNR (Bra183)	0	13
White Court Wood (Bra51)	n/a, over 1km	18

Habitats - desk study

9.7.13 There are eight Ancient Woodland Inventory sites located within the 1km study area (Figure 9.2), many of which are also designated as LWS. 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 to the south of Kelvedon. In addition, there are 36 veteran trees within 1km of the proposed scheme.

9.7.14 There are eight Ancient Woodland Inventory sites and 27 veteran trees within 200m of the ARN.

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

9.7.16 Two areas of wet woodland priority habitat were identified, one located along the River Ter and one along the River Blackwater. These were also classified as Annex I habitat 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

9.7.17 Habitats within the following designated sites were identified through desk-based assessment as likely comprising GWDTEs:

- Boreham Road Gravel Pits LWS
- Braxted Park LWS
- Coggeshall Hall Farm LWS
- Copford Hall Wood North LWS
- Feering Marsh LWS
- Hoo Hall Meadow LWS
- Keeper's Cottage Wood LWS
- Long Wood Complex LWS
- Marks Tey Brickpit LWS
- Moor Gardens LWS
- Pits Wood LWS
- River Chelmer LWS
- Riverview Meadows LWS
- Sparkey Wood LWS
- Spitman's Garden LWS
- The Grove LWS
- Whetmead LNR
- Brockwell Meadows LNR

9.7.18 Further details of this assessment and the habitats identified are provided in Chapter 14: Road drainage and the water environment.

Habitats - field survey

9.7.19 The Phase 1 habitat survey (Jacobs, 2020a) 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 (Figure 9.2).

9.7.20 The survey confirmed the presence of the following priority habitats within the study area:

- 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

9.7.21 The majority of grassland habitats identified were either improved grassland or cultivated/disturbed land. Species-poor neutral grassland was found, 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.

9.7.22 There were several rivers and numerous smaller streams within the surveyed area. Most of the study area is divided between the catchments of the Chelmer, which extends across the study area between Chelmsford and Witham, and the 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.

9.7.23 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.

9.7.24 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.

9.7.25 The proposed scheme crosses seven main rivers: Boreham Brook, the River Ter, the River Brain, Rivenhall Brook, the River Blackwater, Domsey Brook and the Roman River.

9.7.26 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, resectioning 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'.

9.7.27 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.

9.7.28 Some stands of woodland identified in the Ancient Woodland Inventory (Natural England, 2020b), 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.

9.7.29 A number of other areas of potentially ancient woodland that are not identified in the inventory were recorded during field surveys, including the following named 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 and Jubb's Row. A low number of potential veteran trees were also identified.

9.7.30 Field boundaries, lanes and tracks support an extensive and complex network of ditches and hedgerows across arable areas.

9.7.31 Hedgerow surveys recorded 343 hedgerows, of which 107 were species-rich, 291 qualified as priority habitat and 88 were important under the wildlife and landscape criteria of the Hedgerows Regulations 1997.

9.7.32 Of the hedgerows surveyed, 195 showed a diversity of features indicating that many 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.

9.7.33 Field surveys also confirmed the presence of GWDTEs, including areas of wet woodland priority habitat to the north of Rivenhall Brook, along Domsey Brook and along the River Ter near junction 20a (Hatfield Peverel South interchange).

Protected and notable species - desk study

9.7.34 The desk study identified records for a range of protected and notable species within 2km of the proposed scheme. 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.

9.7.35 A record of dormice was shared by Essex Wildlife Trust through the stakeholder engagement process. The record was located approximately 3.5km south-west of the proposed scheme to the south of Chelmsford within 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 in multiple points including at junction 17 and junction 18 and at the River Chelmer, indicating that the proposed scheme has no connectivity with confirmed dormice populations. No other records of dormice were identified.

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

9.7.37 The Environment Agency and EWTBRC provided records of protected and notable fish species, including brown trout *Salmo trutta*, bullhead *Cottus gobio* and European eel *Anguilla anguilla* 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).

9.7.38 The desk study identified a number of records of INNS including Japanese knotweed *Fallopia japonica* as well as two records of invasive non-native animals: American mink *Neovison vison* and Turkish crayfish *Astacus leptodactylus*.

Protected and notable species - field survey

9.7.39 Preliminary results of surveys for protected and notable species are summarised in subsequent sections and shown in Figure 9.3.

Bats

9.7.40 A total of 37 bat roosts in trees, buildings and structures were recorded within the study area, with four roosts located within the provisional Order Limits (one roost in a building, one in a pile of breeze blocks one in a tree and one in a bridge).

9.7.41 Further surveys are required to determine the types of roosts at the majority of locations. Roosts were primarily used by common and soprano pipistrelle, though three brown long-eared bat roosts and two noctule roosts were identified. Full survey details of roosts will be provided in ecological survey reports to be appended to the Environmental Statement.

9.7.42 The majority of roosts recorded were likely lower status roosts, i.e. roosts used intermittently by low numbers of non-breeding males. However, two possible mating roosts (a roost used by bats to mate), one hibernation roost (a roost used by bats to hibernate over winter) and one possible maternity roost (i.e. a roost where female bats give birth and raise their young) were recorded. Bat roost surveys are ongoing and may identify further roosts.

9.7.43 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 *Plecotus auritus*, common pipistrelle *Pipistrellus pipistrellus*, Leisler's bat *Nyctalus leisleri*, *Myotis* sp., Nathusius' pipistrelle *Pipistrellus nathusii*, noctule *Nyctalus noctula*, and soprano pipistrelle *Pipistrellus pygmaeus*. Most notable of these is the nationally rare IUCN threatened species barbastelle bat, which was recorded to the south of junction 24 (Kelvedon North interchange).

9.7.44 Analysis of bat activity survey data is ongoing, and further detail regarding significance and importance of bat foraging and commuting habitats, as well as details of further roost surveys will be included in the Environmental Statement.

Badger

9.7.45 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).

9.7.46 Due to the sensitive nature of the data, sett locations are not shown on Figure 9.3 and detailed location descriptions are not included here. This information will be included within a technical report and shared with key stakeholders.

9.7.47 In total, 86 setts were recorded within a 250m study area around the proposed scheme, including 18 main setts. Of the setts recorded, 57 were located within the provisional Order Limits. Of these, five were main setts: Sett 39 located to the east of Hatfield Peverel; Sett 80 located west of Rivenhall End; Sett 73 located to the south of junction 22 (hereafter referred to as the Witham main sett); Sett 89 located to the south-west of junction 23 (Kelvedon South interchange) (hereafter referred to as the Rivenhall End main sett); and Sett 123 located close to the Domsey Brook towards Marks Tey.

Otter

9.7.48 Otter signs, including spraints, resting places and sightings, were recorded on all main rivers within the study area (Boreham Brook, Domsey Brook, Rivenhall Brook, River Blackwater, River Brain, River Ter, and Roman River) (see Figure 9.3).

9.7.49 Otter signs including spraints and potential and confirmed resting places were also recorded along six ditches and six ponds/lakes.

9.7.50 The closest sprainting sites to the proposed scheme were found directly beneath the A12, on ledges of BE18 Ashman's Bridge over the River Blackwater (National Grid Reference TL 85581 17699), and BE23 Domsey Brook Bridge over the Domsey Brook (National Grid Reference TL 87680 19078).

9.7.51 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.

9.7.52 The nearest holt was confirmed to be 40m north of the A12 on the River Blackwater (National Grid Reference TL 85690 17823), and an otter was observed swimming and entering the resting place. Three otters were also observed swimming at the same location on a separate occasion.

9.7.53 No confirmed breeding sites were identified, however surveys to confirm the status of the identified holt are ongoing.

Water vole

9.7.54 Surveys carried out in 2020 identified the presence of water vole latrines and burrows on one watercourse (Domsey Brook to the south of junction 24) and two ditches to the south of junction 19 (see Figure 9.3), indicating low-density populations of water voles in these areas.

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

Hazel dormouse

9.7.56 No dormice or evidence of dormice were recorded during field surveys. Although dormice are known to be present within the wider landscape (as evidenced by the record of dormice shared by Essex Wildlife Trust), connectivity between known populations and the proposed scheme is poor and dormice are considered likely to be absent from the study area.

9.7.57 This species has been scoped out from further assessment and is not discussed further in this chapter. The dormouse technical report will be provided to key 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 study area. Details of consultation will be provided in the Environmental Statement.

Other mammals

9.7.58 Incidental observations of brown hare and hedgehog were recorded around the study area. These species are listed as species of principal importance under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.

9.7.59 Incidental observations of water shrew *Neomys fodiens* were also made in one pond in 2017, National Grid Reference TL 91614 23296.

9.7.60 Numerous sightings of rabbit *Oryctolagus cuniculus,* including burrows, were recorded around the study area. Rabbits are common and widespread and have no conservation status and are therefore not considered further, however details of how they will be protected from specific acts in accordance with the Wild Mammals (Protection) Act 1996 will be included within the legislative compliance report submitted with the DCO application.

Barn owl

9.7.61 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 (see Figure 9.3). These were all located within the survey buffer and none were identified within the provisional Order Limits.

9.7.62 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). None of the nest sites fell within the provisional Order Limits. Four were within the survey buffer and the remaining five were located outside the survey area but were identified either incidentally or earlier prior to refinement of the provisional Order Limits.

9.7.63 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*.

9.7.64 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).

9.7.65 Type 1 habitats were located in discrete parcels across the study area in proximity to junction 25, junction 24, junction 23 and junction 21, with the largest areas being outside of the provisional Order Limits.

Breeding birds

9.7.66 A combined total of 90 bird species were recorded across the 27 transects surveyed within the study area in 2017 and 2020, of which 35 were confirmed breeders, 16 probable breeders, 18 possible breeders, and 21 non-breeders (feral or birds observed on migration).

9.7.67 Several bird species recorded within the study area were listed as Red or Amber British Trust for Ornithology (BTO) Birds of Conservation Concern (BoCC), species of principal importance under Section 41 of the NERC Act 2006 (NERC S41) and/or the Essex Red Data List (ERL).

9.7.68 The surveys found that 42 recorded species have conservation/legal status indicating historical population declines or targeted conservation for certain species. Of these, 15 species are included on the BoCC Red List, 21 are on the BoCC Amber List, 16 are species of principal importance (NERC S41), 15 are included on the ERL and two species are cited under the Essex Local Bio-diversity Action Plan (LBAP). In addition, three species are listed under Schedule 1 of the Wildlife and Countryside Act 1981. These species are listed in Table 9.6 below.

Table 9.6 Status of notable bird species within the study area (breeding bird surveys)

Species	Conservation status	Breeding status
Black-headed gull *Chroicocephalus ridibundus*	BoCC Amber	Non-breeder
Bullfinch *Pyrrhula pyrrhula*	BoCC Amber, NERC S41, ERL	Possible breeder
Cetti's warbler *Cetti cetii*	Schedule 1	Possible breeder
Common gull *Laurus canus*	BoCC Amber	Non-breeder
Common sandpiper *Actitis hypoleucos*	BoCC Amber	Non-breeder
Common tern *Sterna hirundo*	BoCC Amber	Non-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
Grey wagtail *Motacilla cinerea*	BoCC Red	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 Amber, ERL	Possible breeder
House sparrow *Passer domesticus*	BoCC Red, NERC S41	Probable breeder
Kestrel *Falco tinnunculus*	BoCC Amber	Confirmed breeder
Kingfisher *Alcedo atthis*	BoCC Amber, Schedule 1	Possible breeder
Lapwing *Vanellus vanellus*	BoCC Red, NERC S41, ERL	Confirmed breeder
Lesser black-backed gull	BoCC Amber	Non-breeder
Lesser redpoll *Acanthis cabaret*	BoCC Red, NERC S41	Possible breeder
Linnet *Carduelis 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
Mute swan *Cygnus olor*	BoCC Amber	Confirmed breeder
Red kite *Milvus milvus*	Schedule 1	Possible breeder

Species	Conservation status	Breeding status
Reed bunting *Emberiza schoeniclus*	BoCC Amber, NERC S41, ERL	Possible breeder
Sand martin *Riparia riparia*	ERL	Confirmed 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 Red, NERC S41, ERL, LBAP	Probable breeder
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 Amber	Non-breeder
Turtle dove *Streptopelia turtur*	BoCC Red, NERC S41, ERL	Confirmed breeder
Willow warbler *Phylloscopus trochilus*	BoCC Amber	Probable breeder
Yellow wagtail *Motacilla flava*	BoCC Red, NERC S41, ERL	Probable breeder
Yellowhammer *Emberiza citronella*	BoCC Red, NERC S41, ERL	Probable breeder

9.7.69 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.

9.7.70 The study area supported scarce breeding bird species of county importance including hobby *Falco subbuteo*, turtle dove *Streptopelia turtur* and sand martin *Riparia riparia*. Cetti's warblers *Cettia cetti* were observed in 2017 and the species is considered to be a possible breeder.

9.7.71 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.

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

9.7.73 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.

9.7.74 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 *Emberiza citronella* and house sparrow *Passer domesticus*.

9.7.75 The River Blackwater and areas around Domsey Brook provide important habitats for a variety of species including Cetti's warbler, grey wagtail *Motacilla cinerea*, kingfisher *Alcedo atthis* and reed bunting *Emberiza schoeniclus*.

Wintering birds

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

9.7.77 Several bird species recorded within the study area were listed as Red or Amber BTO BoCC, species of principal importance under Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC S41) and/or the ERL.

9.7.78 The surveys recorded 30 species that have conservation/legal status indicating historical population declines or targeted conservation for certain species. Of these, 15 species are included on the BoCC Red List, 14 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.

9.7.79 A number of birds recorded were also listed as qualifying features of nearby SPA and Ramsar sites.

9.7.80 These notable species, their conservation status and listing as qualifying features are shown in Table 9.7.

Table 9.7 Status of notable bird species within the study area (wintering bird surveys)

Species	Conservation status	SPA and Ramsar sites where 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*	-	-
Common gull *Larus canus*	BoCC Amber	-
Coot *Fulica atra*	-	• Abberton Reservoir SPA and Ramsar site

Species	Conservation status	SPA and Ramsar sites where species is listed as a qualifying feature
Cormorant *Phalacrocorax phalacrocorax*	-	• 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*	-	• Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Goldfinch *Carduelis carduelis*	-	-
Great black-backed gull *Larus marinus*	BoCC Amber	-
Great crested grebe *Podiceps cristatus*	-	• Abberton Reservoir SPA and Ramsar site • Stour and Orwell Estuaries SPA and Ramsar site
Great white egret *Ardea alba*	-	-
Green sandpiper *Tringa ochropus*	BoCC Amber, Schedule 1	-
Greenfinch *Chloris chloris*	-	-
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
Lesser black-backed gull *Larus fuscus*	BoCC Amber	• Alde-Ore Estuary SPA and Ramsar site
Linnet *Linaria cannabina*	-	-

Species	Conservation status	SPA and Ramsar sites where species is listed as a qualifying feature
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 Amber	• 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*	-	-
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 Red, 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 Red, NERC S41, ERL, LBAP	-
Starling *Sturnus vulgaris*	BoCC Red, NERC S41	-
Stock dove *Columba oenas*	BoCC Amber	-
Tufted duck *Aythya fuligula*	-	• Abberton Reservoir SPA and Ramsar site
Water rail *Rallus aquaticus*	ERL	-

Species	Conservation status	SPA and Ramsar sites where species is listed as a qualifying feature
Wigeon *Anas penelope*	-	• Abberton Reservoir SPA and Ramsar site
Woodcock *Scolopax rusticola*	BoCC Red	-
Yellowhammer *Emberiza citronella*	BoCC Red, NERC S41, ERL	-

9.7.81 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 very 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.

9.7.82 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.

9.7.83 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.

9.7.84 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.

Reptiles

9.7.85 Reptile surveys were undertaken in 2017 at 13 sites assessed as having suitability for reptiles within the study area. Habitats surveyed include rough grassland and interfaces of tall and short vegetation such as dense scrub or tall ruderal vegetation in field margins.

9.7.86 Common lizard was recorded at eight sites, slow worm at four sites and grass snake at one site. Reptiles were not detected at four of the sites that were surveyed.

9.7.87 The survey results indicate that the study area supports a low population of common reptile species.

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

Great crested newt

9.7.89 Surveys comprised HSI assessments, eDNA surveys and presence/absence surveys undertaken in 2017.

9.7.90 In addition, two 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, 2020c); and a second as a result of informal discussion with a landowner in 2020.

9.7.91 These sources identified the presence of breeding GCN in 12 ponds within the study area. Of these, two (P91 and P099) are located within the provisional Order Limits (Table 9.8 and Figure 9.3).

Table 9.8 Locations and population estimates for positive GCN ponds

Pond ID	Location (national grid reference)	Source of data and year	Maximum count per survey	Population size
P005	TL 91709 23325	Population survey, 2017	3	Small
P007	TL 91614 23296	Population survey, 2017	1	Small
P013	TL 91576 22918	Population survey, 2017	6	Small
P014	TL 91081 22785	Population survey, 2017	54	Medium
P036	TL 88303 19838	Population survey, 2017	1	Small
P058	TL 84941 17729	eDNA survey only, 2017	Unknown	Unknown
P91	TL 81416 12903	Natural England Open Data (Natural England, 2020c)	Unknown	Unknown
P098	TL 80768 12532	Population survey, 2017	10	Small
P099	TL 79956 12708	eDNA survey only, 2017	n/a	n/a
P125	TL 88131 20780	Population survey, 2017	4	Small
P144	TL 77893 10794	eDNA survey only, 2017	Unknown	Unknown
P345	TL 83109 15844	Record obtained informally from landowner, 2020	Unknown	Unknown

Other amphibians

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

9.7.93 Common toad *Bufo bufo* was recorded in five ponds and one ditch around the proposed scheme in 2017 as shown in Table 9.9. None of these waterbodies are located within the provisional Order Limits. Common toad is listed under Section 41 of the NERC Act 2006 as a species of principal importance.

Table 9.9 Locations of ponds supporting common toad

Pond ID	Location (national grid reference)
P025	TL 89993 21509
P036	TL 88284 19834
P036b	TL 88320 19860
P037	TL 88252 19603
P065	TL 84704 17051
D059	TL 84774 16870

Freshwater fish

9.7.94 Six watercourses were surveyed for freshwater fish and species recorded are shown in Table 9.10. The locations of the watercourses are shown on Figure 9.3.

Table 9.10 Summary of freshwater fish survey results

Watercourse	Species
Boreham Brook	• Bullhead *Cottus gobio* (International Union for Conservation of Nature (IUCN) Red List) • European eel *Anguilla anguilla* (NERC S41, IUCN Red List) • Three-spined stickleback *Gasterosteus aculeatus*
Domsey Brook	• Brown Trout *Salmo trutta* (NERC S41) • Bullhead (IUCN Red List) • Dace *Leuciscus leuciscus* • European eel *Anguilla anguilla* (NERC S41, IUCN Red List) • Gudgeon *Gobio gobio* • Minnow *Phoxinus phoxinus* • Stone loach *Barbatula barbatula* • Three-spined stickleback

Watercourse	Species
River Blackwater	• Brown trout (NERC S41) • Bullhead (IUCN Red List) • Chub *Squalius cephalus* • Dace • Gudgeon *Gobio gobio* • Minnow • Perch *Perca fluviatilis* • Pike *Esox lucius* • Roach *Rutilus rutilus* • Stone loach • Three-spined stickleback
River Brain	• Bullhead (IUCN Red List) • Chub • Dace • European eel (NERC S41, IUCN Red List) • Gudgeon • Minnow • Perch • Pike • Roach • Stone loach

Watercourse	Species
River Ter	• Brown trout (NERC S41) • Bullhead (IUCN Red List) • Chub • Dace • European eel (NERC S41, IUCN Red List) • Gudgeon • Minnow • Perch • Pike • River lamprey and brook lamprey *Lampetra fluviatilis* and *Lampetra planeri* (Annex II of Habitats Directive, also NERC S41 in the case of river lamprey but species was not confirmed) • Roach • Stone loach • Three-spined stickleback
Roman River	• Brown trout (NERC S41) • Roach • Three-spined stickleback

White-clawed crayfish

9.7.95 No white-clawed crayfish were recorded and this species is therefore considered likely to be absent from the study area.

9.7.96 This species has therefore been scoped out from further assessment, as agreed with the Environment Agency, and is not discussed further.

Terrestrial invertebrates

9.7.97 Five sites identified as having good suitability for terrestrial invertebrates were surveyed (see Figure 9.3). These were: Brockwell Meadows LNR; Little Braxted Fishing Lakes; site at Prested Hall; site west of Hatfield Peverel; and Whetmead LNR.

9.7.98 Results including records of notable species are shown in Table 9.11.

Table 9.11 Summary of terrestrial invertebrate survey results

Site name	Site location (national grid reference)	Site description	Summary of notable species
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: • flea beetle *Podagrica fuscicornis* (Nationally scarce – least concern, ERL) • leaf beetle *Longitarsus lycopi* (Nationally scarce – least concern) • rove beetle *Sepedophilus bipunctatus* (Nationally scarce, ERL) • ruddy darter dragonfly *Sympetrum striolatum* (ERL) • spider *Ballus chalybeius* (Nationally scarce – least concern) • spider *Rugathodes instabilis* (Nationally scarce – least concern) • true bug *Deraeocoris olivaceus*, (Nationally scarce, ERL) • true bug *Lygus pratensis* (Rare – Red Data Book 3 (RDB3)) • true bug *Macrosteles sardus*, (new to Britain) • tumbling flower beetle *Mordellistena neuwaldeggiana* (Nationally scarce – least concern, ERL) • weevil *Liparus coronatus* (Nationally scarce, ERL) • weevil *Polydrusus formosus* (Nationally scarce) • weevil *Protapion filirostre* (Nationally scarce, ERL)

Site name	Site location (national grid reference)	Site description	Summary of notable species
Little Braxted Fishing Lakes	TL 83206 14938	Semi-natural and plantation woodland with fishing lake margins.	144 species identified, four considered as species of conservation importance: • dark blood bee *Sphecodes niger* (Rare – RDB3, ERL) • false flower beetle *Anaspis thoracica* (Nationally scarce – least concern, 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) • true bug *Lygus pratensis* (Rare – RDB3)
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: • ant *Lasius brunneus* (Nationally scarce, ERL) • band-eyed brown horsefly *Tabanus bromius* (ERL) • beetle *Involvulus cupreus* (Nationally scarce) • beetle *Rhinocyllus conicus* (Nationally scarce) • beetle *Tanymecus palliatus* (Nationally scarce, ERL) • beetle *Meligethes umbrosus* (Nationally scarce, ERL) • blue carpenter bee *Ceratina cyanea* (Rare – RDB3, ERL) • hornet mimic hoverfly *Volucella zonaria* (ERL) • lobe-spurred furrow bee *Lasioglossum pauxillum* (Nationally scarce) • small heath butterfly *Coenonympha pamphilus*

Site name	Site location (national grid reference)	Site description	Summary of notable species
			(IUCN Near Threatened, NERC S41) • spider *Phylloneta impressa* (ERL) • spider wasp *Anoplius nigerrimus* (ERL) • true bug *Lygus pratensis* (Rare – RDB3) • welted lesser mason bee *Hoplitis claviventris* (ERL)
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, 22 considered as species of conservation importance • beetle *Longitarsus lycopi* (Nationally scarce – least concern) • beetle *Rhagonycha lutea* (Nationally scarce – least concern, ERL) • beetle *Rhinocyllus conicus* (Nationally scarce) • beetle *Variimorda villosa* (Nationally scarce – least concern, ERL) • bloody cranesbill weevil *Zacladus exiguus* (Nationally scarce, ERL) • chocolate tipula cranefly *Nigrotipula nigra* (ERL) • dotted fan-foot moth *Macrochilo cribrumalis* (ERL) • true hornet mimic hoverfly *Volucella zonaria* (ERL) • hovertrue fly *Pipizella virens* (ERL) • hovertrue fly *Volucella inanis* (ERL) • hovertrue fly *Volucella inflata* (ERL)

Site name	Site location (national grid reference)	Site description	Summary of notable species
			• lobe-spurred furrow bee *Lasioglossum pauxillum* (Nationally scarce) • ridge-cheeked furrow bee *Lasioglossum puncticolle* (Nationally scarce, ERL) • small heath butterfly *Coenonympha pamphilus* (IUCN Near threatened, NERC S41) • jumping spider *Ballus chalybeius* (Nationally scarce, ERL) • spider wasp *Auplopus carbonarius* (Nationally scarce, ERL) • true bug *Deraeocoris olivaceus* (Nationally scarce, ERL) • true bug *Lassus 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) • 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)

Site name	Site location (national grid reference)	Site description	Summary of notable species
			• beetle *Rhinocyllus conicus* (Nationally scarce) • lobe-spurred furrow bee *Lasioglossum pauxillum* (Nationally scarce) • mallow flea beetle *Podagrica fuscipes* (Nationally scarce – least concern, ERL) • ridge-saddled carpenter bee *Heriades truncorum* (Rare – RDB3) • small heath butterfly *Coenonympha pamphilus* (IUCN Near threatened, NERC S41) • spined hylaeus bee *Hylaeus cornutus* (Nationally scarce, ERL) • swollen-thighed blood bee *Sphecodes crassus* (Nationally scarce, ERL) • true bug *Drymus latus* (Nationally scarce, ERL) • true bug *Lygus pratensis* (Rare – RDB3)

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

9.7.100 All sites surveyed are located at least partially within the provisional Order Limits; however, these are generally only small areas with the majority of the site areas sitting outside the provisional Order Limits.

9.7.101 No legally protected invertebrate species were recorded.

Freshwater macro-invertebrates

9.7.102 Ten sites were surveyed for freshwater macro-invertebrates across seven watercourses (Boreham Brook, Domsey Brook, Rivenhall Brook, River Blackwater, River Brain, River Ter and Roman River (see Figure 9.3)).

9.7.103 All sites, with the exception of the Boreham Brook in autumn 2017, achieved 'good' status or above using the Whalley, Hawkes, Paisley and Trigg metric for macro-invertebrate communities, indicating minor variation from reference conditions.

9.7.104 For macro-invertebrate surveys, each species was assigned a Community Conservation Index score. Any score above seven is considered to be a species of conservation importance. No species of conservation importance were recorded.

Notable plants

9.7.105 Notable vascular plants were identified during botanical surveys (see Figure 9.3). Several populations of the nationally scarce lesser calamint *Clinopodium calamintha* were recorded on poor semi-improved grassland along road verges of the A12 and edges of nearby fields between junction 22 and junction 23.

9.7.106 The near threatened field scabious *Knautia arvensis* and the near threatened common cudweed *Filago vulgaris*, were recorded in numerous locations within arable field margins and open, disturbed vegetation between junction 21 and junction 25.

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

9.7.108 No legally protected plant species were recorded.

Freshwater macrophytes

9.7.109 The notable plant, river water dropwort *Oenanthe fluviatilis* (near threatened on the IUCN Red List) was recorded from the River Blackwater in proximity to the existing A12 (see Figure 9.3).

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

Invasive Non-Native Species

9.7.111 INNS recorded as incidental sightings during fieldwork and listed on Schedule 9 of the WCA 1981 as amended, included giant hogweed *Heracleum mantegazzianum*, giant rhubarb *Gunnera manicata*, Himalayan balsam *Impatiens glandulifera*, Japanese knotweed, montbretia *Crocosmia x crocosmiiflora*, New Zealand pygmyweed *Crassula helmsii* and variegated yellow archangel *Lamiastrum galeobdolon subsp. argentatum*.

9.7.112 An invasive species management plan (ISMP) will be produced by the principal contractor and will describe how non-native plant and animal species will be managed and/or removed in order to prevent their spread in the terrestrial and aquatic environment.

Future baseline

9.7.113 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), further developments in the study area could further reduce the areas of agricultural soils. 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 significantly alter the land use, and therefore the habitats, prior to construction of the proposed scheme.

Long-term impacts from climate change could alter the species composition and types of habitats in and around the site, and therefore 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 (i.e. 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.

9.7.114 The exception to this is Colemans Farm Quarry which is currently operational. The planning consent for the quarry includes restoration of the site. For the purpose of the EIA, the restored site will be 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.

Importance of receptors

9.7.115 All receptors within the baseline have been assigned an importance based on criteria in DMRB LA 108 Biodiversity (Highways England, 2020m) and using professional judgement. Table 9.12 summarises the value of receptors identified within the study area.

Table 9.12 Importance of receptors in the study area for biodiversity

Importance	Description	Examples within the study area
Designated sites		
International or European	Features that have been selected as internationally important through expert consensus according to European criteria.	• 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
UK or national	Features that have been selected as nationally important through expert consensus according to national criteria.	• Tiptree Heath SSSI • River Ter SSSI

Importance	Description	Examples within the study area
Regional	Designated sites (non-statutory)	No features present within the study area at this level of importance.
County	Has been selected for county designation by consensus according to county wildlife site criteria.	• Whetmead LNR • Brockwell Meadows LNR • Cuckoo Wood LNR • Spring Lane Meadows LNR • Bocking Blackwater LNR • Galleywood Common LNR • 34 LWS designated sites within 1km of the proposed scheme 34 LWS within 200m of the ARN
Local	Wildlife and nature conservation sites designated at a local level.	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
UK or national	Habitat that is considered irreplaceable.	• Ancient Woodland Inventory sites and additional ancient woodland habitats identified through field survey • Veteran trees and potential veteran trees
	UK Priority habitats	• 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	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	The habitat is rare in Essex is listed as near threatened on the Red List of European habitats (European Commission, 2016) and is an Annex I habitat (selected as internationally important through expert consensus according to European criteria).	• Annex I habitat: wet woodland

Importance	Description	Examples within the study area
Local	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; or 2) the population forms a critical part of a wider population at this scale; or 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.
UK or national	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; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at a UK or national scale.	• Freshwater fish communities of Domsey Brook, Boreham Brook, River Brain and River Ter including European eel *Anguila anguila* • Freshwater macrophyte communities of the River Blackwater including river water dropwort *Oenanthe fluviatilis*
Regional	Species identified in regional plans or strategies.	No features present within the study area at this level of importance.

Importance	Description	Examples within the study area
County	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; or b. the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or 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 *Barbastella barbastellus* • Barn owl *Tyto alba* • Notable breeding birds; hobby *Falco subbuteo*, turtle dove *Streptopelia turtur* and sand martin *Riparia riparia* • Otter *Lutra lutra* • Water vole *Arvicola amphibius* • Species of principal importance; brown hare *Lepus europaeus*, hedgehog *Erinaceus europaeus* and polecat *Mustela putorius* • Great crested newt *Triturus cristatus* • Species of principal importance; common toad *Bufo bufo* • Freshwater fish communities of the River Blackwater and Roman River • Terrestrial invertebrate assemblages • Notable plants (Nationally scarce) lesser calamint *Clinopodium calamintha* and wall bedstraw *Galium parisiense*
Local	Widespread and relatively abundant at a local level. The populations within the study area are likely to make a very limited contribution to the conservation status of the assemblage or species	• Badger *Meles meles* • Breeding bird assemblage • Wintering bird assemblage • Commoner reptiles; common lizard *Zootoca vivipara*, grass snake *Natrix helvetica*, slow worm *Anguis fragilis* • Freshwater macro-invertebrate communities of the River Blackwater, Boreham Brook, River Ter, Roman River, River Brain and Domsey Brook • Notable plants (near threatened) - Field scabious *Knautia arvensis* and common cudweed *Filago vulgaris*

9.8 Potential impacts

Construction

9.8.1 The proposed scheme would require the temporary and permanent loss of terrestrial and aquatic habitats. This would include priority habitats, and habitats likely to be used by or to support protected and notable species including notable vascular plants.

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

9.8.3 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.

9.8.4 During the construction phase, utilities diversions, site clearance, earthworks, excavations, works affecting watercourses, 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 footprint of the proposed scheme.

9.8.5 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.

9.8.6 Air quality changes could occur through dust during construction works and changes in pollutant levels caused by emissions from construction plant and machinery, with resulting effects on sensitive habitats. Chapter 6 provides additional details on air quality.

9.8.7 There is potential for hydrological change to cause significant effects during construction where works would directly or indirectly affect watercourses. Hydrological changes are detailed in Chapter 14: Road drainage and the water environment, and include changes to both water quality and quantity within nearby watercourses through surface 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 and groundwater

9.8.8 Table 9.13 lists the biodiversity resources of interest and the associated potential impacts associated with construction of the proposed scheme without mitigation.

Table 9.13 Summary of potential construction effects on biodiversity resources without additional mitigation

Biodiversity resource	Impact	Characterisation of impact from construction
Designated sites		
• 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	Disturbance (from changes to noise, vibration, visual and light stimuli)	Due to their distance from the proposed scheme, no direct disturbance impacts are likely to occur to these sites. During construction, the majority of qualifying species that could potentially be present within the zone of influence of significant disturbance effects would have the capacity to move away from sources of disturbance into adjacent undisturbed habitat, if needed. Any such avoidance behaviour is considered to have 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. It is considered that the proposed scheme would therefore result in a negligible disturbance of mobile qualifying species outside the SPA and Ramsar sites considered.
	Hydrological and water quality changes to surface and groundwater	The proposed scheme crosses the River Blackwater, the River Brain, the River Ter, Domsey Brook and the Boreham Tributary and would fall within the surface water catchment of the Roman River at the eastern extent of the study area. These watercourses have downstream hydrological connectivity with the Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar, and Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar. No other SPA, Ramsar or SAC is hydrologically connected to the proposed scheme (see Figure 9.1). The closest watercourse crossing is approximately 10km upstream from the closest designated site (Abberton Reservoir SPA and Ramsar site).
• Essex Estuaries SAC	Hydrological and water quality changes to surface and groundwater	The proposed scheme crosses the River Blackwater, the River Brain, the River Ter, Domsey Brook, Boreham Brook and the Roman River all of which have downstream hydrological connectivity with the Essex Estuaries SAC. The closest watercourse crossing is approximately 9km upstream from the SAC. No changes from groundwater levels are predicted.

Biodiversity resource	Impact	Characterisation of impact from construction
• Tiptree Heath SSSI	Air quality changes – dust	Tiptree Heath SSSI is more than 1km from the proposed scheme. Therefore, based on DMRB LA 105 which states only sites up to 200m from construction activity could be impacted by construction dust, air quality impacts due to dust are scoped out for this site.
	Air quality changes – construction traffic	No change. Following air quality assessment, no impact to this site from air quality changes due to construction traffic are considered likely.
• River Ter SSSI	Hydrological and water quality changes to surface and groundwater	The River Terr SSSI is located approximately 8km upstream from the proposed scheme. There are therefore not considered to be any likely impacts to this site from construction of the proposed scheme due to hydrological or water quality changes.
• Whetmead LNR and LWS	Loss of habitats	Permanent loss of approximately of 0.8ha of semi-natural broadleaved woodland habitats adjacent to the A12 on the western boundary of the LNR during site clearance.
	Hydrological and water quality changes to surface and groundwater	This site may be impacted by 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 which could impact on groundwater over the operation of the proposed scheme. Further assessment of the sensitivity of this receptor to changes in groundwater flow will be undertaken for the Environmental Statement to assess the magnitude of any potential impact.
	Air quality changes – dust	Construction of the proposed scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period.
	Air quality changes – construction traffic	No change. Following air quality assessment, no impact to this site from air quality changes due to construction traffic are considered likely.
	Introduction of INNS	The introduction of INNS to this site during construction and their subsequent dominance could significantly affect the habitats present by reducing habitat quality and species composition.

Biodiversity resource	Impact	Characterisation of impact from construction
• Brockwell Meadows LNR and LWS	Hydrological and water quality changes to surface and groundwater	It is considered unlikely that these sites would be impacted via hydrological or hydrogeological pathways as no construction of below ground structures is anticipated within proximity which could alter the groundwater resource of the sites.
	Air quality changes – dust	Construction of the proposed scheme within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period.
	Air quality – construction traffic	No change. Following air quality assessment, no impact to this site from air quality changes due to construction traffic are considered likely.
	Introduction of INNS	The introduction of INNS to these sites during construction and their subsequent dominance could significantly affect the habitats present by reducing habitat quality and species composition.
• 30 additional LWSs within 1km of the proposed scheme	Air quality changes – dust	Construction activities within 200m of the site could lead to changes in air quality, due to the impacts of dust produced during the construction period.
	Air quality – construction traffic	No change. Following air quality assessment, no impact to this site from air quality changes due to construction traffic are considered likely.
• 18 LWSs with potential GWDTE habitats	Hydrological and water quality changes to surface and groundwater	No change. It is considered unlikely that any of these sites would be impacted via this pathway as no construction of below ground structures is anticipated within proximity to these sites which could alter the groundwater resource of the site.

Biodiversity resource	Impact	Characterisation of impact from construction
Habitats		
• Ancient Woodland Inventory sites and additional ancient woodland habitats identified through field survey • Priority habitat and Annex 1 habitat: wet woodland	Air quality (dust and construction traffic)	No change. Following air quality assessment, no impact to these habitats from air quality changes due to construction traffic are considered likely.
	Hydrological and water quality changes to surface and groundwater	Works affecting groundwater such as shallow cutting in proximity to this habitat have the potential to negatively impact wet woodland habitats during the construction period.
	Loss of habitats	No Ancient Woodland Inventory sites, additional ancient woodland habitats or wet woodlands would be lost as a result of the proposed scheme.
• Veteran trees • Potential veteran trees	Air quality (dust and construction traffic)	No change. Following air quality assessment, no impact to these habitats from air quality changes due to construction traffic are considered likely.
	Hydrological and water quality changes to surface and groundwater	Works affecting groundwater such as shallow cutting in proximity to veteran trees have the potential to negatively affect them during the construction period.
	Loss of habitats	Loss of two potential veteran trees within the footprint of the proposed scheme during construction, one located east of junction 22 and one west of junction 21 (see Figure 8.1, which supports Chapter 8: Landscape and visual).
• Priority habitat; arable field margins	Loss of habitats	Some areas of arable field margins will be lost as a result of construction of the proposed scheme.
• Priority habitat; lowland mixed deciduous woodland	Loss of habitats	Loss of up to 6.5ha of lowland mixed deciduous woodland habitats within the footprint of the proposed scheme.
	Air quality (dust and construction traffic)	No change. Following air quality assessment, no impact to these habitats from air quality changes due to construction traffic are considered likely.

Biodiversity resource	Impact	Characterisation of impact from construction
• Priority habitat; eutrophic standing waters	Loss of habitats	There could potentially be a loss of 1ha of eutrophic standing water which sits within the provisional Order Limits of the proposed scheme.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction could lead to impacts to these habitats.
• Priority habitat; hedgerows	Loss of habitats	Hedgerows would be lost as a result of construction of the proposed scheme.
	Air quality - dust and construction traffic	No change. Following air quality assessment, no impact to these habitats from air quality changes due to construction traffic, are considered likely.
• Priority habitat; open mosaic habitats on formerly developed land	Loss of habitats	Some areas of these habitats will be lost within the footprint of the proposed scheme.
• Priority habitat; ponds	Loss of habitats	The loss of 19 ponds is anticipated as a result of construction of the proposed scheme.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction could lead to impacts to these habitats.
• Priority habitat: rivers	Modification of habitats associated with culverts and diversions	Construction of the proposed scheme would require diversions of Domsey Brook, Roman River and Rivenhall Brook watercourses, installation of new culverts on Rivenhall Brook and Domsey Brook and widening of bridges over the River Brain and River Blackwater. There is therefore the potential to alter a small amount of river habitat through changes to vegetation, bank profile, width, depth and shading which could alter river function.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction activities could lead to permanent hydrological impacts to river habitats.

Biodiversity resource	Impact	Characterisation of impact from construction
• Priority habitat: wood-pasture and parkland	Loss of habitats	No wood pasture and parkland habitats are likely to be lost as a result of the Proposed Scheme.
	Air quality - dust and construction traffic	No change. Following air quality assessment, no impact to these habitats from air quality changes due to construction traffic are considered likely.
Protected and notable species		
• Bat assemblage	Direct mortality	Construction of the proposed scheme may result in impacts to three currently identified roosts: B1463, a commercial building containing a likely common pipistrelle summer roost located at National Grid Reference (NGR) TL 87664 18932; B599b, a pile of breeze blocks containing a likely summer roost of a yet to be determined species located at NGR TL 79740 12245; and BE11 North Benton Bridge, a concrete overbridge containing a likely common pipistrelle and soprano pipistrelle roost located at NGR TL 82482 13392. Any bats present within these features could be affected by mortality if works (including destruction or modification of these features) are undertaken without mitigation. In addition, bats may begin to use other roosts within the zone of influence in the period up to construction of the proposed scheme, and additional roosts may be recorded by further surveys.
	Loss of roosts	Construction of the proposed scheme may result in the loss of three currently identified roosts detailed above. Further surveys will be undertaken to characterise these roosts. The impact would be of greater magnitude if the roosts are considered to have a higher value (i.e. maternity or hibernation roosts are identified).
	Loss of foraging habitat	Construction would result in the loss of habitats which bats use as foraging areas, as well as potentially impacting invertebrate species which bats prey on. There would be permanent loss of current foraging habitat within the construction footprint and temporary loss within the temporary work area during construction. Exact calculations of extent of habitats to be lost as a result of the proposed scheme are ongoing. Analysis of bat activity survey data to determine significance and importance of bat foraging habitats is ongoing.

Biodiversity resource	Impact	Characterisation of impact from construction
	Fragmentation of habitats due to loss of linear commuting routes	Construction would result in the loss of hedgerow or woodland/scrub edge habitats which bats use to commute. There would be permanent loss of current commuting routes within the construction footprint and temporary loss within temporary work areas during construction. Exact calculations of extent of habitats to be lost as a result of the proposed scheme are ongoing. Analysis of bat activity survey data to determine significance and importance of bat commuting habitats is also ongoing.
	Loss of roosting sites, foraging habitat or fragmentation of commuting routes due to lighting	Low levels of light spillage from construction activities at night could negatively affect bat activity during the construction of the proposed scheme.
	Disturbance (from changes in noise, vibration, visual and light stimuli)	Construction activities during the proposed scheme could negatively impact bats through disturbance via light spillage, noise and vibration which could discourage commuting, foraging or accessing roosts.
• Badger	Direct mortality	Increased badger mortality could potentially be caused by collisions with construction traffic or through actions which lead to badger mortality while in a sett which is damaged or modified.
	Loss of setts	Construction of the proposed scheme could potentially result in damage to or destruction of 42 setts (of which only 28 were active in recent surveys) comprising two mains, two annexes, five subsidiaries, 31 outliers and two setts of unknown status.
	Disturbance (from changes in noise, vibration)	The proposed scheme could impact badgers through disturbance from nearby noise and vibration from construction activity which may discourage foraging or accessing setts.

Biodiversity resource	Impact	Characterisation of impact from construction
	Loss of foraging habitat	Loss of foraging habitat including arable fields and grasslands is likely during the advanced works and construction of the proposed scheme.
	Fragmentation of habitats	Badger foraging and sett-building habitats could become fragmented and isolated due to construction of the proposed scheme.
• Otter	Direct mortality	Construction activities could potentially cause otter mortality through collisions with construction traffic, or while an otter is in a resting place which is damaged or modified.
	Loss of holts and couches	Otter holts or couches could be damaged or destroyed by construction works in proximity to otter habitats, for example river diversions, creation of culverts or bridge widenings.
	Loss of habitat	Discrete areas of riverine otter habitats would be lost or altered as a result of river diversion works and the installation of new culverts as part of the proposed scheme.
	Disturbance (from changes in noise, vibration, visual and light stimuli)	Construction could impact on otters through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat.
	Fragmentation of habitats	Otter foraging, commuting and resting habitats could become fragmented and isolated due to construction of the proposed scheme, particularly in relation to in-channel works such as river diversions and the construction of new culverts which may inhibit movement around the study area.
• Water vole	Direct mortality	Water vole mortality could potentially be caused by collisions with construction traffic or through actions which might cause water vole mortality while commuting such as river diversion works, or while a water vole is in a resting place which is damaged or modified. This is considered to be unlikely given the restricted distribution of water vole populations and the limited work planned in proximity to water vole habitats.
	Loss of habitat	Water vole habitats including ditches, streams and rivers could be lost as a result of any works which remove or alter these habitats including river diversions.

Biodiversity resource	Impact	Characterisation of impact from construction
	Fragmentation of habitats	Water vole habitats could become fragmented and isolated due to construction of the proposed scheme, particularly in relation to in-channel works such as river diversions and the construction of new culverts which may inhibit movement around the landscape.
	Disturbance (from changes in noise, vibration, visual and light stimuli)	Construction activities could impact on water voles through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat.
• Species of principal importance; brown hare, hedgehog and polecat	Direct mortality	Movement of construction traffic could lead to increased mortality to mammals. 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.
	Loss of habitat	Habitats which support mammals, such as arable fields which support hares, and grasslands, scrub and hedgerows which support hedgehogs, would be lost as a result of construction of the proposed scheme.
	Fragmentation of habitats	Habitats of hares, hedgehogs and polecats could become fragmented and isolated due to construction of the proposed scheme.
	Disturbance	Construction activities could impact on hares and hedgehogs through disturbance from lighting, noise and vibration which could discourage commuting, resting and/or accessing foraging habitat.
• Barn owl	Direct mortality	Movement of construction traffic could lead to direct mortality to barn owls, either through increased likelihood of collisions or through an activity which damages or destroys a barn owl resting place while in use. These potential impacts can likely be avoided by the implementation of appropriate working practices.
	Disturbance	Construction activity could cause disturbance to barn owls when in nests or roosts through additional construction noise, vibration or artificial lighting emitted especially when within 30m of a barn owl roost or nest.

Biodiversity resource	Impact	Characterisation of impact from construction
	Loss of roost/nest sites	No nest sites or roost sites are considered likely to be lost as a result of construction of the proposed scheme based on current barn owl survey information.
	Loss of foraging habitat	Loss of small areas of suitable foraging habitats for barn owl are anticipated during construction of the proposed scheme.
• Notable breeding birds; hobby *Falco subbuteo*, turtle dove *Streptopelia turtur* and sand martin *Riparia riparia* • Breeding bird assemblage	Loss of habitat	Woodland, hedgerows, scrub and grassland habitats which have the potential to support breeding birds, as well as bare ground areas used by sand martins are likely to be lost during construction of the proposed scheme.
	Disturbance	Construction activities may cause disturbance to nesting birds though noise, vibration and lighting.
	Direct mortality	Movement of construction traffic could potentially lead to direct mortality to breeding birds, either through increased likelihood of collisions or through an activity which damages or destroys a nest while in use. This would be most marked for ground-nesting birds which often nest in open fields and are camouflaged which may reduce their ability to be seen by site traffic.
• Wintering bird assemblage	Loss of habitats	Wintering birds may be impacted by a reduction in foraging and resting habitats as a result of construction of the proposed scheme.
	Disturbance	There could potentially be a temporary increase in disturbance to foraging and resting wintering birds due to construction activities and traffic.

Biodiversity resource	Impact	Characterisation of impact from construction
• Commoner reptiles; common lizard, grass snake and slow worm	Direct mortality	There is potential for mortality or injury to reptiles during removal of vegetation, site clearance, groundworks and movement of construction traffic around the site.
	Loss of habitat	Loss of suitable resting, commuting and foraging habitats for reptiles including grasslands, scrub, arable field margins, open mosaic habitats and hedgerows.
	Fragmentation of habitats	Reptile habitats could become fragmented and isolated due to construction of the proposed scheme.
• Great crested newt	Direct mortality	There is the potential of mortality or injury to GCN in their terrestrial habitat during removal of vegetation, site clearance, groundworks and movement of construction traffic around the site. Mortality of GCN could also potentially occur when animals are present in ponds affected by construction works.
	Loss of breeding and terrestrial habitats	Two breeding ponds and terrestrial habitats associated with 11 confirmed breeding ponds would be lost or modified as a result of construction of the proposed scheme. A further two confirmed breeding ponds and their associated terrestrial habitats are also within 500m of the scheme and could be affected.
	Fragmentation of habitats	Fragmentations of metapopulations of GCN could occur through construction of the proposed scheme. Isolation of GCN from breeding ponds and resting/foraging habitats could also occur.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality of ponds from construction could lead to impacts to GCN through modification of conditions required to support habitats and prey species upon which these species depend.
• Species of principal importance; common toad	Direct mortality	Mortality or injury to common toad could potentially occur during removal of vegetation, site clearance, groundworks and movement of construction traffic around the site. Mortality of toads could also potentially occur where ponds are directly impacted by construction.

Biodiversity resource	Impact	Characterisation of impact from construction
	Habitat loss	Loss of breeding ponds, terrestrial habitats and foraging habitats are anticipated due to construction of the proposed scheme.
	Fragmentation of habitats	Fragmentation of toad populations could occur through construction of the proposed scheme, through isolation of breeding ponds and resting/foraging habitats.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality of ponds from construction could lead to impacts to toads through modification of conditions required to support habitats and prey species upon which these species depend.
• Freshwater fish communities of Domsey Brook, Boreham Brook, River Brain and River Ter including European eel *Anguila anguila* • Freshwater fish communities of the River Blackwater and Roman River	Habitat loss or modification	Construction activities could lead to loss or damage to habitats due to works affecting rivers where fish species are present including diversions of Domsey Brook, Roman River and Rivenhall Brook watercourses, installation of new culverts on Rivenhall Brook and Domsey Brook and widening of bridges over the River Brain and River Blackwater with the potential to alter a small amount of river habitat through changes to vegetation, bank profile, width, depth and shading.
	Direct mortality	Construction activities could potentially lead to direct mortality to fish species during in-channel works through interaction with construction plant.
	Disturbance	Construction activities could impact freshwater fish through disturbance from lighting, noise and vibration which could discourage commuting, foraging and/or accessing foraging and breeding habitat.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction could lead to impacts to fish species through modification of conditions required to support habitats and prey species upon which these species depend.

Biodiversity resource	Impact	Characterisation of impact from construction
	Fragmentation of habitats - barriers to fish passage during river diversion and realignment works	In-channel works to watercourses where fish are present, including river diversion, culvert installations and works to river crossings, could present barriers to fish passage.
• Terrestrial invertebrate assemblage	Direct mortality	Mortality or injury to invertebrates would occur during removal of vegetation, site clearance, groundworks and movement of construction traffic around the site.
	Loss of important habitats	Of the five areas of habitats identified as having importance to terrestrial invertebrates, only Whetmead LNR is likely to be significantly affected by construction through vegetation clearance and permanent loss during advanced and site clearance works leading to a decrease in available habitats for invertebrate species.
	Hydrological and water quality changes to surface and groundwater	Hydrological changes may negatively affect sites which are important for terrestrial invertebrates, most notably Whetmead LNR which has been identified as being potentially vulnerable to changes to groundwater.
• Freshwater macrophyte communities of the River Blackwater including river water dropwort *Oenanthe fluviatilis*	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction could lead to impacts to invertebrate and macrophyte species through modification of conditions required to support habitats upon which these species depend.
	Habitat loss	Construction activities could lead to loss or damage to habitats due works affecting rivers where invertebrate and macrophyte species are present including diversions of Domsey Brook, Roman River and Rivenhall Brook watercourses, installation of new culverts on Rivenhall Brook and Domsey Brook and widening of bridges over the River Brain and River Blackwater with the potential to alter a small amount of river habitat through changes to vegetation, bank profile, width, depth and shading.

Biodiversity resource	Impact	Characterisation of impact from construction
• Freshwater macro-invertebrate communities of the River Blackwater, Boreham Brook, River Ter, Roman River, River Brain and Domsey Brook	Direct mortality	Mortality or injury to freshwater invertebrates could occur during in-channel works.
	Hydrological and water quality changes to surface and groundwater	Changes in hydrology and water quality from construction could lead to impacts to invertebrate species through modification of conditions required to support habitats upon which these species depend.
	Loss of habitats to culverts and new crossings	There would be a minor permanent loss of habitats within the footprint of new culverts and crossings due to shading and changes to hydrology beneath these structures.
• Notable plants (Nationally scarce) lesser calamint *Clinopodium calamintha* and wall bedstraw *Galium parisiense* • Notable plants (near threatened) - Field scabious *Knautia arvensis* and common cudweed *Filago vulgaris*	Direct damage or removal	Site clearance works could result in the damage or removal of these species where they occur.

Operation

9.8.9 The offline sections of the proposed scheme would fragment habitats south of the existing A12 between junctions 22 and 23, and between junctions 24 and 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.

9.8.10 Severance leads 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.

9.8.11 Mortality in the operational phase relates to animals attempting to cross a wide road, used by fast 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 morality through operation of the proposed scheme is permanent.

9.8.12 Sources of disturbance in the operational phase relate to road noise and lighting. 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.

9.8.13 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, e.g. otter and badger). The effects of road lighting are complex but include roost disturbance and abandonment; severance (for light-shy species such as 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); and increased traffic collisions for bat species such as common pipistrelle that will actively forage on insects attracted to lighting. Habitats where the impact of lighting can be particularly severe include along river corridors, woodland edges and hedgerows.

9.8.14 The key receptors that may be sensitive to changes in vehicle emissions are the designated sites noted for their floristic importance, sensitive priority habitats, ancient woodland habitats, and any species that depend on them. Elevated nitrogen concentration is generally considered to be the main threat to vegetation from vehicle emissions, but only within 200m of the ARN.

9.8.15 Operational effects to 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.

9.8.16 Groundwater could also become polluted if drainage is discharged to the ground or groundwater (although current proposals are for drainage by outfall to surface waters).

9.8.17 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.

9.8.18 The Water Framework Directive (WFD) assessment will aim to determine the effects of the proposed scheme on ecological quality, identifying any potential impacts that could cause deterioration in the assigned status of a water body or prevent a water body from meeting its WFD objectives. WFD assessment is covered in Chapter 14: Road drainage and the water environment.

9.8.19 Table 9.14 lists the biodiversity resources of interest and the associated potential impacts associated with operation of the proposed scheme without mitigation.

Table 9.14 Summary of potential operational impacts on biodiversity resources without additional mitigation

Biodiversity resource	Impact	Characterisation of impact from operation
Designated sites		
• Abberton Reservoir SPA and Ramsar site • Alde-Ore SPA and Ramsar site	Disturbance (from changes to noise, vibration, visual and light stimuli)	Due to their distance from the proposed scheme, no direct disturbance impacts are likely to occur to these sites. It is considered that the proposed scheme would therefore result in a negligible disturbance of mobile qualifying species outside the SPA and Ramsar sites considered.
• 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	Hydrological and water quality changes to surface and groundwater	The proposed scheme crosses the River Blackwater, the River Brain, the River Ter, Domsey Brook and the Boreham Tributary and would fall within the surface water catchment of the Roman River at the eastern extent of the study area. These watercourses have downstream hydrological connectivity with the Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar, and Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar. No other SPA, Ramsar or SAC is hydrologically connected to the proposed scheme (see Figure 9.1). The closest watercourse crossing is approximately 10km upstream from the closest designated site. There would therefore be no change to the water environment upstream that could cause likely significant effects to the Blackwater Estuary (Mid-Essex Coast Phase 4) SPA and Ramsar or Colne Estuary (Mid-Essex Coast Phase 2) SPA and Ramsar.
• Essex Estuaries SAC	Hydrological and water quality changes to surface and groundwater	The proposed scheme crosses the River Blackwater, the River Brain, the River Ter, Domsey Brook, Boreham Brook and the Roman River all of which have downstream hydrological connectivity with the Essex Estuaries SAC. During operation, approved drainage designs and water management, such as using new attenuation ponds to store surface runoff, would be implemented. The closest watercourse crossing is approximately 9km upstream from the SAC, and there is therefore no change to upstream environment anticipated which could result in impacts to this site.

Biodiversity resource	Impact	Characterisation of impact from operation
• Tiptree Heath SSSI	Air quality	No change. Following air quality assessment, no impact from changes in air quality is considered likely to Tiptree Heath SSSI as a result of operation of the proposed scheme.
• River Ter SSSI	Hydrological and water quality changes to surface and groundwater	The River Terr SSSI is located approximately 8km upstream from the proposed scheme. There are therefore not considered to be any likely impacts to this site from operation of the proposed scheme due to hydrological or water quality changes.
• Whetmead LNR and LWS	Air quality	Air quality assessment has indicated that this site had a predicted total nitrogen deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4kg N/ha/year and therefore has the potential to be adversely affected by changes in nitrogen deposition.
• Brockwell Meadows LNR and LWS • Cuckoo Wood LNR • Spring Lane Meadows LNR • Bocking Blackwater LNR • Galleywood Common LNR	Air quality	Following air quality assessment, no impact from changes in air quality are considered likely to these sites as a result of operation of the proposed scheme.
• Perry's Wood LWS	Air quality	Air quality assessment has indicated that this site had a predicted total nitrogen deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4kg N/ha/year and therefore has the potential to be adversely affected by changes in nitrogen deposition.

Biodiversity resource	Impact	Characterisation of impact from operation
• 32 LWS within 1km of the proposed scheme • 34 LWS within 200m of the ARN	Air quality	The air quality assessment is ongoing, and therefore the magnitude of impact due to changes in air quality on these receptors has not yet been determined. It is possible that changes in air quality from operation could lead to impacts to these sites.
Habitats		
• Veteran trees • Potential veteran trees	Air quality	Air quality assessment has indicated that this habitat had a predicted total nitrogen deposition rate above the minimum critical load, with both a predicted change in nitrogen deposition of more than 1% of the minimum critical load and of more than 0.4kg N/ha/year and therefore has the potential to be adversely affected by changes in nitrogen deposition.
• Ancient Woodland Inventory site, veteran trees and additional ancient woodland habitats identified through field survey. • Priority habitats: lowland mixed deciduous woodland, hedgerows, wood pasture and parkland	Air quality	No change. Following air quality assessment, no impact from changes in air quality is considered likely to these habitats as a result of operation of the proposed scheme.
• Priority habitat and Annex 1 habitat: wet woodland	Air quality	No change. Following air quality assessment, no impact from changes in air quality is considered likely to these habitats as a result of operation of the proposed scheme.
	Hydrological and water quality changes to surface and groundwater	Operation of the proposed scheme could lead to negative impacts to water quality from surface runoff and groundwater in proximity to this habitat from operation of the proposed scheme. During operation, approved drainage designs and water management, such as using new attenuation ponds to store surface runoff, would be implemented. There is therefore considered to be no likely impact to this habitat.

Biodiversity resource	Impact	Characterisation of impact from operation
• Priority habitat: eutrophic standing waters • Priority habitat: ponds • Priority habitat: rivers	Hydrological and water quality changes to surface and groundwater	Operation of the proposed scheme could lead to negative impacts to water quality from surface runoff and groundwater in proximity to these habitats from operation of the proposed scheme. During operation, approved drainage designs and water management, such as using new attenuation ponds to store surface runoff, would be implemented. There is therefore considered to be no likely impact to these habitats.
Protected and notable species		
• Bat assemblage • Badger • Barn Owl • Notable breeding birds; hobby *Falco subbuteo*, turtle dove *Streptopelia turtur* and sand martin *Riparia riparia* • Breeding bird assemblage • Wintering bird assemblage • Commoner reptiles; common lizard, grass snake and slow worm	Increased mortality and injury from road collisions	Operation of the proposed scheme could lead to increases in mortality due to increased likelihood of collisions.
	Fragmentation of habitats	Operation of the proposed scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats.
	Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the proposed scheme could lead to disturbance caused by increased traffic noise, vibration and lighting.
• Otter • Water vole • Great crested newt • Priority species; common toad	Increased mortality and injury from road collisions	Operation of the proposed scheme could lead to increases in mortality due to increased likelihood of collisions.
	Fragmentation of habitats	Operation of the proposed scheme potentially leading to changes in habitat use including fragmentation of foraging, commuting and resting habitats.

Biodiversity resource	Impact	Characterisation of impact from operation
	Disturbance (from changes in noise, vibration, visual and light stimuli)	Operation of the proposed scheme could lead to disturbance caused by increased traffic noise, vibration and lighting.
	Hydrological and water quality changes to surface and groundwater	Operation of the proposed scheme could lead to negative impacts on hydrology and water quality to aquatic and semi-aquatic wildlife through modification of conditions required to support habitats and prey species upon which these species depend.
• Freshwater fish communities of Domsey Brook, Boreham Brook, River Brain and River Ter including European eel *Anguila anguila* • Freshwater fish communities of the River Blackwater and Roman River • Freshwater macro-invertebrate communities of the River Blackwater, Boreham Brook, River Ter, Roman River, River Brain and Domsey Brook • Freshwater macrophyte communities of the River Blackwater including river water dropwort *Oenanthe fluviatilis*	Hydrological and water quality changes to surface and groundwater	Operation of the scheme could lead to negative impacts on hydrology and water quality to aquatic and semi-aquatic wildlife through modification of conditions required to support habitats and prey species upon which these species depend.

9.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

9.9.1 The environment team is working 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. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision-making process.

9.9.2 In addition, the design of the scheme has taken into account the locations of valuable and priority habitats including important connective habitats (i.e. hedgerows, watercourses and tree lines) and the locations of protected species. Where practicable the design has been modified to avoid impacts to these features.

9.9.3 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/existing crossing structures.

9.9.4 The design of linear habitats such as hedgerows and lines of trees would aim to increase connectivity along the proposed scheme, linking with retained woodland and hedgerows where possible.

9.9.5 River realignments would be designed in collaboration with a qualified ecologist and geomorphologist to provide more environmental gain where practicable. Realigned watercourses will be designed in order to provide a net gain for biodiversity where practicable. Freshwater ecologists would work closely with hydromorphologists so that beneficial features for wildlife including natural banks, riffles, sinuosity and variation in depths are included within designs.

9.9.6 Attenuation ponds would be provided to mitigate for flood risk and enable road runoff to be treated prior to discharge into receiving watercourses, mitigating pollution of surface water. These would be designed to mimic natural water bodies where possible by providing varying depths including shallow margins, native wetland plant species and macrophytes, and surrounded by wildflower and grassland areas seeded from an appropriate species-rich seed mix.

9.9.7 Groundwater pollution would be mitigated by lining ponds situated on permeable strata to prevent road runoff discharging into the ground and groundwater.

9.9.8 Where practicable, clear span bridges would be provided for new structures as they provide limited impact to hydromorphological processes and maintain the riparian structure of banks.

9.9.9 Fencing would be incorporated within the proposed scheme where necessary (and where this would not conflict with requirements for other species and with road user safety) to minimise the risk of wildlife road casualties.

9.9.10 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the proposed scheme description and Chapter 3: Assessment of alternatives.

Standard mitigation

9.9.11 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect include the following:

- Loss of habitats with importance for wildlife such as hedgerows, woodland, scrub and water bodies would be avoided in the first instance.
- Works would be timed to avoid sensitive periods for protected species where possible, for example: timing works to avoid impacts to bat roosts (i.e. avoiding works in proximity to a maternity roost outside of the maternity period); avoiding night working near sensitive features such as badger setts, bat roosts and watercourses; avoiding removal or disturbance of any nesting bird habitat during bird breeding season (generally between 1 March and 31 August); and avoiding in-channel works for main rivers during freshwater fish spawning and migration periods (March-June).
- Clearance of habitats within the construction area under ecological 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 young birds have fledged and the nest is no longer active.
- Clear demarcation of construction areas, compounds and material storage in order to avoid encroachment onto surrounding habitats; and avoiding the creation of features which could attract wildlife into works areas, for example large stockpiles of earth in areas of known badger activity to prevent the excavation of new setts.
- Leaving important commuting features such mammal pathways and river channels clear of obstruction and raising temporary fencing slightly off the ground (150mm) or providing gaps at regular intervals to allow wildlife to move freely throughout their normal territories where appropriate.
- Any trenches, trial pits and excavations such as the borrow pits would be covered overnight or fenced off in order to prevent animals falling in and becoming trapped. Where excavations would not be able to be closed or filled on a nightly basis, a means of escape would be provided.
- Implementing appropriate buffer zones and stand-off distances from sensitive features such as confirmed bat roosts, badger setts, otter holts, water vole burrows, birds' nests and watercourses, to be demarcated using physical barriers such as Heras fencing to prevent encroachment of works.

- Control of lighting at night near to light-sensitive features such as watercourses where otters and fish species, badger setts, and bat roosts and commuting habitats are present. Temporary and permanent lighting would be designed to avoid light spill on important bat foraging habitats, which could reduce foraging resource through disturbance in accordance with best practice guidance (Bat Conservation Trust, 2018).
- Control of noise and vibration from construction and operation of the proposed scheme using noise barriers or landscaping, for example bunding, around sensitive features such as confirmed bat roosts, badger setts, barn owl nests and watercourses.
- Implementation of the Invasive Species Management Plan (ISMP) to control and prevent the spread of INNS.
- General protective and control measures to be detailed in Environmental Management Plans (EMP), risk assessments and method statements during the construction phase.
- Water pollution would be avoided through standard mitigation measures to be detailed in the EMP (see Chapter 14: Road drainage and the water environment, for more information).
- A Landscape and Ecology Management Plan (LEMP) would be produced detailing how landscape and ecology mitigation will be delivered.
- Construction Industry Research Information Association (CIRIA) guidance would be adopted as good practice (see Chapter 14 for more information).

9.9.12 Pre-construction surveys would be undertaken for bats, badgers, otter, water vole and reptiles to confirm status within the study area.

9.9.13 Standard mitigation will be included in a first iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (Chapter 5: Environmental assessment methodology).

Additional mitigation

9.9.14 Additional mitigation for each biodiversity resource is described below and where appropriate on the Preliminary Environmental Masterplan (Figure 2.1).

Designated sites

9.9.15 Impacts to Whetmead LNR would need to be offset through creation or enhancement of habitats within the proposed scheme. One option is to restore or improve the condition of formerly wet habitats within the site, possibly through lowering the land in localised areas. Proposals for mitigation will be developed in collaboration with groundwater specialists. Discussions with stakeholders to inform this approach are ongoing.

9.9.16 Brockwell Meadows LNR sits outside of the footprint of the proposed scheme on the opposite side of the River Blackwater. It is therefore considered highly unlikely that any of the activities associated with the construction or operation of the proposed scheme would impact on this site and therefore no specific mitigation is recommended.

9.9.17 Brockwell Meadows LWS is located adjacent to the proposed scheme and working areas would be clearly delineated through standard mitigation methods to avoid any encroachment of activities into this site and therefore no additional mitigation would be required.

Habitats

9.9.18 The proposed scheme, as part of the wider Highways England Delivery Plan, would aim to achieve no net loss of biodiversity (with an aspiration to provide a net gain), in line with the requirements of the National Planning Policy Framework and NNNPS.

9.9.19 Calculations to determine the exact areas and extent of habitats post-construction are ongoing, however one of the general aspirations of the proposed scheme is to create net gains to biodiversity, and in principle, where habitats are lost as a result of the proposed scheme, new habitats of equal or greater value would be created.

9.9.20 This would include the creation of wildflower and grassland areas, seeded from an appropriate species-rich seed mix, as well as the planting of new trees and woodland and species-rich hedgerows and scrub comprising locally native tree, shrub and herbaceous species of local provenance. Where practicable, hedgerows would be planted at a ratio of 2:1 in relation to those lost, and planting will be designed to maintain and increase connectivity around the proposed scheme and within the wider landscape.

9.9.21 Two new ponds would be created for every one lost, where practicable. New ponds would be designed to mimic natural water bodies by providing varying depths including shallow margins, native wetland plant species and macrophytes, and would be surrounded by wildflower and grassland areas seeded from an appropriate species-rich seed mix.

9.9.22 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 would be incorporated into the proposed scheme designs. This would include some planting of more established trees and shrubs (aged 4-5 years) where possible.

9.9.23 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, badgers, brown hare, hedgehogs, polecat, breeding and wintering birds, GCN, reptiles and terrestrial invertebrates.

Protected and notable species

9.9.24 A Protected Species Compliance Report will be provided with the Environmental Statement to document the mitigation that would be put in place to comply with legal requirements for protected species that may be impacted but that would not be significantly affected in EIA terms.

Bats

9.9.25 Owing to their legal status, a Natural England EPSM licence would be required to destroy or disturb any bat roost. All EPSM licences required would be applied for following the grant of the DCO, with mitigation work, such as the provision of replacement roosting habitat, preceding this where necessary. The EPSM licence applications would provide details of the works proposed (including programme), replacement roost creation, and the working methods to ensure avoidance of harm to bats and any additional survey and monitoring work that would be undertaken as part of each EPSM licence as described in more detail below.

9.9.26 Three confirmed bat roosts (one building, one pile of breeze blocks and one bridge structure) may be impacted (lost or altered) as part of construction of the proposed scheme.

9.9.27 These are B1463, a commercial building containing a likely common pipistrelle roost located at National Grid reference TL 87664 18932, B599b, a pile of breeze blocks containing a likely summer roost of a yet to be determined species located at NGR TL 79740 12245, and BE11 North Benton Bridge, a concrete overbridge containing a likely common pipistrelle and soprano pipistrelle roost located at National Grid reference TL 82482 13392. Further surveys are required to fully characterise these roosts; however, it is anticipated that the loss of these roosts would be mitigated through the provision of suitable roosting boxes. Should further surveys determine the presence of higher value roosts (i.e. maternity or hibernation roosts), increased mitigation in line with relevant guidance may be required.

9.9.28 The size and style of the box would be suitable for the species in the existing roost, and three boxes would be provided to mitigate for every roost lost. 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, i.e. away from sources of noise or lighting disturbance.

9.9.29 Building assessment surveys are ongoing and may record additional roosts which would be subject to impacts from the proposed scheme.

9.9.30 Where buildings containing bat roosts need to be removed or altered as part of the proposed scheme, the following general process would be undertaken:

- A ‘ghost’ Natural England EPSM licence detailing the specific mitigation approach would be sought prior to the DCO application; this would detail the specific mitigation approach.
- Pre-works surveys including internal inspections and/or emergence and re-entry surveys to inform and update the EPSM licence application.
- 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 demolition 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 the best times for works in relation to bats; and work in October also avoids the risk of disturbance to nesting birds.
- 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.
- The provision of alternative roosting habitat. A number and variety of bat boxes would also be erected in nearby trees (on a ratio of at least three bat boxes erected per roost removed to be suitable for the species of bat roosting in the existing feature) prior to works taking place which could impact a roost. A plan, detailing the location of all replacement roosts/bat boxes, would be included in the EMP for reference during construction.

9.9.31 A number of bat roosts in trees have been identified, however none would be damaged, altered or lost as a result of construction or operation of the proposed scheme. Tree assessment surveys are ongoing and may record additional roosts which may be subject to impacts from the proposed scheme.

9.9.32 Should trees which have been confirmed to contain bat roosts need to be removed or altered as part of the proposed scheme, the mitigation approach would be similar to that undertaken for roosts in buildings and structures.

9.9.33 Where impacts to a roost from noise and vibration are unavoidable and likely to cause disturbance, a suitable EPSM licence will be sought from Natural England.

9.9.34 Landscaping and habitat planting will be designed to increase connectivity across the landscape and avoid fragmentation of foraging and commuting habitats.

9.9.35 Impacts to important bat foraging and commuting habitats such as woodlands, hedgerows and watercourses would be avoided in the first instance.

9.9.36 Where this cannot be avoided, habitat lost as a result of the proposed scheme would be mitigated by the provision of newly created habitat. This would be designed so that connectivity across the proposed scheme is maintained with the wider landscape.

9.9.37 Creation of new habitat within landscaping and mitigation areas would be designed to enhance bat foraging, for example through the provision of native flowering trees and shrubs which would attract invertebrate prey species.

Badger

9.9.38 Construction of the proposed scheme would result in damage to or destruction of 42 setts comprising two mains, two annexes, five subsidiaries, 31 outliers and two setts of unknown status.

9.9.39 A Natural England ghost licence would be sought as part of the DCO application for the closure of multiple setts; this would apply to 28 setts which were determined to be partially active or very active.

9.9.40 Destruction of 14 setts determined to be disused may be undertaken without licensing.

9.9.41 Usage 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 start of works.

9.9.42 Two artificial setts would be created to mitigate the loss of two main setts and facilitate the relocation of badgers within their existing territory. In accordance with Natural England guidelines, these would need to be constructed at least six months prior to the exclusion phase (governed by the licence). Natural England licences for development work in respect of badgers are issued with a start date from 1 July and badger exclusion works must be completed by the end of November the same year. Suitable locations within proximity to the existing setts have been identified and will be subject to agreement with Natural England.

9.9.43 Surveys to establish the levels of activity and numbers of individual badgers using these setts, which will inform the design of the artificial setts, are ongoing.

9.9.44 Exclusion of badger setts would follow standard procedures under licence, as supervised by a suitably experienced ecologist.

Otter

9.9.45 Where an otter resting place (i.e. a couch or a holt) would be disturbed, damaged or destroyed as a result of the proposed scheme, a ghost Natural England EPSM licence would be submitted as part of the DCO application and would detail the specific mitigation approach.

9.9.46 Where an otter resting place is recorded within proximity to the proposed scheme but would not be disturbed, damaged or destroyed, a safe working methodology would be followed as determined by a suitably qualified ecologist, which may involve a pre-works check of the site and supervision of works in that area.

9.9.47 Mammal ledges would be created within newly constructed or modified existing culverts where possible, or other suitable mammal passage to be agreed. Mammal ledges would be at least 500mm wide and accessible from the bank by ramps and would be positioned at least 150mm above the 1:100 flood level and allow for at least 600mm headroom to allow for movement of otters under the proposed scheme (as well as other species such as badgers).

Water vole

9.9.48 The proposed scheme would have no direct impacts on the banks of the ditches located at junction 19 where water vole activity was recorded.

9.9.49 Should a water vole burrow which would be disturbed, damaged or destroyed as a result of the proposed scheme, be discovered ahead of works, an EPSM licence would be obtained from Natural England.

9.9.50 During construction in proximity to known water vole habitats, bankside habitat would be fenced off and a sufficient buffer from works maintained to prevent unnecessary damage to water vole burrows and disturbance to water voles. Site control measures would be detailed in the EMP.

9.9.51 Works on Domsey Brook to the south of 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. Pre-construction surveys would be undertaken to ensure that no further burrows have been created ahead of works.

9.9.52 No other evidence of water vole was recorded at any watercourse around the proposed scheme during the 2020 surveys. However, as there is historic evidence of water voles in the area as well as a number of watercourses which have potential to support water voles, measures are included in the design to allow for future migration of water voles around the study area.

9.9.53 Drainage designs include mammal ledges within culverts and under bridges at all suitable watercourses that would be crossed by the proposed scheme where practicable or other suitable mammal passage to be agreed. This would allow for the safe passage of water voles and other mammal species under the carriageway.

9.9.54 Where possible, drainage features would allow for the creation of new habitat suitable for water voles through the selection of ponds and open drainage ditches with vegetated earth banks, as opposed to closed (culverted or buried) drainage options that would not support water voles. Drainage features around junction 19 are being designed to encourage movement of nearby water vole populations into these habitats.

9.9.55 New ditches and ponds would also be planted or seeded with suitable water vole food plants to provide cover and foraging resource.

Other mammals

9.9.56 No additional mitigation for other mammals is recommended.

Birds

9.9.57 Provision of bird nesting boxes to mitigate for the loss of nesting habitat, 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. These would be made from hard wearing materials such as exterior grade plywood, recycled plastic or woodcrete. These would be installed in retained vegetation within the Order Limits such as attached to tall trees, new or existing buildings or structures, or free-standing posts as appropriate.

9.9.58 Creation of new habitats such as woodland, trees, scrub, grassland and water bodies would benefit birds through provision of new foraging and nesting opportunities, as well as mitigating the loss of other habitats.

Barn owl

9.9.59 No barn owl roosting or nesting sites are considered likely to be lost or altered as a result of the proposed scheme. Pre-construction surveys of all trees and buildings which would be impacted would be completed in order to determine their use by barn owls ahead of works.

9.9.60 Barn owl boxes would be installed over 1.5km from the proposed scheme to increase nesting opportunities and avoid increased barn owl road casualties. These would be made from hard-wearing materials such as exterior grade plywood or recycled plastic and locations of boxes would be identified through stakeholder engagement with Essex Wildlife Trust.

9.9.61 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

9.9.62 Surveys indicated that low populations of 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.

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

9.9.64 Where clearance of areas of known reptile presence (or large areas considered suitable for reptiles) is required, a translocation exercise would be undertaken by suitably experienced ecologists to remove reptiles to receptor sites ahead of works and avoid direct mortality of animals.

9.9.65 Suitable receptor sites would ideally be located in close proximity to the donor sites, would not currently support a population of reptiles and amphibians, and would be able to support the translocated populations given appropriate remedial works or improvement. These may include habitat planting and the creation of basking sites, hibernation sites (hibernacula) and refuges as necessary to be undertaken in advance of works.

9.9.66 A number of sites with suitability to serve as receptor sites for translocated reptile populations are being considered. The exact locations of these sites will be reported within the Environmental Statement. New ponds, ditches, grassland, scrub and woodland habitats within these areas would be designed with suitability for reptiles in mind, including the provision of habitat piles, hibernacula and refugia to support reptiles at all life stages and mitigate the loss of reptile habitats. The exact locations, extent and number of these receptor sites which will be pursued is yet to be confirmed pending stakeholder consultation.

9.9.67 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.

9.9.68 Receptor sites would be established well ahead of any translocation (at least six months) as part of the advanced works to allow newly created and enhanced habitats to become sufficiently established prior to introducing the animals.

9.9.69 Receptor sites would be designed to tie in with the wider environment to prevent fragmentation of populations, including providing connectivity with proposed scheme road verges so that populations are able to naturally expand and move across the study area. This could include, for example, provision of habitat strips on road crossings to mitigate potential barrier effects.

9.9.70 Translocation would be undertaken using standard approved methods overseen by suitably experienced ecologists.

Great crested newt

9.9.71 Two confirmed GCN breeding ponds, and terrestrial habitats in proximity to (i.e. within 500m of) 11 GCN breeding ponds, would be lost, damaged or modified as a result of construction of the proposed scheme.

9.9.72 GCN mitigation to alleviate these impacts would be delivered via Natural England's district level licensing 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 habitat 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 are 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.

9.9.73 Discussions with Natural England regarding the details of this process are ongoing, however no further survey for GCN is required.

9.9.74 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 of the working area by a suitably licensed ecologist. Areas of suitable habitat would be identified and confirmed ahead of works.

Other amphibians

9.9.75 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 outside of the working area by a suitably experienced ecologist.

9.9.76 New ponds would be created around the proposed scheme within mitigation and landscape areas at a ratio of 2:1 against ponds lost where practicable, which would benefit toads by mitigating the loss of any ponds which they may use.

Freshwater fish

9.9.77 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.

Terrestrial invertebrates

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

- Felled vegetation and dead timber would be retained and made into habitat piles within retained vegetation and proposed landscaping and mitigation areas under direction of a suitably experienced ecologist. The exact number and location of habitat piles would be identified ahead of the DCO submission and included within the first iteration of the EMP.
- Mitigation areas, as well as broader landscaping, will be designed with benefits to invertebrates in mind. Designs may 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.
- Planting of new habitats will be designed in line with preferences of notable invertebrate species, for example the provision of 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.

Freshwater macro-invertebrates

9.9.79 No additional mitigation for freshwater macro-invertebrates is recommended.

Notable plants

9.9.80 Measures that would be implemented to avoid impacts on notable plants would comprise the following:

- Areas where notable plants have been recorded would be avoided in the first instance and suitable buffers maintained to prevent encroachment of working areas. These areas and measures would be included in the first iteration of the EMP
- Habitat creation would be designed to include native species of local provenance in keeping with the landscape character of the proposed scheme and surrounds

9.9.81 In addition, it is considered that where notable plants are disturbed or lost to the construction works, they are likely to re-seed and recolonise following construction of the proposed scheme.

Freshwater macrophytes

9.9.82 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.

9.9.83 Appropriate stand-off distances would be implemented around watercourses where suitable, using physical barriers during construction works to protect aquatic species from destruction and disturbance.

Enhancement

9.9.84 Options for enhancements for biodiversity are being investigated and may include the following:

- A net gain of new habitats within landscape and mitigation areas, including new wildflower and grassland areas seeded from a species-rich seed mix, as well as trees and woodland and species-rich hedgerows and scrub comprising native tree, shrub and herbaceous species of local provenance.
- Creation of new wildlife-friendly ponds. These would be designed to mimic natural water bodies by providing 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.
- Incorporating wildlife-friendly design into any new drainage features such as ponds and ditches in line with the above.
- Provision of bat roosting boxes (over and above the numbers required for mitigating roost losses) suitable for supporting roosts of various species ranging from summer roosts for low numbers of non-breeding male crevice-dwelling species (i.e. common pipistrelle) to larger boxes suitable for maternity roosts and hibernation boxes. Bat boxes would be made of woodcrete which is hard wearing and long lasting (20-25 years). 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.
- Investigation of opportunities for the creation of a bat hibernacula to provide new hibernation habitat for the local bat population.
- 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 barn owl boxes over 1.5km from the proposed scheme to increase nesting opportunities and avoid increased barn owl road casualties. These would be made from hard-wearing materials such as exterior grade plywood or recycled plastic, and locations of boxes would be identified through stakeholder engagement with Essex Wildlife Trust.
- Planting-up of gappy hedgerows with native shrub and woody species of local provenance to improve diversity and habitat connectivity.
- Creation of habitat piles from felled vegetation and dead wood, to be installed within retained habitat and designated landscaping and mitigation areas.
- Management of watercourses including removal of bankside vegetation to decrease shading, and removal of in-channel vegetation where this has become choked to increase biodiversity and function.

- Realigned watercourses would be designed to provide a net gain for biodiversity where practicable. Freshwater ecologists will work closely with hydromorphologists so that beneficial features for wildlife including natural banks, riffles, sinuosity and variation in depths are included within designs at an early stage.
- Creation of new water vole habitat in the form of ditch networks and ponds close to watercourses supporting this species currently or recently.

9.9.85 Enhancements will be discussed and agreed with stakeholders. It may be possible to make use of Designated Funds to deliver additional enhancements, however these would be delivered through discrete projects outside of the proposed scheme (i.e. not included in the DCO application).

9.10 Assessment of likely significant effects

Construction

Designated sites

9.10.1 No adverse effects to any SAC, SPA or Ramsar sites are anticipated from construction and the significance of effects is therefore considered to be **neutral**.

9.10.2 As the River Ter SSSI is approximately 8km upstream from the proposed scheme crossing, no impacts to the surface water environment are anticipated this far upstream and the significance of effects would be **neutral**.

9.10.3 Brockwell Meadows LNR sits outside of the footprint of the proposed scheme on the opposite side of the River Blackwater. Brockwell Meadows LWS is located adjacent to the proposed scheme, however no direct impacts are considered likely. It is therefore considered that hydrological impacts to the site can be discounted, providing mitigation measures are used to prevent changes in hydrology including pollution. Impacts from dust and air quality during construction are also considered unlikely with mitigation measures in place and therefore the significance of effect is considered to be **neutral**.

9.10.4 LWS within 200m of construction of the proposed scheme (Boreham Road Gravel Pits, Riverview Meadows LWS, Sandon Riverside Potential LWS and The Grove LWS) are considered to be unlikely to be affected by dust and air quality changes during construction with mitigation and therefore the significance of effect is considered to be **neutral**.

9.10.5 Construction of the proposed scheme would result in the direct loss of approximately 0.8ha of semi-natural broadleaved woodland which forms part of Whetmead LNR as well as permanent land take from construction.

9.10.6 Mitigation of these impacts is currently being developed through stakeholder discussions. It is considered that there are likely to be several suitable options to mitigate this impact and that following confirmation of the approach, the significance of effect would be neutral with respect to habitat loss.

9.10.7 This site may be impacted by 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 which could impact on groundwater during the operational period of the proposed scheme.

9.10.8 Impacts from dust and air quality during construction are also considered unlikely with mitigation measures in place.

9.10.9 Further assessment of the sensitivity of this receptor to changes in groundwater flow will be undertaken for the Environmental Statement to assess the magnitude of any potential impact. Therefore, in the absence of assessment on groundwater flow, on a precautionary basis, significance of effects is assessed as **slight adverse** at this time.

Habitats

9.10.10 No areas of Ancient Woodland Inventory habitat, potential ancient woodland habitat or wet woodland would be lost as a result of construction of the proposed scheme. However, these habitats have the potential to be affected by air quality changes during construction, albeit these impacts would be temporary and the significance of effects is assessed as **neutral**.

9.10.11 Two potential veteran trees would be lost due to construction of the scheme. Loss of veteran trees cannot be mitigated due to the time period over which a veteran tree matures. Significance of effects on potential veteran trees is therefore assessed as **moderate adverse**.

9.10.12 No confirmed veteran trees would be lost due to construction of the scheme.

9.10.13 No wood pasture and parkland habitats would be lost as a result of construction of the proposed scheme, and only small areas of lowland mixed deciduous woodland would be lost, with the majority retained.

9.10.14 Construction of the proposed scheme would lead to a direct temporary loss of habitats, including some areas of priority habitats which, although common and widespread throughout the UK and the local area, provide ecological value at the national level. Whilst mitigation for the loss of these would be provided through habitat creation, some of these habitats (for example lowland mixed deciduous woodland) would take a significant time to mature to the quality of habitats being lost. It is therefore assessed that loss of woodland habitats would lead to a **moderate adverse** significance of effect.

9.10.15 Much of the land within the footprint of the proposed scheme (approximately 75%) is cultivated arable land of negligible ecological value, and therefore, loss of this habitat type would not result in any significant effects.

9.10.16 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.

9.10.17 The LEMP would include details of how the soft estate of the proposed scheme would be managed in an ecologically sensitive manner to be of benefit to wildlife, so that the conservation status provided by the landscaping and mitigation areas is maintained in the long term.

9.10.18 Given the permanent loss of broadly lower-status arable habitats, and the creation of new more diverse habitats, it is considered that the significance of effects from construction on priority habitats including arable field margins, eutrophic standing waters, hedgerows, open mosaic habitats on formerly developed land, pond and river habitats, would be **slight beneficial**.

Protected and notable species

Bats

9.10.19 No confirmed bat roosts in trees are likely to be lost as a result of constructing the proposed scheme, however, surveys are ongoing.

9.10.20 One structure (BE11 North Benton Bridge), one pile of breeze blocks (containing a likely summer roost of a yet to be determined species located at NGR TL 79740 12245) and one building (B1463) confirmed as in use by roosting common and soprano pipistrelle bats would likely be lost or altered as a result of constructing the proposed scheme. Ongoing surveys to characterise these roosts will determine the level of impact anticipated.

9.10.21 Construction of the proposed scheme may result in the temporary reduction of roosting habitat through the removal of trees with some suitability for 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.

9.10.22 Construction of the proposed scheme could result in significant 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.

9.10.23 Analysis of bat commuting activity survey data is ongoing, and there is therefore some uncertainty regarding the significance and importance of the habitats within the provisional Order Limits for bats. Of note are the records of the rare barbastelle bat, and any effects determined to this species may be of greater significance.

9.10.24 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 increase foraging and roosting resource for bats as well as enhancing commuting and foraging routes once habitats have had time to mature.

9.10.25 It is therefore considered that construction of the proposed scheme would lead to a **neutral** significance of effect on bats.

Badgers

9.10.26 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.

9.10.27 General impacts from construction, including impacts to most setts identified in the proposed scheme footprint and impacts to commuting and/or foraging badgers, can 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.

9.10.28 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.

9.10.29 Construction of the proposed scheme would result in the destruction of 42 setts, including two main badger setts, with provision of two artificial setts to mitigate this loss.

9.10.30 Surveys to establish the activity levels and number of individuals at these locations to better inform the design of the artificial setts are ongoing. Once confirmed, the design and locations of artificial setts will require approval from Natural England via the ongoing consultation process.

9.10.31 In addition, Natural England will require evidence that the artificial setts are in use, for licences to interfere with a badger sett for development purposes to be granted. There is therefore a risk to the findings of this assessment if this cannot be evidenced.

9.10.32 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 significant 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 and it is therefore considered that the significance of effect on badgers would be **neutral**.

Otter

9.10.33 Otters could be affected by construction activities through direct mortality, loss of resting places, loss of habitats, disturbance associated with noise and vibration, and through potential changes to water quality and hydrology in the absence of mitigation.

9.10.34 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 is required (e.g. at Rivenhall Brook between junction 22 and junction 23) is likely to prevent otters from commuting, foraging and resting in these areas for the duration of construction.

9.10.35 Otters would likely avoid areas of disruption during the construction period for resting and foraging. Commuting corridors would therefore be maintained throughout the construction phase to allow otters to reach resting and foraging areas up and downstream of the proposed scheme where practicable. Where this is not possible there would be temporary impacts on commuting otters for the duration of the works.

9.10.36 Bridges and culverts are being designed to include passage for otters, allowing for continued foraging and commuting during operation. However, this may be temporarily reduced during construction as otters are likely to avoid these areas.

9.10.37 Monitoring of an otter holt is ongoing and it is therefore currently uncertain whether this feature may be affected by construction of the proposed scheme.

9.10.38 Where a likely impact to an otter resting place is determined, a Natural England EPSM licence would be sought which would detail how these impacts would be mitigated.

9.10.39 Standard mitigation would be used to avoid or alleviate effects to watercourses and will be included within the first iteration EMP and detailed in the Environmental Statement.

9.10.40 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 provisional Order Limits, and the significance of effects would be **neutral**.

Water vole

9.10.41 Water vole presence is highly localised within the study area, with two small populations present in proximity to the proposed scheme.

9.10.42 Water voles could be impacted by increased disturbance through noise and vibration within these areas, although this would be temporary and limited to the movement of construction traffic for the duration of construction.

9.10.43 Creation of wildlife-friendly water features such as ponds and ditches in proximity to confirmed water vole populations, particularly around junction 19, would create a net gain in habitats for water voles.

9.10.44 Standard mitigation would be used to avoid or alleviate effects to watercourses and will be included within the first iteration EMP and detailed in the Environmental Statement.

9.10.45 The significance of effects on water voles are considered to be **moderate beneficial**.

Other mammals

9.10.46 Construction of the proposed scheme would result in temporary impacts to brown hares and hedgehogs and any other notable mammals present within the footprint of the proposed scheme through direct mortality, disturbance and habitat loss without mitigation.

9.10.47 Standard mitigation measures to be outlined in the first iteration EMP would avoid direct mortality of these species as well as the majority of disturbance impacts.

9.10.48 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 additional resource for foraging and resting.

9.10.49 The significance of effects on other mammals would therefore be **slight beneficial**.

Barn owl

9.10.50 The proposed scheme is likely to cause disturbance to roosting or nesting barn owls through noise and vibration without the implementation of mitigation.

9.10.51 Construction of the proposed scheme is unlikely to significantly alter existing barn owl foraging habitats.

9.10.52 No barn owl nest sites would be lost as a result of the proposed scheme, but four roost sites may be lost. Standard mitigation would be used to prevent disturbance to roosting or nesting barn owls in proximity to the proposed scheme footprint.

9.10.53 Barn owls would benefit in the long term from the creation of new habitats 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 of the study area.

9.10.54 The significance of effects on barn owls is considered to be **neutral**.

Breeding birds

9.10.55 Construction impacts upon breeding birds are likely to include temporary loss of available roosting and nesting habitat from physical land take and clearance within the footprint of the proposed scheme, disturbance from noise, artificial lighting and a general increase in human activity in many areas. Breeding birds would be vulnerable to mortality or injury during site clearance in the absence of mitigation.

9.10.56 Disturbance would be most pronounced on smaller species which would be especially vulnerable to noise and direct habitat loss, and ground-nesting species such as lapwing *Vanellus vanellus*, skylark and yellow wagtail *Motacilla flava*, that would be vulnerable to movement of construction traffic and land take effects.

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

9.10.58 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.

9.10.59 Creation of new habitats such as woodland, trees, scrub, grassland and water bodies would benefit birds through provision of new foraging and nesting opportunities, as well as mitigating the loss of other habitats.

9.10.60 The significance of effects on breeding birds is therefore considered to be **neutral**.

Wintering birds

9.10.61 Wintering birds may be affected by temporary impacts from construction including disturbance from noise, artificial lighting and a general increase in human activity in some areas.

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

9.10.63 Key habitats for wildfowl, such as Colemans Reservoir in proximity to junction 22, would remain unchanged as a result of the proposed scheme. Key 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.

9.10.64 Creation of new habitats including grasslands and ponds may be beneficial to wintering bird species in the long term through increased foraging and resting resource.

9.10.65 Significance of effects on wintering birds from construction is therefore considered to be **neutral**.

Reptiles

9.10.66 Commoner reptiles identified within the study area (common lizard, grass snake and slow worm) are also common and widespread throughout the wider landscape.

9.10.67 Clearance within the footprint of the proposed scheme during construction has the potential to cause harm to any reptiles that are present at the time through direct mortality and injury.

9.10.68 The proposed scheme would also result in the loss of some areas of reptile habitat.

9.10.69 Translocation of reptiles into newly created habitats would avoid mortality and injury to populations. In addition, the creation of new ponds, ditches, grassland, scrub and woodland habitats within landscaping areas would result in a net increase in the amount of suitable reptile habitat present.

9.10.70 Significance of effects on reptiles would therefore be **slight beneficial**.

Great crested newt

9.10.71 GCN would likely suffer mortality and habitat loss as a result of construction of the proposed scheme without mitigation.

9.10.72 Two confirmed GCN breeding ponds (P91 and P099) are likely to be damaged or lost as a result of constructing the proposed scheme, and terrestrial habitats associated with 11 other confirmed breeding ponds would also be lost, damaged or altered during construction.

9.10.73 Mitigation for GCN delivered through the district level licensing 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. Discussions with Natural England regarding this process are ongoing.

9.10.74 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.

9.10.75 This would provide a significant benefit to GCN populations within the study area and surrounds. The significance of effect from construction would therefore be **moderate beneficial**.

Other amphibians – common toad

9.10.76 Common toad would be subject to habitat loss and likely mortality as a result of the proposed scheme without mitigation.

9.10.77 Common toads would be protected via mitigation for reptiles which would reduce impacts of direct mortality. In addition, no confirmed common toad breeding ponds would be lost or modified as a result of constructing the proposed scheme.

9.10.78 Common toad would benefit from habitat creation in mitigation and landscaping areas, including new woodland, grassland, hedgerow and pond habitats.

9.10.79 Significance of effects on common toad from construction would therefore be **slight beneficial**.

Freshwater fish

9.10.80 Freshwater fish are likely to be affected by the proposed scheme due to construction disturbance from noise, vibration and artificial light, and the potential of water pollution.

9.10.81 Fish may also be impacted by watercourse diversion which could prevent movement up and downstream in the absence of mitigation.

9.10.82 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 and the significance of effect would be **neutral**.

Terrestrial invertebrates

9.10.83 Terrestrial invertebrates would be affected by the construction of the proposed scheme through loss of some habitats within sites surveyed, most notably within Whetmead LNR. All other sites would be retained, or only very small areas of habitats would be affected.

9.10.84 Impacts to Whetmead LNR, identified as an important site for invertebrates, would involve the loss of approximately of 8,000m^2 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. Therefore, the majority of notable species recorded at this site would not be significantly impacted by the removal of woodland habitats.

9.10.85 Mitigation for loss of habitats at Whetmead LNR would also mitigate impacts to the invertebrate assemblage of this site. In addition, creation of new habitats, 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.

9.10.86 The significance of effect from construction on terrestrial invertebrates is therefore considered to be **slight beneficial.**

Freshwater macro-invertebrates

9.10.87 Freshwater macro-invertebrates could be affected by construction of the proposed scheme through the direct mortality from in-channel works, the potential for water pollution and habitat loss as a result of constructing new culverts and river realignments.

9.10.88 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.

9.10.89 Bridges over watercourses and culverts are being designed to mitigate effects on aquatic receptors. Watercourse realignments are being designed with the aim of making improvements for biodiversity.

9.10.90 With mitigation, the significance of effects during construction on freshwater macro-invertebrates is considered to be **neutral**.

Notable plants

9.10.91 Notable plants would be impacted by the proposed scheme through disturbance and removal as a result of site clearance.

9.10.92 Notable plants would be avoided in the first instance and working areas demarcated to prevent encroachment of site activities into these habitats. Where notable plants are affected it is considered that these species are likely to become re-established following construction.

9.10.93 The significance of effects from construction on notable plants is therefore considered to be **neutral**.

Freshwater macrophytes

9.10.94 The notable freshwater macrophyte river water dropwort may be affected by construction of the proposed scheme through the potential for water pollution. Habitat loss is possible from shading of watercourses as a result of bridge and culvert construction.

9.10.95 Water pollution would be avoided through standard mitigation measures. Appropriate stand-off distances would be implemented using physical barriers around watercourses during construction works to protect aquatic species from disturbance where suitable.

9.10.96 River water dropwort was only recorded on the River Blackwater which would not be subject to any new structures, only widening of an existing structure. It is therefore considered that there would be no risk to this species from destruction or removal.

9.10.97 Significance of effects of the construction of the proposed scheme on freshwater macrophytes is therefore considered to be **neutral**.

Operation

Designated sites

9.10.98 Operation of the proposed scheme has the potential to adversely affect designated sites and ecological receptors through changes in air quality.

9.10.99 The proposed scheme has the potential to cause an exceedance of lower critical load thresholds, or for nitrogen deposition rates to exceed 1% of the lower critical load, at some sites.

9.10.100 Air quality modelling indicates a potential significant effect on Whetmead LNR and LWS and Perry's Wood LWS through operation of the proposed scheme. Further assessment is required when air quality modelling data is available, therefore as a precaution the potential impact is considered to be **moderate adverse** at this time. This will be assessed further in the Environmental Statement and the level of impact and significance of effect may be refined.

Habitats

9.10.101 Air quality modelling indicates a potential significant effect on veteran trees and potential veteran trees through operation of the proposed scheme which is considered to be **moderate adverse**. This will be assessed further in the Environmental Statement and the level of impact and significance of effect may be refined.

Protected and notable species

Bats

9.10.102 Bats may be affected by operation of the proposed scheme through increased mortality, disturbance from noise, vibration and light.

9.10.103 Landscaping and habitat planting would be designed to minimise mortality of bats, for example use of hop-overs to encourage bats to fly high over the carriageway, and through potential crossing options which are currently being investigated.

9.10.104 Although habitats close to the road may decrease in suitability for bats due to disturbance, it is considered that new habitat creation within the provisional Order Limits away from the new road verges would benefit bats through provision of an increased foraging resource.

9.10.105 The significance of effects on bats is therefore considered to be **neutral**.

Badgers and other mammals

9.10.106 Potential effects on badgers, brown hare, hedgehogs and polecat from operation of the proposed scheme would include increased mortality, disturbance from noise, vibration and light.

9.10.107 Roadside fencing and provision of mammal ledges in culverts or other means of wildlife passage where practicable, would reduce deaths from collisions and provide a means of traversing the road.

9.10.108 It is anticipated these mammals would become habituated to the consistent levels of noise close to the road, however the landscaping design would provide alternative resources in less disturbed areas should this be required by badgers.

9.10.109 The significance of effect on badgers and other mammals is therefore considered to be **neutral**.

Otter and water vole

9.10.110 Otters and water voles may be affected by operation of the proposed scheme through disturbance, hydrological changes (most notably pollution or watercourses), and from direct mortality from collisions.

9.10.111 It is considered that operation of the proposed scheme is unlikely to cause greater disturbance to water voles than the current situation and would not result in any significant negative impacts upon the conservation status of water vole within the study area.

9.10.112 Fencing would be used to dissuade otters from crossing the proposed scheme. New and modified culverts with mammal ledges or other means of wildlife passage would allow for continued connectivity for otter commuting and foraging across the wider landscape. Realigned watercourses are being designed to be beneficial for wildlife.

9.10.113 Pollution of watercourses would be prevented through design of drainage and use of attenuation ponds to clean water prior to discharge.

9.10.114 Lighting would be designed to prevent spillage onto the watercourses and otters are not anticipated to be disturbed by the consistent noise from traffic.

9.10.115 It is therefore considered that operation of the proposed scheme would not present any significant impacts on the conservation status of otter and water vole within the study area and the significance of effect would be **neutral**.

Breeding and wintering birds

9.10.116 Operation of the proposed scheme may result in impacts to breeding and wintering birds through increases in traffic noise levels, and a greater risk of mortality through collisions with vehicles.

9.10.117 Increases in traffic may affect the suitability of habitat adjacent to the road, in particular for breeding birds which are reliant on song and calls as part of their mating behaviour. However, habitat creation away from the road would increase the carrying capacity for birds in alternative nearby habitats, reducing the impact on the local population.

9.10.118 In the absence of noise modelling data at this time, a precautionary approach has been taken and it is assessed that there would be a **slight adverse** effect on breeding and wintering bird assemblages.

Barn owl

9.10.119 Operation of the proposed scheme would comprise higher levels of disturbance to barn owls, however it is not considered likely that this would lead to a significantly higher rate of collisions above the pre-construction baseline. In addition, the proposed scheme would generally cross habitats of lower value to foraging barn owls, and would not significantly reduce availability of foraging habitat within the wider area.

9.10.120 It is therefore considered that there would be a **neutral** effect on barn owls.

Reptiles

9.10.121 Reptiles may be affected by operation of the proposed scheme through disturbance and direct mortality.

9.10.122 Mortality of reptiles is unlikely to be significantly higher from operation of the proposed scheme than from the baseline, and reptiles would benefit from increased habitat resource compared to the pre-construction baseline.

9.10.123 Operation of the proposed scheme would not result in a significant negative effect upon the conservation status of reptiles within the study area.

9.10.124 It is therefore considered that there would be a **neutral** effect on reptiles through operation of the proposed scheme.

Great crested newt

9.10.125 Operation of the proposed scheme would not result in additional impacts to GCN as the population which the proposed scheme is aiming to conserve is outside the provisional Order Limits. It is therefore considered that there would be a **neutral** effect on GCN through operation of the proposed scheme.

Other amphibians – common toad

9.10.126 Common toad may be affected by operation of the proposed scheme through direct mortality and changes in the water quality of breeding ponds.

9.10.127 Mortality of toads is unlikely to be significantly higher from operation of the proposed scheme than from the baseline, and toads would benefit from increased habitat resource compared to pre-operation levels.

9.10.128 Pollution of water bodies would be prevented through design of drainage and use of attenuation ponds to clean water prior to discharge. Groundwater pollution would be mitigated by lining ponds situated on permeable strata to prevent road runoff discharging into the ground and groundwater.

9.10.129 It is considered that there would be a **neutral** effect on toads through operation of the proposed scheme.

Freshwater fish, freshwater macro-invertebrates and freshwater macrophytes

9.10.130 Freshwater fish could be impacted by operation of the proposed scheme through changes in hydrology and water quality.

9.10.131 Pollution of watercourses would be prevented through design of drainage and use of attenuation ponds to clean water prior to discharge.

9.10.132 With mitigation it is considered that there would be no significant impacts on the conservation status of freshwater fish, freshwater macro-invertebrates and freshwater macrophytes within the proposed scheme footprint or in a wider context and the significance of effect would be **neutral**.

Terrestrial invertebrates

9.10.133 Some species of invertebrate may be vulnerable to direct mortality on the proposed scheme. Habitats within the provisional Order Limits would support terrestrial invertebrate species and increase populations within the local area, offsetting the numbers reduced through mortality.

9.10.134 With mitigation it is considered that there would be no significant impacts on the conservation status of terrestrial invertebrates within the proposed scheme footprint or in a wider context and the significance of effect would be **neutral**.

Notable plants

9.10.135 There are no significant negative impacts anticipated to notable plant assemblages as a result of operation of the proposed scheme and the significance of effects would be **neutral**.

9.10.136 A summary of significance of effects for all biodiversity matters is shown in Table 9.15. The assessment has been undertaken on a precautionary basis in the absence of air quality and noise modelling data, and the assessment will be completed for the Environmental Statement.

Table 9.15 Summary of likely significance of effects on biodiversity resources

Biodiversity resource	Significance of effects		Certainty at PEIR stage
	Construction	Operation	
Internationally designated sites for nature conservation	Neutral	Neutral	High due to HRA assessment
Tiptree Heath SSSI	Neutral	Neutral	High
River Ter SSSI	Neutral	Neutral	High
Whetmead LNR and LWS	Slight adverse	Moderate adverse	Low for construction pending further assessment of groundwater impacts, Low for operation pending further assessment of air quality impacts
Brockwell Meadows LNR and LWS	Neutral	Neutral	High
Cuckoo Wood LNR, Spring Lane Meadows LNR, Bocking Blackwater LNR, Galleywood Common LNR	Neutral	Neutral	High
Perry's Wood LWS	Slight adverse	Moderate adverse	High for construction, Low for operation pending further assessment of air quality impacts
29 additional LWS sites within 1km of the proposed scheme	Neutral	Neutral	High
34 additional LWS sites with 200m of ARN	Neutral	Neutral	High
Ancient woodland inventory sites and additional ancient woodland sites	Neutral	Neutral	High
Veteran trees	Neutral	Moderate adverse	High for construction, Low for operation pending further assessment of air quality impacts
Potential veteran trees	Moderate adverse	Moderate adverse	High for construction, Low for operation pending further assessment of air quality impacts

Biodiversity resource	Significance of effects		Certainty at PEIR stage
	Construction	Operation	
Ancient and irreplaceable hedgerows	Moderate adverse	Neutral	Moderate due to ongoing habitat loss and gain calculations
Priority habitats; lowland mixed deciduous woodland	Moderate adverse	Neutral	Moderate due to ongoing habitat loss and gain calculations
Priority habitats; wet woodland, wood-pasture and parkland	Neutral	Neutral	High
Priority habitats; arable field margins, eutrophic standing waters, hedgerows, open mosaic habitats on formerly developed land, ponds, rivers	Slight beneficial	Neutral	Moderate due to ongoing habitat loss and gain calculations
Bat assemblage including barbastelle bat *Barbastella barbastellus*	Neutral	Neutral	Moderate due to ongoing bat surveys
Badger *Meles meles*	Neutral	Neutral	Moderate due to ongoing badger surveys
Otter *Lutra lutra*	Neutral	Neutral	Moderate due to ongoing otter surveys
Water vole *Arvicola amphibius*	Moderate beneficial	Neutral	High
Priority species; brown hare *Lepus europaeus*, hedgehog *Erinaceus europaeus* and polecat *Mustela putorious*	Slight beneficial	Neutral	High
Barn owl *Tyto alba*	Neutral	Neutral	High
Notable breeding birds; hobby *Falco subbuteo*, turtle dove *Streptopelia turtur* and sand martin *Riparia riparia*	Neutral	Slight adverse	Moderate due to ongoing noise assessments
Breeding bird assemblage	Neutral	Slight adverse	Moderate due to ongoing noise assessments
Wintering bird assemblage	Neutral	Slight adverse	High

Biodiversity resource	Significance of effects		Certainty at PEIR stage
	Construction	Operation	
Commoner reptiles (common lizard *Zootoca vivipara*, grass snake *Natrix helvetica* and slow worm *Anguis fragilis*)	Slight beneficial	Neutral	High
Great crested newt *Triturus cristatus*	Moderate beneficial	Neutral	High
Priority species; common toad *Bufo bufo*	Slight beneficial	Neutral	High
Freshwater fish communities of Domsey Brook, Boreham Brook, River Brain and River Ter including European eel *Anguila anguila*	Neutral	Neutral	High
Freshwater fish communities of River Blackwater and Roman River	Neutral	Neutral	High
Terrestrial invertebrate assemblages	Slight beneficial	Neutral	Moderate due to ongoing habitat loss and gain calculations
Freshwater macro-invertebrate communities of the River Blackwater, Boreham Brook, River Ter, Roman River, River Brain and Domsey Brook	Neutral	Neutral	High
Notable plants – lesser calamint *Clinopodium calamintha* and wall bedstraw *Galium parisiense*	Neutral	Neutral	High
Notable plants – field scabious *Knautia arvensis* and common cudweed *Filago vulgaris*	Neutral	Neutral	High
Freshwater macrophyte communities of the River Blackwater including river water dropwort *Oenanthe fluviatilis*	Neutral	Neutral	High

10 Geology and soils

10.1 Topic introduction

10.1.1 This chapter provides a preliminary assessment of the likely significant effects of the proposed scheme with respect to geology (bedrock geology and superficial deposits including geological designations and valuable non-designated features), soil resources (mostly agricultural), and land contamination (effects on human health, surface water and groundwater), in accordance with Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (Highways England, 2019e). Mineral resources are covered in Chapter 11: Material assets and waste. Hydrogeology, where not associated with land contamination, is covered in Chapter 14: Road drainage and the water environment.

10.1.2 This chapter identifies and assesses the potential effects of the construction and operational phases of the proposed scheme with respect to geology and soils, and outlines the proposed design, mitigation and enhancement measures that would be put in place.

10.1.3 This chapter is supported by Figure 10.1 Geology and Soils Land Contamination Constraints Plan (see Appendix A).

10.2 Stakeholder engagement

10.2.1 A summary of the key stakeholder feedback and key requirements from the Planning Inspectorate's Scoping Opinion (2021) relevant to geology and soils is provided in Table 10.1.

Table 10.1 Key stakeholder feedback for geology and soils aspect

Stakeholder	Comment	Response
The Planning Inspectorate	The Planning Inspectorate agreed that the Marks Tey Brickpit Site of Special Scientific Interest (SSSI) and associated risk to human health for site users and the general public during operation can be scoped out of the assessment. However, the Scoping Report does not provide sufficient evidence that the drainage and runoff from the proposed scheme during operation would not result in significant effects to soils, groundwater or surface water in areas adjacent to the scheme. On this basis, the operational impact on soils, groundwater and surface water should not be scoped out.	Marks Tey Brickpit SSSI and the potential risk to human health for site users and the general public during operation have been scoped out of the assessment. Although operational effects on soils, surface water and groundwater have been scoped out of the geology and soils aspect, they are scoped into the road drainage and water environment aspect in terms of potential pollution from road runoff and drainage. Appropriate cross references with the road drainage and the water environment assessment will be made.

Stakeholder	Comment	Response
Environment Agency	The Environment Agency confirmed the nature of wastes received by the historical landfills at Witham included hazardous wastes. Other landfill information provided by the Environment Agency generally confirmed the available information obtained during the desk study stage of this assessment including the landfill at junction 25 which is being investigated as part of ground investigation (GI) works. The Environment Agency commented that due to the age of the deposits within the landfill sites, there will be many uncertainties as to the actual waste inputs. They recommended that any works disturbing the landfill wastes must be fully assessed for impacts that may lead to mobilisation of contaminants and thereby increase the risk of groundwater pollution. They advised that site investigations should be considered to determine the ground conditions and appropriate protocols, including remedial measures to be put in place should unsuitable or unexpected material be encountered.	Additional GI of the Witham landfill area has been scheduled, targeting the area where the proposed scheme encroaches on the hazardous waste landfill. However, it is not known when the actual GI works will be undertaken. It is anticipated that ground works in the area could potentially disturb the landfill waste. Detailed risk assessment will therefore be undertaken after the GI works to assess the impact of exposing landfill wastes on human health, groundwater and surface waters bordering the landfill. Findings will be reported in the Environmental Statement.
Natural England	Natural England confirmed that impacts from the proposed scheme should be considered in light of the Government's policy for the protection of the best and most versatile (BMV) agricultural land as set out in the National Planning Policy Framework. They recommended that an Agricultural Land Classification (ALC) survey should be carried out, if not already available, and advised that the Environmental Statement should provide details of how any adverse impacts on soils can be minimised.	An ALC survey to clearly identify areas of BMV land will be undertaken and the Environmental Statement will assess the impact of agricultural land take and recommend mitigation.
Braintree District Council	Braintree District Council commented that the majority of Braintree District consists of BMV agricultural land. Although the proposed scheme is linear in nature, the cumulative impact of the loss of such land (i.e. parts of many agricultural fields) could be major and the Council request that the Environmental Statement give due consideration to this and clearly identifies the quantity, locations and categories of such land which would be lost.	

10.2.2 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

10.3 Legislative and policy framework

10.3.1 The National Networks National Policy Statement (NNNPS) 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.

10.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 5.168 states that applicants should take into account the economic and other benefits of the BMV agricultural land (defined as land in grades 1, 2 and 3a of the ALC system). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value.

- Paragraph 5.176 states that the decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision-maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5' (as defined in the ALC system, described in Section 10.7) 'except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy.

- Paragraph 5.168 states that for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this. The policy recommends the adoption of the Model Procedures for Management of Land Contamination (CLR11) which sets out procedures for risk assessment, deciding on remedial options and implementing remediation. The Environment Agency published an online replacement to this document in May 2020 entitled Land Contamination: Risk Management (LCRM).

- Paragraph 5.22 states that where the project is subject to EIA the applicant should ensure that the Environmental Statement clearly sets out any likely significant effects on international, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England).

- Paragraph 5.23 states that the applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.

- Paragraph 5.25 states that as a general principle, and subject to the specific policies, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives.

10.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

10.4 Assessment methodology

10.4.1 The assessment of the potential effects on the geology and soils considers the following legislation, regulations, planning policies and guidance:

- Environmental Protection Act 1990, Part IIA
- Water Framework Directive (Council Directive 2000/60/EC); implemented in England by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- National Planning Policy Framework (NPPF)
- National Networks National Policy Statement (NNNPS) (Department for Transport, 2014)
- DMRB LA 104 – Environmental Assessment and Monitoring (Highways England, 2020c)
- DMRB LA 109 – Geology and Soils (Highways England, 2019e)
- DMRB LA 113 – Road Drainage and the Water Environment (Highways England, 2020a)

10.4.2 The criteria that will be used to assess the value (sensitivity) of receptors and magnitude of impacts are based upon those in DMRB LA 109.

10.4.3 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for this aspect. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

10.4.4 The significance of effects will be determined by combining the sensitivity of geology and soils receptors, with the magnitude of impacts. In accordance with DMRB LA 109, the significance matrix in DMRB LA 104 (which is replicated in Plate 5.1 in Chapter 5: Environmental assessment methodology) will be used to assist professional judgement when determining the significance of effects.

10.4.5 A desk study has been completed for the proposed scheme which includes a land contamination risk assessment that was completed in accordance with LCRM. A Conceptual Site Model (CSM) (based on LCRM) was developed as part of the initial desk-based assessment of the scheme. The CSM (included in the Preliminary Sources Study Report (PSSR) Version P01, Highways Agency Geotechnical Data Management System (HAGDMS) number 29472, dated June 2017[5]) supports the identification and assessment of pollutant linkages using the source-pathway-receptor model. Development of the CSM forms the main part of a preliminary risk assessment, and the model is subsequently refined or revised as more information becomes available.

10.4.6 The ground investigation (GI) for Section 1, 2 and 3 of the proposed scheme have been completed, however, the post fieldwork environmental monitoring works, including groundwater and gas monitoring, are ongoing at the time of writing this report. The available factual reports for Section 1 of the proposed scheme, which covers the area between junction 19 to junction 21 and the proposed borrow pit sites, have been reviewed and the findings of the GI included in this chapter. The Section 2 and Section 3[6] GI findings are yet to be reviewed and will be included in the Environmental Statement.

10.4.7 The CSM and preliminary risk assessment presented in the PSSR will be updated in the Section 1 Ground Investigation Report (GIR) to reflect the findings of the Section 1 GI.

10.4.8 Potential risks to human health have been assessed using the CSM and screening soil contaminant concentrations against relevant soil screening criteria for assessment of risk to human health from land contamination. Similarly, potential risks to controlled waters have been assessed using the CSM and screening monitoring data against relevant generic screening criteria.

10.4.9 The GI was completed in spring 2021. The full GI information (Section 1, Section 2 and Section 3) will be included in the Environmental Statement.

10.5 Assessment assumptions and limitations

10.5.1 The following limitations have been encountered at the time of writing the Preliminary Environmental Information Report (PEIR):

- Only provisional ALC data were available for the majority of the study area at the time of this assessment and therefore the significance of soil quality effects may change in the Environmental Statement. An ALC survey will be undertaken to inform further stages of assessment.
- In the absence of complete GI data assessment for the proposed scheme, potential impacts from the scheme on human health and controlled waters (groundwater and surface water) from land contamination cannot be fully assessed at this stage. As such, the assessment for PEIR is based on qualitative information gathered as part of the PSSR.

[5] The PSSR and other relevant geotechnical information will be appended to the Environmental Statement

[6] Section 2 GI covers A12 between junctions 21 and 23; Section 3 GI covers A12 between junctions 23 and 25.

- The GI is programmed to be completed and data made available in time to inform the Environmental Statement. However, if some of the GI data are unavailable at the time of drafting the Environmental Statement (due to unforeseen circumstances), a qualitative land contamination risk assessment will be carried out based on existing desk study information and available GI.

- It is proposed to undertake additional technical consultation with various statutory and non-statutory bodies and external sources to obtain the latest information on baseline conditions. However, the information held by these sources may in some cases be limited and may be delayed. Where there is a lack of third-party data, professional judgement will be used in interpreting available desk study and GI information.

10.6 Study area

10.6.1 In the absence of a defined study area in DMRB for geology and soils, a buffer of 250m around the provisional Order Limits has been used to establish baseline conditions and identify potential impacts on receptors. This is primarily based on Guidance for the Safe Development of Housing on Land Affected by Contamination (National House Building Council *et al*. 2008) and is a conservative but sensible approach in the context of the proposed development, considering the distance over which contamination can migrate or which effects on soils or geological features may occur. The study area and key geological and land contamination constraints are shown in Figure 10.1.

10.6.2 Within the study area the following has been considered; geology including geological designations, soil resources (mostly agricultural land), potential sources of land contamination from both current and historical land uses including petrol stations, historical infilled land, historical landfills and other uses. In addition, potential receptors of any contamination exposed and mobilised as part of the proposed scheme development have been considered, including groundwater and any associated abstractions and surface water.

10.6.3 The proposed scheme also includes the assessment of four potential borrow pit locations identified along the scheme (see Table 2.9 in Chapter 2). The PSSR (HAGDMS No.31435) for the original 11 borrow pits, which provides an interpretation of the ground conditions expected at each of the locations, was undertaken in November 2019. The GI of the 11 borrow pits was undertaken in in 2020 and followed by a GIR in 2021. The findings of the GI relevant to the geology and soils assessment are included in this chapter.

10.7 Baseline conditions

Baseline sources

10.7.1 Information on geology and ground conditions is based on site-specific data and information obtained from the British Geological Survey (BGS), Envirocheck report (ref. 87509587_1_1, dated 25-May-2016) and Enviro Insight and Geo Insight reports, dated July 2018, from Groundsure Ltd.

10.7.2 The data gathered on baseline ground conditions are sourced primarily from the PSSR (Version P01, HAGDMS number 29472, dated June 2017) which includes information from the Envirocheck report, site walkover report, and regulatory authorities' consultations undertaken in 2017. An addendum PSSR (HAGDMS No. 30459) was also undertaken in 2018 which contains supplementary information between junction 24 and 25. This report includes information from the Groundsure report.

10.7.3 The following sources have been used to establish baseline conditions:

- An Envirocheck report (ref. 87509587_1_1, dated 25 May 2016) for the A12 between junctions 19 and 25
- Groundsure report (Groundsure reference: Enviro-A12-A_250, dated 19 July 2018, HAGDMS No. 30508) specifically for junction 24 to junction 25
- Online British Geological Survey's Geology of Britain Viewer and relevant historic borehole scans (BGS, 2019a)
- GeoEssex website (2020) - this website provides information on sites designated either as Sites of Special Scientific Interest (SSSI) or as local geological sites within the study area
- The MAGIC Map application (Defra, 2021)
- The Environment Agency's Water Framework Directive Assessment Essex and South Suffolk SMP2 (Environment Agency, 2010)
- LandIS Soilscapes (Cranfield University, 2020)
- Essex Minerals Local Plan (Essex County Council, 2014)
- Provisional ALC (Natural England, 2020d)
- ALC Grades – Post 1988 Survey (Natural England, 2020e)
- Zetica's Regional Unexploded Bomb Risk Map for Essex (Zetica, no date)
- Zetica Unexploded Ordnance (UXO) Desk Study and Risk Assessment for the A12 Scheme (Zetica Doc. No. P7265-17-R1/Revision B dated January 2018)

Baseline conditions

Geology

10.7.4 The study area is underlain by a bedrock geology consisting of London Clay, part of the Thames Group (clay with some silts and sands). The London Clay Formation is expected to be underlain by the undifferentiated Paleogene Lambeth Group and Thanet Formation (both consisting of silts, sands and gravel) and the Cretaceous Chalk. The Thanet Sand Formation is thought to outcrop above the London Clay to the south-west of Kelvedon. The London Clay is believed to be up to 125m thick in places, with the chalk at a minimum depth of 50m below ground level. Existing borehole data support the depths for both the London Clay and Chalk.

10.7.5 The superficial geology comprises Head deposits (clay, silt and sand), glaciofluvial deposits (sand and gravel), Lowestoft Formation (formed of Diamicton), Brickearth and localised alluvium (clay, silt and sand) and River Terrace Deposits (sand and gravel). There are also localised deposits of glaciolacustrine materials (sand and gravel) and Kesgrave Catchment Subgroup (sand and gravel).

10.7.6 Areas of made ground, worked ground and infilled ground are within the study area associated with historical land uses. This includes infilled historical mineral sites identified in several places along the proposed scheme, and the dismantled Witham and Kelvedon branch railway lines decommissioned in the 1970s, both crossing the current line of the A12.

10.7.7 The Section 1 GI encountered made ground up to 6m in thickness in parts of the A12 embankment. Made ground generally comprised either cohesive sandy gravelly clay or granular clayey sands and gravels.

10.7.8 The assessment of the information from the Section 2 and Section 3 GI is currently ongoing at the time of writing; further information will be provided in the Environmental Statement.

10.7.9 There is one designated geological SSSI - Marks Tey Brickpit - located 115m north-west of junction 25, which is designated due to its geological features.

10.7.10 Based on the GeoEssex database, there are no local geological sites within 250m of the proposed scheme. There are no other designated sites within 250m of the study area, including regionally important geological or geomorphological sites (RIGS) which are non-statutory designated sites for geology.

10.7.11 Effects to the Marks Tey Brickpit SSSI are unlikely, as this lies outside of the footprint of the proposed scheme. Marks Tey SSSI is therefore scoped out of the assessment.

Soils

10.7.12 The economic resource value of soil is primarily measured by its ability to support agricultural uses. This is quantified by its ALC grade, with six grades defined within the ALC for England and Wales: Revised criteria for Grading the Quality of Agricultural Land (Ministry of Agriculture, Fisheries and Food, 1988), as follows:

- Grade 1 (excellent quality)
- Grade 2 (very good quality)
- Subgrade 3a (good quality)
- Subgrade 3b (moderate quality)
- Grade 4 (poor quality)
- Grade 5 (very poor quality)

10.7.13 BMV agricultural land equates to grades 1, 2 and subgrade 3a of the ALC system and is the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield, and the cost of obtaining yield.

10.7.14 Provisional ALC data for the study area show the area to be dominated by grade 2 and undifferentiated grade 3 soils, with a small area of grade 4 at the southern end. Post-1988 ALC data are only available for small areas and mostly show grade 1, grade 2 and subgrade 3a to be present. As such, where grade 3 land is mapped by the provisional ALC data, it is assumed at this stage that subgrade 3a land is likely to be present.

10.7.15 An ALC survey is planned to take place in 2021 and results will be included within the Environmental Statement.

10.7.16 Soils may also be of importance in supporting sites of ecological importance, therefore a high-level review of soil types has been undertaken using the Soilscapes application. Soilscapes conveys a summary of the broad regional differences in the soil landscapes of England and Wales. Soilscapes identifies the following soil types within the study area:

- soilscape 6 – freely draining slightly acid loamy soils
- soilscape 8 – slightly acid loamy and clayey soils with impeded drainage
- soilscape 18 – slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
- soilscape 9 – lime-rich loamy and clayey soils with impeded drainage

10.7.17 None of these soil types is inherently particularly sensitive, but soils supporting sites of ecological importance identified within Chapter 9: Biodiversity, will be considered within the Environmental Statement in line with DMRB LA 109. Baseline information for these sites will not be repeated in this chapter.

Mining, quarrying and mineral resources

10.7.18 Detailed information on mineral resources present along the study area and the potential effects of the proposed scheme on mineral resources are assessed within Chapter 11: Material assets and waste.

10.7.19 The Section 2 GI includes locations within the study area covered by the Coleman's Farm quarry permit. The results and assessment will be included within the Environmental Statement.

Historical mineral extraction site (potentially infilled)

10.7.20 Based on the Envirocheck report of the study area and the Section 1 GI, there are a number of historical mineral extraction sites within 250m of the proposed scheme including brickfields, gravel pits, sand pits and quarries. Some of the sites have been redeveloped and others appear to be infilled with unknown materials and are therefore considered as potential sources of land contamination in this chapter.

10.7.21 The Section 1 GI identified an infilled gravel pit in a proposed borrow pit (borrow pit J) which had been backfilled with waste materials including suspected asbestos-containing materials (ACM).

10.7.22 The sites are summarised in Table 10.2 below.

Table 10.2 Potentially infilled historical mineral extraction sites

Historical mineral extraction sites	Location (approximate)	Distance from proposed scheme	Current land use
Junction 19 - 21			
Boreham House gravel pit	TL 74109 09589	20m north	Agricultural
Historical Hogwells brickfield	TL 76706 10934	On route and extends 140m to the south of the scheme	Residential properties shown on the footprint
Historical brick works at Hatfield Peverel	TL 79755 12218	8m north	Residential (southern section). Northern section is undeveloped
Historical sand and gravel pit at Hatfield Peverel	TL 80093 12084	150m south	Landscaped as a lake
Junction 23 - 24			
Historical gravel pit (Ewell Hall)	TL 86451 17764	120m south	Undeveloped
Historical brickfield (Brick Kiln / Park farms)	TL 87602 18967	On route	Existing A12 built on this site. Brickfield extends from the A12 to approximately 200m south of the road
Historical sand pit (Threshelfords Farm)	TL 87546 19393	180m north	Redeveloped into Threshelfords business park
Borrow pit J			
Historical gravel pit	TL 86895 17714	Within borrow pit J 360m south-east of the scheme	Infilled with construction waste including suspected ACM

Landfills

10.7.23 There are records of historical landfills in the study area which are summarised in Table 10.3.

10.7.24 Perry Road, Refuse Tip East of Sewage Works, and East of Railway Line landfills are phased landfills operated in the same area immediately to the east and possibly underlying the A12 to the south of Witham. The Section 2 GI included sections of A12 near the landfills. The results and assessment will be included within the Environmental Statement.

10.7.25 Limited GI was undertaken where the proposed scheme encroaches the landfills in Witham as (part of Section 2 GI works). Additional GI work is planned in 2021 around the Witham landfills and will be included in the Environmental Statement.

10.7.26 The London Road landfill has been investigated as part of the Section 3 GI. The results and assessment will be included within the Environmental Statement.

Table 10.3 Landfills within 250m of the proposed scheme

Landfill	Location (approximate)	Waste	Operation date	Distance from proposed scheme	Current use
East of railway line	TL 583000 213800	Industrial, commercial & household	1964 -1974	Adjacent and possibly underlying A12	Whetmead Local Nature Reserve and A12 Highway
Perry Road			1977 - 1990		
Refuse Tip East of Sewage Works		Industrial, commercial & liquids/sludge	Unknown		
Blackwater Lane	TL 582700 213800	Household & hazardous	1958 - 1964	Adjacent and possibly underlying A12	Partially undeveloped, sewage treatment works and A12 Highway
Maldon Road	TL 582700 214300	Industrial, commercial & liquids/sludge	1963 - 1964	170m east	Warehouse in Witham Industrial Estate
London Road	TL 592400 224000	Unknown	Unknown	Adjacent and possibly underlying A12	According to the EA, site was infilled between 1960 to 1972 with material from Stanway by-pass construction.
Foundry Lane	TL 592900 224100	Inert, household & industrial	1958 - 1980	150m south	Residential properties

Potential sources of contamination

10.7.27 The study area is predominantly in a rural setting consisting of mostly agricultural land use. Most of the industrial activity is focused in Chelmsford and Witham. The A12 originally followed the path of the old Roman Road, with the road being constructed on its current route in the 1960s. In addition to the landfill sites and potentially infilled former brick pits and quarries noted in the above sections, there are further potentially significant land uses in the study area including:

- Railway infrastructure including the Witham and Kelvedon branch lines shown on the late 19th century maps and decommissioned sometime in the 1970s, both crossing the current line of the A12.
- Sewage works including an existing sewage works at Witham which extends on both sides of the current A12, including parts of Whetmead Local Nature Reserve (LNR); an existing sewage works 300m south of Rivenhall End; and a former sewage works, which is now a pumping station, near the confluence of the River Blackwater and Domsey Brook.
- Rifle ranges dating back to the late 19th and early 20th centuries including one to the north-east of Boreham, 250m north of the A12, and one near junction 22, 250m south of the A12.
- A malt house and gasometer adjacent to Marks Tey Station approximately 50m north of the current route (early 19th century; gasometer demolished by 1900, Malthouse converted to warehouse in the 1960s and demolished with construction of the A12).
- Current and former industrial areas, including: Springfield industrial estate, constructed in the 1970s and still present immediately west of junction 19 (Boreham); a depot immediately south-west of Hatfield Peverel Station which was built in the 1960s; works of unknown purpose constructed in Boreham in the 1970s, 250m south-east of the current A12; Witham industrial area located between the A12 and the Witham branch line, which included an ‘industrial gas works’; and a gas governor built adjacent to Little Braxted Lane.
- Fuel stations including those immediately adjacent to the A12 at junctions 19, 21, at Rivenhall End, junction 23 and junction 25.
- Two grade 2 ‘significant’ pollution incidents have occurred within 250m of the current A12. One was located 200m north-west of junction 22 and was of alcohols/aldehydes/other organics to water and occurred in 1997. The other was of oils and fuels to water 150m west of the A12, on Stepfield road in Witham between junctions 22 and 23 and occurred in 2014.

10.7.28 Potential sources of land contamination listed above are shown in Figure 10.1 in Appendix A.

Soil assessment

10.7.29 Soil samples were collected for chemical analysis in the laboratory as part of the Section 1 GI to determine the extent of ground contamination potentially caused by historical and current land uses along the A12 and to assess the suitability of site-won soils and materials within the proposed borrow pit areas for reuse on the proposed scheme.

10.7.30 Based on the chemical analysis of soil samples taken during the GI, no significant contamination has been identified across the proposed scheme between junction 19 and junction 21. Only four samples, of which two were tarmacadam samples, breached the human health screening criteria for commercial/industrial land use out of 336 soil samples tested as part of the Section 1 GI including the proposed borrow pit sites.

10.7.31 The locations listed in Table 10.4 recorded various polycyclic aromatic hydrocarbons (PAH) in soils above adopted screening criteria. Sample locations are shown on Figure 10.1.

10.7.32 A total of 93 soil samples were collected from four potential borrow pits and analysed for various determinands. Concentrations of all the determinands recorded are below the human health generic assessment criteria (GAC) for commercial/industrial end use in all the samples tested. This indicates that soils excavated from the borrow pits could be used during the construction of the proposed scheme subject to the CL:AIRE Definition of Waste, Development Industry Code of Practice (2011) (DoWCoP).

10.7.33 Limited GI of an area of historical infilled land at borrow pit J revealed the presence of suspected asbestos cement sheets and other waste materials. The presence of asbestos fibres has not been confirmed.

10.7.34 The findings of the Section 2 and Section 3 GI will be included in the Environmental Statement.

Table 10.4 Proposed scheme – locations with PAHs exceeding soils screening criteria

Location ID	Location Description	Depth (metres below ground level)	Proposed works at location	Geological formation (description)
WS1435B	A12 Southbound, south of Witham. Figure 10.1 sheet 3 of 8	0.50 – 0.80	Embankment widening	Made Ground (sandy gravelly silt)
WS1429A	A12 Northbound, east of Hatfield Peverel. Figure 10.1 sheet 3 of 8	0.82 – 0.92	Existing cutting	Made Ground (Tarmacadam)
BH+RC1106	A12 Northbound, Hatfield Peverel. Figure 10.1 sheet 2 of 8	0.40 – 0.50	Embankment widening	Made Ground (Tarmacadam)
		0.90 – 1.00	Embankment widening	Glaciofluvial Deposits (Slightly gravelly silty sand)

Ground gas assessment

10.7.35 Potential sources of ground gases, including historical landfill sites and infilled land, have been identified on and in close proximity to the proposed scheme and the borrow pit sites as part of the Section 1 GI.

10.7.36 Gas monitoring standpipes were installed in selected locations with screening zones targeting mainly made ground. Six weekly ground gas monitoring rounds were undertaken post GI works to provide information on the ground gas regime in the monitored locations and to enable assessment of potential risks to human health.

10.7.37 The monitoring undertaken recorded limited flow rates and low concentrations of harmful ground gases across the proposed scheme. Methane concentrations are well below the lower explosive limit (LEL) of 5% volume by volume[7]. As the ground works are expected to take place in open, well ventilated areas, hazardous conditions are unlikely to occur.

10.7.38 Available ground gas monitoring data indicate that methane levels recorded in the monitored borrow pits boreholes are below the LEL. The ground gas risk assessment undertaken shows that the majority of the proposed borrow pits have low gas-generating potential in the monitored locations. Proposed works within the borrow pits would involve open excavations – confined spaces are unlikely to be created.

[7] Volume/volume percentage (v/v percent) is a measure of the concentration of a substance in a solution/gas. It is expressed as the ratio of the volume of the solute/gas to the total volume of the solution/gas multiplied by 100

10.7.39 The findings of the Section 2 and Section 3 GI will be included in the Environmental Statement.

Surface water and groundwater

10.7.40 There is the potential that contaminants from contaminated land and landfills may impact on groundwater and surface water. Information on surface water and groundwater receptors are covered in Chapter 14: Road drainage and the water environment. To avoid duplication, this section does not describe the water environment baseline, as Chapter 14 provides a full description of the baseline conditions.

Groundwater quality assessment

10.7.41 As part of the Section 1 GI, groundwater quality assessment was undertaken to assess the chemical quality of the groundwater underlying the study area and the borrow pits to provide baseline data which will be used to assess the impact, if any, of the scheme on controlled waters during and after construction works.

10.7.42 A total of 43 groundwater samples were collected from the area affected by the proposed scheme and analysed for various determinands including inorganics, metals, semi-metalloids, total petroleum hydrocarbons (TPHs) and PAHs. Selected samples were analysed for volatile and semi-volatile organic compounds (VOC and SVOC) and benzene, toluene, ethylbenzene and xylene (BTEX).

10.7.43 Locations where various determinands are recorded in groundwater above the screening criteria are shown on Figure 10.1 and summarised in Table 10.5.

Table 10.5 Proposed scheme – exceedances of groundwater screening criteria

Location ID	Proposed works at location	Exceeding analyte
BH+RC1101	Attenuation pond	Bioavailable metals and chloride
BH+RC1104	Proposed footbridge	Bioavailable metals and sulphate
BH+RC1107	Proposed bridge	Bioavailable metal
BH+RC1108	Proposed footbridge	Bioavailable metals and total cyanide
BH+RC1109	Proposed footbridge	Bioavailable metal
BH+RC1114	Proposed embankment	Bioavailable metal, chloride and total cyanide
BH+RC1160a	Proposed structure	Bioavailable metal, chloride and total cyanide
BH+RC1164a	Proposed structure	Bioavailable metal, chloride and total cyanide
BH+RC1166a	Proposed structure	Bioavailable metal and chloride
BH+RC1177a	Proposed structure	Chloride and cyanide (total)

Location ID	Proposed works at location	Exceeding analyte
BH+RC1178	Proposed structure	Cyanide (total)
BH+RC1181	Existing embankment	Bioavailable metals
WS1403	Existing embankment	Cyanide (total)
WS1523	Existing cutting	Cyanide (total)

10.7.44 The results indicate that there are elevated concentrations of various contaminants in groundwater beneath the study area.

10.7.45 Chemical analysis of groundwater samples collected across the borrow pits recorded concentrations of various contaminants above the adopted controlled water screening criteria indicating that groundwaters underlying most of the borrow pits have possibly already been impacted by the potentially contaminative historical on-site and off-site land uses surrounding the sites. The contaminants recorded are mainly metals and inorganics.

10.7.46 Groundwater within the superficial deposits at both the proposed scheme and the borrow pits may be in hydraulic continuity with surface water features. Therefore, there is a potential for contaminants to migrate to off-site surface waters.

10.7.47 Groundwater quality monitoring is currently being undertaken for the remaining parts of the proposed scheme as part of Section 2 and Section 3 GI works. The results will be reported in Environmental Statement.

Soil leachate assessment

10.7.48 As part of the Section 1 GI, soil leachate samples were taken to assess the potential for the soil to act as a source of contamination to controlled waters.

10.7.49 Leachable substances were recorded above the screening criteria in most of the samples collected from the borrow pits.

10.7.50 Based on the soil leachability analysis there is potential for the soils within the borrow pits to act as a source of contamination to surface water and groundwater if used for the scheme.

Surface water monitoring

10.7.51 Monitoring of surface watercourses likely to be impacted by the proposed scheme was undertaken in 2018 to obtain baseline water quality information prior to the proposed scheme development works. The results of the monitoring are provided in a Jacobs report titled A12 Junction 19 to 25 Surface Water Monitoring Factual Report (B229H130-001) which will be included within the Environmental Statement as an appendix.

Future baseline

Geology

10.7.52 Due to the extensive mineral extractions in the study area and potential for new extraction licences to be approved in the future, it is likely that the current superficial sand and gravel deposits would be removed in some areas and backfilled with engineering fill. The geology is unlikely to change.

Soil

10.7.53 Future developments in the study area could further reduce the area of BMV agricultural soils.

Surface water and groundwater

10.7.54 Any future land use changes, for example a new oil depot or garage introduced in the study area, would potentially impact groundwater and surface water quality in the area. Existing ground conditions would generally improve (particularly groundwater and surface water quality) in areas where existing and historical land contamination sources identified along the route are remediated.

Value and sensitivity of receptors

10.7.55 All receptors within the baseline have been assigned a value based on criteria in DMRB LA 109 and using professional judgement. Table 10.6 summarises the value of receptors identified within the study area.

Table 10.6 Value of receptors in the study area for geology and soils

Value / sensitivity	Receptor	Description	Examples within the study area
Very high	Geology	International designated sites of geological value (e.g. UNESCO World Heritage Sites).	None identified within the study area.
	Human health	Very sensitive land use such as residential or allotments.	Residential properties in close proximity to the landfills at Witham and junction 25.
	Soil	ALC grades 1 and 2. Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area).	ALC grade 2 was identified within the study area based on provisional data and the limited post-1988 data; a small area of grade 1 land is also identified.
	Groundwater quality	Water feeding groundwater dependant terrestrial ecosystems (GWDTEs) with a high or moderate groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, Special Areas of Conservation, Special Protection Areas and SSSIs.	No receptors of this value within the study area.
		Groundwater quality associated with SPZ1 (Inner Source Protection Zone) associated with licensed abstractions.	SPZ1 associated with Inworth Road groundwater abstraction.

Value / sensitivity	Receptor	Description	Examples within the study area
	Surface water quality	Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) with a Q95[8]≥1.0m^3/s.	Boreham Brook/Tributary, Domsey Brook, River Blackwater, River Brain, River Ter, Roman River.
High	Geology	Rare and of national importance with little potential for replacement (e.g. geological SSSI).	Marks Tey Brickpit SSSI near junction 25.
	Human health	High sensitivity land use such as public open space.	Playfield located 20m south of the scheme at junction 25 (former London Road Landfill); recreation grounds (e.g. Marks Tey and Beaulieu Park recreation ground); village greens and local areas of recreational value; sports grounds (e.g. golf courses open to the public).
	Soil	ALC subgrade 3a. Soils directly supporting a UK designated site (e.g. SSSI).	ALC subgrade 3a was identified within the study area within the limited post-1988 data and undifferentiated grade 3 land is mapped for much of the study area.
	Groundwater quality	Groundwater flow, yield and quality associated with extensive non-licensed private water supplies (PWSs - i.e. feeding 10 or more properties or supplying large farming/animal estates).	No receptors of this value within the study area.
	Surface water quality	Watercourse having a WFD classification shown in RBMP with a Q95<1.0m^3/s.	River Chelmer.
Medium	Geology	Regionally Important Geological Sites with limited potential for replacement (e.g. RIGS).	None in the study area.

[8] The flow equalled or exceeded in a watercourse 95% of the time

Value / sensitivity	Receptor	Description	Examples within the study area
	Human health	Medium sensitivity land use such as commercial or industrial.	Users of commercial properties and industrial areas located throughout the study area.
	Soil	ALC grade 3b. Soils supporting non-statutory designated sites (e.g. LNR).	Undifferentiated grade 3 soils are mapped across much of the study area in the provisional data such that subgrade 3b land may be present.
	Groundwater quality	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Secondary B or Secondary undifferentiated aquifer.	Lowestoft Formation (see Chapter 14 for further examples).
		Groundwater quality associated with SPZ3 (Source Catchment Protection Zone) associated with licensed abstractions and with licensed abstractions for which no SPZ is defined.	SPZ3 at north of the proposed scheme.
		Groundwater flow, yield and quality associated with small-scale PWSs (i.e. feeding fewer than 10 properties).	14 private abstractions, such as abstraction at Domsey Chase.
		Water feeding GWDTEs of low groundwater dependence with a national non-statutory UK Biodiversity Action Plan priority; or water feeding highly or moderately groundwater dependent GWDTE sites with no conservation designation.	Groundwater discharging to 24 potential GWDTEs, such as Toppinghoehall Wood Local Wildlife Site.
		Buildings of local importance	Residential properties.
	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q95>0.001m^3/s.	Rivenhall Brook, unnamed watercourses 13, 14, 16, 19, 32 and 37 (see Chapter 14). Ponds, lakes and reservoirs.

Value / sensitivity	Receptor	Description	Examples within the study area
Low	Geology	Geology of local importance or interest with potential for replacement (e.g. non-designated geological exposures, former quarries or mining sites).	Historical mineral extraction sites.
	Human health	Low-sensitivity land use such as highways and rail.	Great Eastern Main Line railway line runs parallel to the proposed scheme. It is located approximately 30m north of the proposed scheme between junction 19 and junction 20a.
	Soil	ALC grades 4 and 5. Soils supporting non-designated notable or priority habitats.	A small area of grade 4 land is mapped by the provisional data at the southern end of the study area.
	Groundwater quality	Unproductive strata.	London Clay.
	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q95≤0.001m^3/s.	Ordinary Watercourses 1 to 12, 15, 15a, 17, 18, 20, 21, 23, 24, 26, 28, 31, 31b, 33 to 36, 38 to 42 (see Chapter 14).
Negligible	Geology	No geological exposures, little or no local interest.	None within the study area.
	Human health	Undeveloped surplus land / no sensitive land use proposed.	Undeveloped fields.
	Soil	Previously developed land formerly in ‘hard uses’ with little potential return to agriculture.	A number of areas within the study area have been previously developed.
	Groundwater quality	Not applicable.	Not applicable.
	Surface water quality	Not applicable.	Not applicable.

10.8 Potential impacts

Construction

Geology

10.8.1 Effects to the Marks Tey Brickpit SSSI are unlikely, as this lies outside of the footprint of the proposed scheme. There could be linkages between the site and sources of contamination exposed during construction, such as from dust or leachate, but these would be avoided through standard mitigation measures and are unlikely to be significant. Marks Tey SSSI is therefore scoped out of the assessment as per the Scoping Opinion (Planning Inspectorate, 2021).

Soils

10.8.2 Soils would be affected in two ways during construction, via:

- physical removal or permanent sealing of agricultural land
- degradation during stripping, handling and storage, through mechanisms such as compaction and smearing.

10.8.3 It is anticipated that approximately 510ha of agricultural land would be sealed by the proposed scheme, or otherwise lost to agricultural production by, for instance, the creation of borrow pits.

Human health

10.8.4 Made ground, infilled materials, and natural soils underlying the proposed scheme may have been potentially contaminated by historical and current land use activities. Disturbance of potentially contaminated soils during construction may create new pathways for exposure of adjacent land users around the proposed scheme.

10.8.5 There is potential for ground gases associated with the existing historical landfills at Witham and junction 25 to migrate to residential properties in close proximity to the proposed scheme if the landfills are disturbed during ground works. The extent of the landfill is not known at this stage; however, ground investigation of the affected areas is being undertaken to help inform the scheme design, risk assessment and any remediation required.

Groundwater and surface water

10.8.6 The Section 1 GI identified elevated contaminant concentrations in groundwater beneath the proposed scheme and the borrow pits. As such, dewatering of excavations and discharging during construction could have the potential to cause harm to the aquatic environment.

10.8.7 Earthworks associated with the proposed scheme could create new pathways for contaminants that could detrimentally affect groundwater.

10.8.8 Leaching of contaminants from soils during excavation, transport, storage and emplacement could negatively impact groundwater, particularly in areas of the proposed scheme classified as SPZ1.

10.8.9 Disturbance of potentially contaminated soils from landfills along the proposed scheme may cause an increase in leaching of soils and mobilising of contaminants along new or existing surface or sub-surface pollution pathways. This may lead to the quality of surface waters and groundwater aquifers being impacted through runoff, infiltration and sub-surface movement.

Operation

Geology

10.8.10 No additional impacts are predicted on geology during the operational phase. Operational effects on geology are therefore scoped out of further assessment.

Soils

10.8.11 No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect. Operational effects on soils are therefore scoped out of further assessment.

Human health

10.8.12 On completion of the construction phase the proposed scheme would comprise mainly hardstanding. Contamination within the proposed scheme area would have been removed during construction reducing the potential for contact with contaminated soil. Impacts on human health during operation have therefore been scoped out of further assessment.

Groundwater and surface water

10.8.13 During the operational stage, potential contaminated land linkages would have been broken due to the construction of the road. Impacts to surface water and groundwater from contaminated land during operation are therefore scoped out of the geology and soils assessment.

10.8.14 There is potential for the proposed scheme to act as a pathway for future contamination sources, such as pollution incidents as a result of fuel and chemical leaks or spills on the new highway by road users. Effects from road runoff, drainage, and pollution incidents are scoped into the assessment and are covered in Chapter 14: Road drainage and the water environment (and therefore will not be assessed in the geology and soils aspect).

10.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

10.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

10.9.2 Embedded mitigation relevant to this aspect includes:

- Consolidated development footprints to reduce the loss of agricultural land, such as reducing the length of the offline bypass between junction 22 and junction 23.
- Stripping of topsoil as a minimum from the footprints of all permanent development (hardstanding and materials placement), followed by sustainable reuse within the proposed scheme or elsewhere wherever practicable.
- Embankment widening south of Witham and adjacent to landfills is dependent on the extent of the Witham and Blackwater Lane landfills. Ground investigation and risk assessments will inform the appropriate design options for the embankment widening.
- An exclusion zone would be set up around the area of infilled land containing suspected ACM in borrow pit J. No works would be undertaken in this area including excavation, vehicle movements and storage to avoid ground disturbance and potential release of airborne asbestos fibres. Appropriate signage would be secured to the fencing displaying the potential risks of the area.

10.9.3 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

10.9.4 Standard mitigation would occur as a matter of course due to legislative requirements and standard sector practices. Examples of standard mitigation for this aspect include:

- Environmental Management Plan (EMP) to be developed prior to the start of construction works
- Materials Management Plan (MMP) for reuse of materials under the CL:AIRE DoWCoP to be developed prior to the start of construction works
- Risk assessments and method statements to be completed as part of the construction process

10.9.5 Standard mitigation will be included in a first iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5).

10.9.6 A soil resource survey will be completed. This will feed into the development and implementation of a soil resource plan prior to construction start of works, consistent with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).

10.9.7 A ground gas assessment of the landfills at Witham and Marks Tey will indicate whether working methods may have to be incorporated during the works to mitigate against gas build-up in voids, and to mitigate the negative effect of land contamination on potential receptors.

10.9.8 Additional monitoring of surface watercourses in close proximity to the proposed scheme and the borrow pits will be undertaken prior to construction start of works to confirm the initial monitoring carried out in 2018 and identify changes to water quality before, during and post construction. A detailed quantitative risk assessment (DQRA) is required for the management and potential treatment of any dewatering at the proposed borrow pit locations and to support a permit for discharge to surface water.

10.9.9 The Section 2 and Section 3 GI aim to confirm locations of landfills in relation to the proposed scheme and provide environmental data including soil, groundwater and gas samples.

10.9.10 Appropriate acceptability criteria would be adopted, derived from a DQRA for any fill materials excavated from the borrow pits for placement on the proposed scheme (particularly in locations where sensitive aquifers and surface water are located).

Additional mitigation

10.9.11 At present, it is not known if there are areas that require remedial treatment, although it is considered unlikely. The GI of the historical landfills at Witham (part of it received hazardous wastes) have not been completed at the time of writing this report. The ongoing Section 2 and Section 3 GI may identify hitherto unidentified contamination that requires remedial treatment (in situ and/or ex situ) of targeted areas, particularly where the route is aligned or located adjacent to potential sources of land contamination.

10.9.12 Re-use of fill materials may require remedial treatment and will be developed with the MMP for the CL:AIRE DoWCoP.

Enhancement

10.9.13 No opportunities for enhancement have been identified at this stage.

10.10 Assessment of likely significant effects

Construction

10.10.1 An assessment of the likely significant effects during construction is described in the following sections and summarised in Table 10.7.

Geology

10.10.2 Construction impacts on geology have been scoped out of the assessment. No significant effects are expected.

Soils

10.10.3 The permanent sealing or wastage of topsoil would be avoided as far as practicable via stripping and sustainable reuse elsewhere, as per the embedded mitigation measures. In addition, by following best practice soil management

measures, degradation during stripping, handling and storage would either be avoided, or would only be temporary in nature. Therefore, a minor magnitude of impact is predicted for soils of medium sensitivity in relation to degradation, resulting in likely slight adverse effects for the soil receptors during construction.

10.10.4 However, a permanent loss of agricultural land associated with the proposed scheme would be unavoidable, much of which is likely to be BMV land (ALC Grade 2 and 3a) which has a high to very high sensitivity. The threshold for a major magnitude of impact is >20ha, as set out in the Environmental Scoping Report. As such, a major magnitude of impact would occur due to the permanent loss of approximately 510ha of agricultural land, resulting in very large to large adverse effects due to the loss of agricultural land.

10.10.5 An ALC survey will be completed in support of the Environmental Statement. This survey will allow a more detailed assessment of effects on soils and agricultural land, including quantification of the various ALC grades affected both temporarily and permanently. This survey will allow a reassessment of the magnitude of the effects.

Human health

10.10.6 Given the current geochemical data available (Section 1 GI only), it is unlikely that soils investigated in the Section 1 GI would constitute a significant risk to human health. The Section 2 and Section 3 GI findings are yet to be reviewed, and hitherto unforeseen soil contamination could be detected. However, with the correct working practices, the effect on human health of any contaminated soils encountered is likely to be minor, resulting in a slight adverse effect.

10.10.7 The area of infilled land in borrow pit J containing the suspected ACM is unlikely to pose a significant effect on human health if the area is undisturbed. Borrow pit J has been designed with an exclusion zone around the suspected ACM to avoid works disturbing the area.

10.10.8 The available ground gas information indicates the ground gas regimes within the proposed scheme and borrow pits are likely to pose a low risk to human health as limited gas flow rates and low concentrations of harmful ground gases were recorded.

10.10.9 As ground works within the borrow pits are expected to take place in open, well ventilated areas, hazardous ground gas conditions are unlikely to build up.

10.10.10 Any work that is planned to take place in confined spaces during the A12 scheme construction will require a separate detailed risk assessment.

10.10.11 Review of the GI findings is ongoing at the time of writing, and the Witham and London Road landfills are still to be fully assessed. Further assessment will be included in the Environmental Statement regarding the risk posed from these landfills.

10.10.12 By following correct working practices, the effect of ground gas on human health is likely to be minor.

Groundwater and surface water

10.10.13 The surface water around the scheme was assessed for its quality as reported in the A12 Junction 19 to 25 Surface Water Monitoring Factual Report (B229H130-001).

10.10.14 The proposed scheme is in close proximity to a number of rivers including the River Chelmer, River Blackwater, River Brain, River Ter, Roman River and Domsey Brook, which classifies the sensitivity of surface waters as high to very high. With the mitigation measures suggested to prevent mobilisation of contaminants to surface waters, the proposed scheme would have a minor magnitude of impact, resulting in a slight to moderate significant effect.

10.10.15 As some of the underlying aquifer in the scheme is classified as a SPZ1, the groundwater receptor sensitivity has been classed as very high. The construction works and the presence of existing groundwater contamination as found in the Section 1 GI means that there is a potential major adverse magnitude of impact. However, with the mitigation measures suggested to prevent the mobilisation of contaminants the proposed scheme would have a minor magnitude impact, resulting in a moderate to large significance of effect.

10.10.16 The mitigation measures suggested would reduce the significance of effect to surface water and groundwaters. Monitoring the water quality throughout the construction would act as an early warning and allow for further mitigation to be put in place.

10.10.17 The groundwater monitoring being done as part of the GI is still ongoing. Further assessment is needed when the data become available, which will be included in the Environmental Statement.

Table 10.7 Significance categories for receptors during construction after mitigation

Receptor	Environmental value	Magnitude of Impact	Significance category
Geology (scoped out)	N/A	N/A	N/A
Soils	Medium	Minor	Slight
BMV agricultural land	Very high to high	Major	Large or very large
Human health	Very high to negligible	Minor	Slight
Surface water	Very high to high	Minor	Sight or moderate
Groundwater	Very high	Minor	Moderate or large

Operation

10.10.18 An assessment of the likely significant effects during operation is described in the following sections and summarised in Table 10.8.

Geology and soils

10.10.19 Operational impacts on geology have been scoped out of the assessment. No significant effects are expected.

Human health

10.10.20 Operational impacts on human health have been scoped out of the assessment. No significant effects are expected.

Groundwater and surface water

10.10.21 Operational impacts on groundwater and surface water from land contamination have been scoped out of the geology and soils assessment. No significant effects are expected.

10.10.22 Potential effects from road runoff, drainage, and pollution spillages are covered in Chapter 14: Road drainage and the water environment, and are not addressed further in the geology and soils aspect.

Table 10.8 Significance categories for receptors during operation after mitigation

Receptor	Significance category
Geology	Scoped out, no significant effects are expected
Soils	Scoped out, no significant effects are expected
BMV agricultural land	Scoped out, no significant effects are expected
Human health	Scoped out, no significant effects are expected
Surface water	Scoped out, no significant effects are expected
Groundwater	Scoped out, no significant effects are expected

11 Material assets and waste

11.1 Topic introduction

11.1.1 This chapter presents the findings of the preliminary environmental assessment undertaken for the material assets and waste aspect. This aspect considers the following matters:

- The use and consumption of 'material assets' (Article 3.1 (d) of Directive 2011/92/EU[9]): this includes materials and products from primary, secondary, recycled, sustainable and renewable sources, and the use of excavated and other arisings that fall within the scope of waste exemption criteria.
- The production and disposal of 'waste' (Annex IV of Directive 2011/92/EU[1]): this includes surplus materials which can become waste, as well as other substances which the holder discards, intends to discard, or is required to discard.

11.1.2 Constructing the proposed scheme would require the use of large quantities of material assets and hence may result in potential impacts on the environment through the depletion of non-renewable natural resources, and sterilisation of mineral safeguarding sites. Conversely, constructing the proposed scheme would also result in large quantities of surplus materials and waste, leading to potential impacts on the available landfill void capacity.

11.1.3 This chapter includes a preliminary environmental assessment of the potential environmental impacts and effects that can reasonably be anticipated from these matters during the construction of the proposed scheme (operational impacts have been scoped out of this assessment for the reasons identified in Section 11.8). It identifies measures for mitigating these effects where practicable, and describes the significance of the residual effects that are likely to remain after mitigation.

11.1.4 Where practicable, those surplus materials and wastes that would arise during the construction of the proposed scheme would be re-used, recycled or otherwise recovered on or off-site, which would prevent the need for off-site disposal to landfill. Diverting materials from landfill and maximising the use of re-used, recycled and responsibly sourced materials would reduce the attendant environmental impacts associated with materials production, thereby supporting a circular economy.

11.1.5 A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which resources are kept in use for as long as possible; the maximum value from resources is extracted while in use; products, components and materials are recovered and regenerated at the end of life; and kept at their highest utility and value at all times.

[9] The UK left the EU on 31 January 2020. Under the European Union (Withdrawal) Act 2018 (as amended), EU-derived domestic legislation (such as existing environmental regulations that implement EU Directives) and direct EU legislation (such as EU regulations and decisions) which were in force immediately prior to the end of the transition period continue to form part of UK domestic law after 31 December 2020.

11.1.6 This chapter is supported by the following figure (see Appendix A):

- Figure 11.1 Minerals and Waste Infrastructure and Designations

11.2 Stakeholder engagement

11.2.1 Table 11.1 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (2021) as relevant to the scope of the material assets and waste assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

11.2.2 A number of the Scoping Opinion responses included matters that are indirectly relevant to the material assets and waste aspect (e.g. impacts on the highway network from import of bulk materials etc). These comments have not been included in Table 11.1 as they are not directly related to the aspect scope and methodology and are being assessed by other environmental aspects.

Table 11.1 Key stakeholder feedback for material assets and waste aspect

Stakeholder	Comment	Response
Planning Inspectorate	The Inspectorate agrees that operational impacts (on material assets and waste) can be scoped out of the Environmental Statement on the basis of the reasoning presented. This is also supported by Essex County Council (ECC).	Operational effects on material assets and waste will be scoped out of the Environmental Statement.
Planning Inspectorate	The locations of waste facilities that may be used to dispose of the proposed scheme's waste should be described within the Environmental Statement.	The locations of waste facilities that may be used to dispose of the waste will be described within the Environmental Statement, with cognisance of the limitations described in Section 11.6.
Planning Inspectorate	The Environmental Statement should state how the design and mitigation measures, including the Site Waste Management Plan and Responsible Sourcing Plan will be secured through the Development Consent Order (DCO) or other legal mechanism.	The design and mitigation measures included in the Environmental Statement will specify how the Site Waste Management Plan and Responsible Sourcing Plan will be secured and monitored.
Essex County Council	Where the proposed scheme has an impact on a Mineral Safeguarding Area, the Secretary of State should ensure that the applicant has put forward appropriate sterilisation mitigation measures to safeguard mineral resources as per national and local policy requirements.	Mineral Resource Assessments will be prepared and submitted with the Environmental Statement to establish the viability of extracting minerals in advance of or in conjunction with the proposed scheme.

Stakeholder	Comment	Response
Essex County Council	ECC has a schedule of information requirements to include when carrying out Environmental Impact Assessments (EIA) on its mineral resources and active, permitted and/or allocated minerals and waste infrastructure.	Mineral Resource Assessments and Mineral and Waste Infrastructure Assessments will be prepared and submitted with the Environmental Statement/DCO application in line with Essex County Council's requirements.
Essex County Council	Policy S4 of the Essex Minerals Local Plan requires that all development proposals shall ensure that mineral waste is minimised and that minerals on development and redevelopment sites are re-used and recycled. It further requires the application of procurement policies which promote sustainable design and construction in the proposed development.	Information will be provided to address the issues identified by ECC and will be reported in various chapters of the Environmental Statement, including but not limited to the material assets and waste aspect (i.e. to be supported by the Responsible Sourcing Plan, Mineral Resource Assessment and Site Waste Management Plan).
Essex County Council	When considering the impact of the proposed scheme on local aggregate supply, the anticipated annual take of the project versus recent annual sales of this mineral over an appropriate geographic area should be reported.	Recent annual sales information has been added to the baseline conditions section. An assessment of the aggregates consumption of the proposed scheme versus recent annual sales will be considered in the Environmental Statement.
Essex County Council	Landfill capacity assessments should not amalgamate inert and non-hazardous landfill capacity. Whilst it is recognised that non-hazardous landfill sites can accept inert waste, Essex CC requests that future assessments are based on dedicated inert landfill capacity, particularly in Essex, in the first instance.	Baseline landfill capacity assessments have been separated into inert and non-hazardous landfill classes for the East of England region and Essex sub-region. Impacts to landfill capacity would be primarily assessed on a regional basis for combined inert and non-hazardous landfill capacity. This is to account for any uncertainty in the classification of construction wastes.
Essex County Council	An assessment of disposal capacity over the lifetime of construction should consider the economics of inert disposal and whether counting all available capacity in the East of England is appropriate. Whilst the desire to scope in capacity at the regional level is understood, there is a need to demonstrate that the various landfill capacities relied upon would be capacity that could realistically serve the project. Future landfill forecasts should include commentary regarding when sites are expected to close.	The rationale for setting the second study area at the regional level (East of England) has been provided in Section 11.6. The baseline assessment has provided a detailed assessment of the current and future landfill capacity likely to be available at the regional and sub-regional levels. Whilst closure dates are not publicly available at the regional level, the information provided by ECC at the sub-regional level has been considered in the baseline assessment.

Stakeholder	Comment	Response
Essex County Council	Commentary will be needed to say that waste from the project may 'push out' waste that would otherwise be disposed of in Essex, and what that means for the Environmental Statement's intended approach. Proposed scope recognises the proximity principle but not the concept of net self-sufficiency which is another main driver for waste planning.	The Environmental Statement will estimate the quantity of residual waste to be disposed of to landfill in the region split by inert and non-hazardous classifications where feasible. This would also contextualise these arisings against the baseline levels of construction and demolition waste forecast to arise at the sub-regional level during the construction phase.
Essex County Council	It is considered appropriate that assessments of mineral take and waste arising are presented annually and linked to the various phases of development.	The estimated minerals consumption and waste generation, associated with constructing the proposed scheme, is to be divided equally across the four-year construction programme to obtain a 'per annum' figure which can be directly compared to the baseline.

11.2.3 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

11.3 Legislative and policy framework

11.3.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIPs) 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.

11.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraphs 4.28 and 4.29 of the NNNPS state that applicants should include design as an integral consideration from the outset of a proposal; and inter alia produce sustainable infrastructure efficient in the use of natural resources.
- Paragraph 5.169 of the NNNPS states that applicants should safeguard any mineral resources on the proposed site as far as possible.
- Paragraph 5.182 of the NNNPS states that where a proposed development has an impact on a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources.
- Paragraph 5.42 of the NNNPS states the applicant should set out the arrangements that are proposed for managing any waste produced. The arrangements described should include information on the proposed waste recovery and disposal system for all waste generated by the development.

The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that the alternative is the best overall environmental outcome.

11.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation, local plans and policy as well as any statutory guidance for this aspect. A summary of legislation and policy is provided in Appendix B. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

11.4 Assessment methodology

Assessment methodology

11.4.1 The preliminary environmental assessment for this aspect focuses primarily on determining the likely significant effects of constructing the proposed scheme on the environment resulting from the consumption of material assets, and the generation and management of waste. The assessment follows the guidance as set out in Design Manual for Roads and Bridges (DMRB) LA 110 (Highways England, 2019c).

11.4.2 This assessment utilises and builds on the information and data gathered as part of the environmental scoping assessment and endeavours to collate additional information to qualify, and ideally quantify, the material assets required, and waste likely to be generated in constructing the proposed scheme.

11.4.3 The EIA, for the purposes of the material assets and waste aspect, is largely a desk-based quantitative study that aims to identify the following assessment information for the anticipated construction phase (2023 to 2027):

- For material assets:
  - types and quantities of materials assets required to construct the scheme
  - information on materials that contain secondary and recycled content
  - information on any known sustainability credentials of materials to be consumed
  - the type and volume of materials that would be recovered from on-site or off-site sources for use on the scheme
  - the cut and fill balance
  - the degree of sterilisation of mineral safeguarding sites and peat resources
  - details of on-site storage and stockpiling arrangements, and any supporting logistical details

- For waste management:
  - types and quantities of waste generated during the construction of the scheme
  - amount of waste (by type and weight) that would be recovered and diverted from landfill either on-site or off-site (i.e. for use on other projects)
  - types and quantities of waste arising from the scheme (demolition, excavation arisings and remediation) requiring disposal to landfill
  - details of on-site storage and segregation arrangements for waste and any supporting logistical arrangements
  - potential for generation of hazardous waste (type and quantity)

11.4.4 There is limited information available at this stage regarding the precise material requirements and waste quantities associated with constructing the proposed scheme. Therefore, there is insufficient information to undertake a detailed quantitative assessment of the proposed scheme against the DMRB LA 110 significance criteria at this stage (see next sub-section).

11.4.5 These limitations are not untypical for a Preliminary Environmental Information Report (PEIR), and the information presented in this chapter is considered to represent an appropriate level of detail in line with the available design information. The following published statistics, benchmarks and key performance indicators have been used to populate the data gaps that exist in relation to the DMRB LA 110 requirements for PEIR:

- Waste and Resources Action Programme (WRAP, 2008), Net Waste Tool - Dataset
- WRAP (2009), Construction Procurement Guidance: Delivering Higher Recycled Content in Construction Projects
- WRAP (2013), Resource Efficiency Benchmarks for Construction Projects
- Mineral Products Association (2020), Profile of the UK Mineral Products Industry Workbook
- Defra (2020d), ENV23 - UK Statistics on Waste dataset

11.4.6 These data sources have been used to undertake a qualitative assessment of the proposed scheme against the DMRB LA 110 simplified assessment framework and descriptors of effect (see next sub-section). This qualitative assessment has described the main areas of construction including those that are likely to consume large quantities of material assets and generate large quantities of waste, and those which would generate likely significant effects according to DMRB LA 110.

11.4.7 Professional judgement has been used to determine which significant effect categories the proposed scheme is likely to fall within with regards to the material assets and waste matters of this aspect. Given the nature of the DMRB LA 110 significance criteria category descriptions, the resulting significance of effect is unlikely to change between the PEIR and the Environmental Statement.

Significance criteria

11.4.8 The Environmental Scoping Report (Highways England, 2020d) sets out the significance criteria which will be used to assess significance for this aspect as per DMRB LA 110 guidance. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf#page=154.

11.4.9 DMRB LA 110 sets out how effects associated with material assets and waste should be assessed through the use of a 'simplified assessment framework' based around a set of standardised descriptors of effect for each significance category. Consequently, this simplified assessment framework precludes the application of a methodology to derive a measure of the significance of effect based on the more traditional approach of combining the value of a resource (or receptor) and the magnitude of impact (as per the general principles detailed in Chapter 5: Environmental assessment methodology).

11.4.10 This simplified assessment framework uses very precise and deliberate language, specifically 'or', 'and' and 'and/or' after each descriptor of effect to denote which significance category should be applied to a given scheme. The descriptors for material assets are generally summative (large, moderate, slight and neutral effects), and all descriptors need to be met in full in order to assign a relevant significance category (with the notable exception of a large effect which can be assigned when a project sterilises 1 or more mineral safeguarding site and/or peat resource). The descriptors of effect for waste are either standalone (very large and neutral effects) or summative (large, moderate and slight effects).

11.4.11 The simplified assessment framework provided in DMRB LA 110 will be used to assess the likely environmental effects of constructing the proposed scheme in relation to the following descriptors of effects:

- For material assets:
  - percentage of non-hazardous construction and demolition (C&D) waste that will be recovered and diverted from landfill either within the first or second study areas (see Section 11.6 for study areas)
  - percentage of aggregates required to be imported to site that comprise re-used or recycled content in relation to the East of England target of 31%[10]

[10] This target is provided in DMRB LA 110 and is taken from the Ministry of Housing, Communities & Local Government (2009) National and Regional Guidelines for Aggregates Provision in England 2005 to 2020. This target excludes site-won borrow pit material and demolition materials. The former is considered a primary material for the purposes of assessment, and the latter is not an imported material.

- likelihood of sterilising 1 or more mineral safeguarding sites or peat resources (as defined in the glossary), placing their future use at risk or rendering them inaccessible for current or future use or extraction

- For waste:
  - percentage reduction or alteration in regional landfill capacity as a result of managing C&D waste from the proposed scheme
  - percentage of C&D waste requiring disposal to landfill outside of the second study area

11.4.12 Professional judgement has been used to determine which significant effect categories the proposed scheme is likely to fall within, with regards to the material assets and waste matters of this aspect, after an assessment of the effectiveness of those embedded, standard and additional mitigation measures identified in Section 11.9.

11.5 Assessment assumptions and limitations

11.5.1 Whilst DMRB LA 110 sets out the requirements for assessing and reporting the effects on material assets and waste, this standard is primarily aimed at compliance with the EIA Directive and guiding statutory Environmental Statements, where there is typically much greater certainty around the design of a project.

11.5.2 There is limited information available at this stage regarding the precise material requirements and waste quantities associated with constructing the proposed scheme; and therefore, there is also insufficient information available at this stage regarding the key assessment parameters identified in Section 11.4.

11.5.3 These limitations are not untypical for a PEIR, and the information presented in this chapter is considered to represent an appropriate level of detail in line with the current design programme. Those published statistics, benchmarks and key performance indicators identified in Section 11.4 have been used to populate these data gaps at this stage. Any limitations in the qualitative assessment approach would be addressed in the Environmental Statement through the gathering and assessment of quantified design information on material assets consumption and waste generation where available.

11.5.4 The baseline data sources used in this PEIR represent the most recently available stakeholder information. However, there is a general lag (in years) for materials, waste processing and landfill capacity data in the UK and conditions may have changed since publication of these data. Although checks are made by stakeholders for anomalies or errors in their data prior to publication, it cannot be guaranteed that these data sets are error free, or whether any commercial or confidentiality decisions have been taken by site operators that may have affected these data.

11.5.5 Material assets and waste can affect the full range of environmental assessment aspects and matters. Where materials are consumed, and waste is generated, it is acknowledged that, depending on how they are managed, indirect adverse effects may arise (from greenhouse gas emissions, water consumption and pollution, visual impacts, dust, noise, vibration, vehicle emissions, disruption to traffic and other potential causes of nuisance, amongst others). Whilst these impacts would typically be assessed as part of the EIA, this would not form part of a material assets and waste assessment. Such impacts, effects and mitigation measures are considered as part of the other aspect chapters in this PEIR.

11.5.6 Similarly, the indirect impacts of off-site materials extraction and production and waste management are assumed to have already been assessed (and where necessary, mitigated) under the Town and Country Planning and Environmental Permitting regimes for those sites and thus would not be assessed as part of the material assets and waste assessment for the proposed scheme. These stages of the materials and waste lifecycles are also considered to be outside the scope of this assessment due to the range of unknown variables associated with these sites.

11.5.7 Whilst existing and allocated waste sites and infrastructure are captured in this chapter at the request of ECC, these sites do not fall under the scope of the DMRB LA 110 assessment method or significance criteria. Notwithstanding this, these sites have been considered in Section 11.7, Section 11.8 and Section 11.9.

11.6 Study area

11.6.1 In accordance with DMRB LA 110, the assessment of material assets and waste has used two geographically different study areas to examine the use of material assets and the generation and management of waste:

- The first study area (proposed scheme) – based on the construction footprint or boundary of the proposed works which is defined by the Order Limits (provisional Order Limits denoted on Figure 11.1). Within these areas, material assets would be consumed, and waste would be generated.

- The second study area (East of England region) – based on the likely provenance of material assets required to construct the main elements of the proposed scheme, and waste infrastructure that is likely to be suitable to accept waste generated by the proposed scheme. These include:

    - The East of England Regional Aggregates Working Party area[11] and Thames and East Coast dredging areas which is likely to be the first source of primary, secondary and recycled aggregates used to construct the proposed scheme.

[11] The East of England Regional Aggregates Working Party area comprises the former East Anglia mineral planning authorities (MPA) (Norfolk, Suffolk, Cambridgeshire and Peterborough) and MPAs from the former South East (Essex, Southend-on-Sea, Thurrock, Hertfordshire, Central Bedfordshire, Bedford Borough and Luton).

- The former East of England Planning Region which is likely to be where the waste management infrastructure used to manage the majority of waste generated by the proposed scheme, is located. This includes the Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk sub-regions.

11.6.2 In accordance with DMRB LA 110, professional judgement, with consideration for a balance of the proximity principle and value for money principle, has been applied in establishing the second study area.

11.6.3 Setting the study area at the regional level (East of England) takes account of the need for the inter-regional movement of materials and waste within England, and echoes the broader approach to minerals and waste planning and management that has traditionally been undertaken on a county and regional-level basis.

11.6.4 This reflects the fact that minerals and waste planning authorities have a statutory duty to plan for an appropriate amount of minerals and waste capacity to be available over a defined period, and take account of minerals and waste that are transferred across minerals and waste planning authority boundaries.

11.6.5 Furthermore, this approach was considered appropriate given the proximity of the proposed scheme to other sub-regions in the East of England, London and South East; and recognising that cross-boundary movements of material assets and waste are likely to occur, whilst endeavouring to adopt the proximity and self-sufficiency principles where practicable.

11.6.6 Reference to Whole Life Carbon Assessment for the Built Environment (RICS, 2017) suggests that in the absence of project-specific information, the following indicative transport distances can be used when estimating the radius, as the crow flies, of imported material assets and exported wastes:

- Material assets:
  - locally extracted or manufactured materials (e.g. soil, aggregates, asphalt, concrete): 50km
  - nationally manufactured materials (e.g. steel, plastics, timber etc): 300km
- Waste management:
  - re-use, recycling or recovery of inert and non-hazardous waste: 50km
  - landfill or incineration of inert and non-hazardous waste: 50km

11.6.7 These distances would suggest that the proposed scheme is likely to have access to material suppliers and waste management facilities in the East of England (Essex, Hertfordshire, Cambridgeshire and Suffolk); and Greater London and the South East of England (Kent). This assumption is also validated by the 2019 Waste Data Interrogator (Environment Agency, 2020a)

which confirms that a notable proportion (>10%) of the C&D waste originating in Essex was managed at facilities located outside of the sub-region in 2019[12].

11.6.8 Whilst commentary has been provided in this chapter to reflect the radius within which materials could be imported and wastes disposed of, the proposed scheme would not be bound by these distances when procuring materials and managing wastes. It would be up to the appointed Contractor to source materials and manage waste during the construction of the proposed scheme, and typically they would look to use local (sub-regional) material sources and waste infrastructure wherever feasible to minimise the environmental impact and cost of transport, and support the economic well-being of local communities.

11.6.9 Procurement rules mean that it is not possible to prescribe specific material suppliers and waste management facilities to be used during construction of the proposed scheme, and these rules prevent setting a precedent that would potentially tie the appointed Contractor to exclusive arrangements with specific material suppliers and waste management facilities. The ability to use materials suppliers and waste management infrastructure from a wide range of locations would allow existing material resources and waste management capacity to be used effectively and efficiently, without resulting in local overcapacity to the detriment of the local economy.

11.7 Baseline conditions

Baseline sources

11.7.1 A desk-based assessment has been undertaken to describe the current and likely future state (in the absence of the proposed scheme) of the following:

- For the first study area:
  - types and quantity of material use and waste associated with operation of the existing A12 where available
  - information on availability of key construction materials required for the proposed scheme
  - location of mineral safeguarding sites and peat resources in relation to the proposed scheme
- For the second study area:
  - regional (or other relevant geographic scale) presence and capacity of material recovery or recycling facilities to be used by the proposed scheme
  - regional (or other relevant geographic scale) presence and capacity of landfill facilities to be used by the proposed scheme

[12] In Hampshire, Kent, Cambridgeshire, West Yorkshire, County Durham, Hertfordshire, Suffolk, Northamptonshire, Lancashire, Wiltshire, Oxfordshire, Surrey, Worcestershire, East London Waste Authority, Tees Valley Unitary Authorities and Buckinghamshire.

11.7.2 Baseline data have been collected at the regional (East of England), sub-regional (Essex) and local (provisional Order Limits) level. The baseline assessment has been prepared with reference to the latest minerals and waste information published by the East of England Aggregate Working Party (EEAWP), ECC minerals and waste planning authority, the Crown Estate, Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency.

11.7.3 No account of future climate change has been considered in the baseline conditions, as this is unlikely to affect the material assets or waste matters baseline within the timescales of constructing the proposed scheme (2023 to 2027). Please refer to Chapter 15: Climate, for potential impacts resulting from climate change during construction and operation of the proposed scheme.

Baseline conditions

Material assets

11.7.4 For the purposes of this assessment, material assets are considered to be the physical resources in the environment required for constructing the proposed scheme, which may be of human or natural origin.

11.7.5 Primary, secondary and recycled aggregates have been chosen to act as a proxy indicator of regional and sub-regional material assets given that large quantities of aggregates are typically required for all-purpose trunk road projects. This was also considered appropriate due to the prominence given to aggregates in the DMRB LA 110 significance criteria.

11.7.6 This is also supported by Highways England's (2017b) Sustainable Development Strategy and Action Plan which confirms that its key ambition covering manufactured capital is to: push towards a 'circular' approach to the management of its resources; minimise its demand for primary resources extracted from the ground; and maximise the re-use of the resources already in use on the network.

Aggregates consumption associated with the existing A12

11.7.7 The operational maintenance of this section of the existing A12 trunk road is likely to consume both unbound aggregates (used as sub-base and drainage applications) and bound aggregates (used in ready mixed concrete, asphalt and pre-cast concrete products).

11.7.8 At the time of writing, there were no precise figures available regarding the baseline quantities of operational and maintenance aggregates consumption generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions in the first study area.

11.7.9 Notwithstanding this, operational effects have been scoped out of the assessment for the reasons identified in Section 11.8.

Primary mineral reserves and sales

11.7.10 The principal materials used in road construction are primary aggregates, including sand, gravel and crushed rock.

11.7.11 Primary aggregates are produced from naturally occurring mineral deposits and used for the first time, as defined by the British Geological Survey (BGS) (2019b) Mineral Planning Factsheet Construction Aggregates. Aggregates are normally defined as being hard, granular materials which are suitable for use on their own or with the addition of cement, lime or bituminous binders. However, a proportion of aggregates sales are for construction fill or other uses where soft and non-granular material may be acceptable or specified.

11.7.12 BGS (2019b) confirms that the main use of sand and gravel is for concrete (63% of the total sand and gravel sold in Great Britain). Other uses for sand include mortar, and for gravel include drainage layers or construction fill. The main use for crushed rock is as roadstone in road construction (40% of the total crushed rock sold), where it is either coated with bitumen in asphalt or used uncoated. A further 15% of crushed rock is used in concrete.

11.7.13 The Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework (NPPF) requires mineral planning authorities (MPAs) to maintain a minimum landbank of 10 years for crushed rock and a minimum landbank of seven years for sand and gravel. This is used to determine whether there is a shortage or surplus of supply in a given minerals planning area. The Annual Monitoring Report 2018 Data (EEAWP, 2019) provides sales and reserves data from January to December 2018. These data are summarised in Table 11.2 for the East of England region and Essex sub-region.

Table 11.2 Land-won aggregate sales, reserves and landbanks in the East of England and Essex, 2018

Mineral	Average sales 2016-2018 (million tonnes) (Mt)	Remaining reserves (at 31/12/18) (Mt)	Landbank based on sub-regional apportionment (years)	Landbank based on rolling average ten-year sales (years)
East of England region				
Sand and gravel	12.20	121.08	8.2	11.4
Crushed rock*	0.36	4.30	10.7	12.1
Essex sub-region				
Sand and gravel	3.46	29.98	6.7	9.3
Crushed rock	N/A	N/A	N/A	N/A

*Sales for Cambridgeshire, Peterborough and Norfolk only. These have been aggregated for confidentiality reasons, and comprise limestone from Cambridgeshire and Peterborough and Carstone from Norfolk.

11.7.14 From Table 11.2 it can be inferred that the East of England region demonstrates landbanks for sand and gravel and crushed rock in excess of the required NPPF thresholds as of the end of 2018, based on both sub-regional apportionment and rolling average ten-year sales.

11.7.15 The 'Greater Essex Local Aggregate Assessment 2020 (Covering the Calendar Year 2019)' (the LAA), (ECC, 2020b) confirms that sub-regional permitted reserves were 33.10Mt in December 2019. The apportionment landbank stood at 7.44 years at the end of 2019, whilst the ten-year sales average landbank stands at 10.14 years. Therefore, the landbank is considered sufficient. In addition, as of the time of writing (September 2020) the LAA reports that there were three pending permissions across Essex, which would permit the working of 5.5Mt of sand and gravel which, if granted and all legal agreements are signed, would further increase the landbank.

11.7.16 The LAA (ECC, 2020b) reports that the ten-year (2010 to 2019) average sales figure (3.26Mt) and the three-year (2017 to 2019) average sales (3.38Mt) for sand and gravel are both below the apportioned tonnage of 4.45 Mt per annum (Mtpa) provision made in the adopted Essex Minerals Plan. The last three years of sales show a decrease from 3.41Mt in 2017 to 3.17Mt in 2019, which amounts to a decrease of 7%. However, the LAA suggests that some of this decrease could be attributed to the lower than expected survey response rate due to staff being on furlough as a result of the COVID-19 pandemic.

11.7.17 Reference to the LAA confirms that there are no hard-rock quarries in Essex, and that Essex is heavily reliant on hard rock importation (1.6Mt imported in 2019), used for roadstone, railway ballast, concrete aggregate, armourstone, other screened and graded aggregate, or for constructional fill. The LAA reports a pattern of long-distance supply, with Essex exporting its sand and gravel, whilst importing hard rock from areas such as the East Midlands and South West. According to the most recent Aggregate Working Party (AWP) Reports for the East Midlands and South West regions, these have an excess of crushed rock reserves (55 years and 41 years respectively).

11.7.18 The East of England is also served by the Thames and East Coast dredging regions. In addition to the land-won aggregates, the Marine Aggregates Capability and Portfolio Document 2020 (Crown Estate, 2020) reports that there were an additional 31.61Mt and 62.49Mt of primary marine aggregate reserves respectively within the Thames and East Coast dredging regions as of 31 March 2019. The LAA (ECC, 2020b) reports that a total of 8.57Mt of aggregate material were dredged from the seabed in 2019 in these regions.

11.7.19 This was an increase of 1.51Mt compared to that dredged in 2018. Licences have been granted that permit the dredging of a total of 11.73Mtpa from these regions. At this rate, there are estimated to be 29 years of primary marine aggregate production permitted in the Thames Estuary and 15 years within the East Coast region (Crown Estate, 2020).

Regional secondary and recycled aggregates production capacity

11.7.20 The Annual Monitoring Report 2018 Data (EEAWP, 2019) confirms that data on secondary and recycled aggregate production and use in the East of England is variable and incomplete. Notwithstanding this, the 2019 Waste Data Interrogator (Environment Agency, 2020a) confirms that approximately 14.0Mt of inert C&D minerals waste was received at waste management facilities in the East of England in 2019, with 7.0Mt of this received at waste management facilities in Essex.

11.7.21 The LAA 2020 (ECC, 2020b) suggests that there is a well-established network of C&D waste recycling and recovery facilities in Essex, with 51 operational aggregate recycling facilities as of March 2019, with a combined operational capacity of approximately 2.1Mtpa. Some of these sites are transient in nature, so there will be a reduction in recycling capacity as temporary permissions expire, unless further permissions are granted.

11.7.22 ECC (2020b) reports that during 2019, two permissions were granted that would increase the inert recovery capacity in Essex to approximately 2.3Mtpa if these facilities were developed. ECC (2020b) reports that it is not known whether secondary aggregates are produced in any significant quantity in Essex. However, it suggests that a lack of heavy industry in the county would imply that there will be little produced.

11.7.23 UK Statistics on Waste – March 2020 (Defra, 2020d) reports that approximately 96% of mineral waste from C&D activities are currently subject to waste recovery in England. The 'mineral wastes' category typically includes wastes such as bricks, stone and road planings that are converted into usable aggregates. These data would therefore further indicate there is likely to be a good potential supply of recycled aggregates available within the East of England region and Essex sub-region to support the construction of the proposed scheme.

Mineral extraction, processing and transhipment sites

11.7.24 The Annual Monitoring Report 2018 Data (EEAWP, 2019) confirms that there were 122 aggregate extraction sites, 137 aggregate recycling sites and 33 wharfs and aggregate rail depots in the East of England in 2018.

11.7.25 Reference to the LAA (ECC, 2020b) shows that 33 sand and gravel quarries were located in Greater Essex, 23 of which were active in 2019. Of the ten inactive sand and gravel quarries, the LAA records that four were considered as long-term 'dormant' and six are permitted, but not actively extracting, as of 31 December 2019. In addition, during 2019, three sites were pending determination and/or legal agreements and a single site ceased mineral extraction or closed.

11.7.26 There are no hard-rock quarries in Essex as reported in Table 11.2. One quarry produces sand and gravel as well as silica sand. Essex also has two brick clay quarries and a single chalk quarry. Furthermore, the LAA confirms that there were 43 mineral processing facilities and 12 permitted wharves and rail depots operational at the end of 2019.

Mineral safeguarding sites

11.7.27 The DMRB LA 110 defines mineral safeguarding sites as 'Operational sites or sites identified within strategic planning documents for the extraction of minerals'.

11.7.28 The NPPF (MHCLG, 2019) requires that planning policies should:

- *'provide for the extraction of mineral resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction'* (paragraph 204(a)).

- *'safeguard mineral resources by defining Mineral Safeguarding Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided, (whilst not creating a presumption that the resources defined will be worked)'* (paragraph 204(c)).
- *'set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place'* (paragraph 204(d)).
- *'safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material'* (paragraph 204(e)).

11.7.29 The Minerals Local Plan (ECC, 2014) confirms that MSAs are designated in Essex for mineral deposits of sand and gravel, silica sand, chalk, brickearth and brick clay considered to be of national and local importance, as defined on the Essex Mineral Local Plan Policies Map. MSAs are areas designated by a MPA which cover known deposits of minerals which are desired to be safeguarded from unnecessary sterilisation by non-mineral development, whilst not creating a presumption that the resources defined in the MSA will be worked.

11.7.30 The Minerals and Waste Authority Monitoring Report (ECC, 2018a) confirms that during 2017/18, 30.5ha of commercial sand and gravel deposits were sterilised by non-mineral development; and that cumulatively between 01 April 2014 and 31 March 2018, 153.9ha had been sterilised. No data are provided for brick clay which is limited in Essex to the MSA located at Marks Tey.

11.7.31 A significant proportion of the first study area lies within an MSA for sand and gravel. Part of the eastern study area also falls within an MSA for brick clay. The first study area also passes through a number of Mineral Consultation Areas (MCA). MCAs are designated within and up to an area of 250m from existing and allocated mineral extraction and infrastructure sites, and act as a trigger for where a district or borough council should consult the MPA for any proposals for non-minerals development. Safeguarded minerals infrastructure and designations located within 250m of the first study area are identified in Table 11.3 and Figure 11.1 (Appendix A).

11.7.32 Policy S8 of the Minerals Local Plan (ECC, 2014) seeks to ensure that mineral resources of national and local importance are not directly sterilised by non-minerals surface development, and that development does not prejudice the effective working of permitted mineral reserves, preferred or reserve site allocations within the Minerals Local Plan. With regards to MCAs, Policy S8 of the plan also seeks to ensure that existing and allocated mineral sites and infrastructure are protected from potentially sensitive or inappropriate neighbouring developments that may prejudice their continuing efficient operation.

Table 11.3 Mineral safeguarding sites within 250m of the first study area

Site type	Site name	Planning application no.
MSAs	Sand and gravel	N/A
	Brick clay	N/A
Mineral Local Plan Allocations or Safeguarded Sites	Bulls Lodge Quarry Coated Stone Plant	MLP p196
	Land at Colemans Farm (allocated for extraction, now existing)	A46 MLP p170
	Marks Tey Rail Siding (existing)	F3 MLP p180
Minerals Infrastructure	Bulls Lodge Quarry Coated Stone Plant	ESS/01/11/CHL
	Bulls Lodge	ESS/37/15/CHL, pending determination
	Bulls Lodge	ESS/36/13/CHL, pending determination
	Colemans Farm	ESS/10/18/BTE
	Colemans Farm	ESS/35/17/BTE
	Colemans Farm	ESS/11/20/BTE
	Marks Tey	ESS/26/08/COL

* The information in this table was provided by ECC in their Scoping Opinion (Planning Inspectorate, 2021) response, and is considered correct as of March 2021.

Peat resources

11.7.33 DMRB LA 110 defines peat resources as existing or potential peat extraction sites.

11.7.34 The Minerals Local Plan (ECC, 2014) confirms that there are no such sites recorded within the study area, and the BGS Minerals Information Online Tool confirms that there are no superficial peat deposits within 250m of the proposed scheme extents.

11.7.35 Peat resources have therefore been scoped out of the assessment as reported in the Environmental Scoping Report (Highways England, 2020d).

Waste management

Waste generation associated with the existing A12

11.7.36 The operational maintenance of this section of the existing A12 trunk road is likely to generate a wide range of C&D wastes including, but not limited to, asphalt planings, soft estate vegetative arisings, road sweepings, gully arisings, oil separator waste, animal by-products and litter.

11.7.37 At the time of writing, there were no precise figures available regarding the baseline quantities of operational and maintenance waste generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions in the first study area.

11.7.38 Notwithstanding this, operational effects have been scoped out of the assessment for the reasons identified in Section 11.8.

National and regional C&D waste generation and management

11.7.39 UK Statistics on Waste (Defra, 2020d) reports that the construction sector is the largest contributing sector to the total waste generation in England. This sector generated 120.3Mt of construction, demolition and excavation (CD&E) waste[13] in 2016 (the most recent year available).

11.7.40 Defra (2020d) provides an update on the generation and management of UK waste, including the contributions made by various sectors. This confirms that the construction sector in England generated a total of 59.6Mt of non-hazardous C&D waste in 2016, 92% of which was recovered, and that the annual recovery rate for C&D waste in England has remained at around 92% since 2010, well above the Waste Framework Directive 2020 target of 70%. This excludes hazardous waste and excavation and dredging waste which are outside the scope of the target.

11.7.41 The 2019 Waste Data Interrogator (Environment Agency, 2020a) confirms that approximately 14.3Mt of C&D waste was managed at waste facilities in the East of England region in 2019, with 7.0Mt of this managed at waste facilities in the Essex sub-region. It also confirms that approximately 9.6Mt of waste was landfilled in the East of England region in 2019 (36% of this to inert landfill and 54% to non-hazardous landfill), with 4.7Mt of this in the Essex sub-region (24% of this to inert landfill and 76% to non-hazardous landfill). 4.4Mt (47% inert waste and 53% non-hazardous waste) and 2.3Mt (15% inert waste and 85% non-hazardous waste) of the waste disposed of to landfill in the East of England and Essex respectively in 2019, was recorded as C&D waste.

Waste treatment, recycling and recovery baseline

11.7.42 The availability of waste management infrastructure, to accept waste likely to be generated during the construction of the proposed scheme, has been ascertained through a review of the 2019 Waste Data Interrogator (Environment Agency, 2020a).

11.7.43 Whilst annual capacity data are published by the Environment Agency for both landfill and incineration facilities at the national, regional and sub-regional level, no annual capacity data are published by the Environment Agency for waste transfer, treatment or metal recycling sites. Only annual permitted throughput is published for these facilities.

[13] The CD&E figures include excavation waste and dredging spoils that are out of scope for the UK C&D waste statistics shown in paragraph 11.7.40.

11.7.44 The total annual permitted throughput or capacity reported by the Environment Agency (2020a) for the East of England region and Essex sub-region are detailed in Table 11.4.

Table 11.4 Total permitted throughput or capacity of transfer, treatment, metal recycling and incineration in the East of England and Essex, 2019

Site type	East of England region (000s tonnes)	Essex sub-region (000s tonnes)
Transfer (annual throughput)		
Hazardous waste transfer stations	1,055	326
Household, industrial, commercial waste transfer stations	3,175	1,128
Non-biodegradable waste transfer stations	374	330
Treatment and metal recycling (annual throughput)		
Material recovery	1,359	692
Physical treatment	4,553	1,421
Physico-chemical treatment	992	135
Chemical treatment	1,559	-
Composting	906	114
Biological treatment	2,097	794
Metal recycling	2,042	1,205
Incineration (annual capacity)		
Co-incineration of hazardous waste	-	-
Co-incineration of non-hazardous waste	-	-
Hazardous waste incineration	-	-
Municipal and/or industrial & commercial incineration	467	-
Biomass or waste wood incineration	490	490
Total	**19,069**	**6,635**

11.7.45 The 2019 Waste Data Interrogator (Environment Agency, 2020a) reports that, as of 2019, there were 1,152 permitted transfer, treatment, metal recovery, incineration and use of waste sites located in the East of England region.

11.7.46 The Minerals and Waste Development Framework Authority Monitoring Report 2016 to 2017 (ECC, 2017a) records that as of 31 March 2017, there were 329 waste management facilities (including waste transfer facilities) located in the Essex sub-region.

11.7.47 These data would indicate that there are likely to be sufficient opportunities for C&D waste arisings to be transferred, treated, recycled or recovered as appropriate within the second study area.

Inert, non-hazardous and hazardous landfill capacity baseline

11.7.48 For wastes which cannot be re-used, recycled or recovered, disposal to landfill would be required. The 2019 Waste Data Interrogator (Environment Agency, 2020a) details the total remaining merchant landfill capacity in the East of England region and Essex sub-region in 2019. This is presented in Table 11.5.

Table 11.5 Total landfill capacity available in the East of England and Essex, 2019

Site type	East of England region (000s tonnes[1])	Essex sub-region (000s tonnes[1])
Hazardous merchant landfill[2]	-	-
Non-hazardous landfill with stable non-reactive hazardous waste (SNRHW) cell[3]	4,139	-
Non-hazardous landfill	18,499	8,015
Inert landfill	30,767	2,193
Total	**53,405**	**10,208**

[1] Landfill capacity is provided in m^3 by the 2019 Waste Data Interrogator (Environment Agency, 2020a). This has been converted to a tonnage figure through the use of the following density convention factors: 1.5t/m^3 for inert landfill and 0.83t/m^3 for non-hazardous landfill.

[2] Merchant landfills accept waste from all users, as opposed to restricted landfills that accept wastes from a restricted set of sources/producers, commonly the site operator.

[3] Some non-hazardous sites can accept some stable non-reactive hazardous waste (SNRHW) into a dedicated cell, but this is usually a small part of the overall capacity of the site.

11.7.49 The Environment Agency (2020a) reports that at the end of 2019 there were 98 permitted operational landfills in the East of England region (comprising 58 inert landfills, 33 non-hazardous landfills and seven non-hazardous landfills with SNRHW cell). The vast majority of these sites (80%) are located in the sub-regions of Essex, Cambridgeshire, Hertfordshire and Suffolk. Reference to Remaining Landfill Capacity 2019 (Environment Agency, 2020b) confirms that there were 23 operational landfills located in the Essex sub-region (comprising 12 inert landfills, 10 non-hazardous landfills and one non-hazardous landfills with SNRHW cell) at the end of 2019.

11.7.50 Whilst the East of England region and Essex sub-region both have good amounts of inert landfill, non-hazardous landfill, and non-hazardous landfill SNRHW capacity, there is currently no merchant hazardous waste landfill capacity available in the region. The management of the relatively small amounts of hazardous waste generated in the region would typically take place at either specialist recycling or recovery facilities located in the second study area, or at facilities designed to meet a national or regional need located outside the second study area.

11.7.51 No information is publicly available at the regional level on when the permitted landfills are scheduled to cease infilling operations. This information is not provided in the Environment Agency's Public Registers or Waste Data Interrogator or Remaining Landfill Capacity datasets. No direct consultation would be undertaken with landfill operators to populate this information.

11.7.52 Notwithstanding this, the Minerals and Waste Authority Monitoring Report (ECC, 2018a) provides some information in terms of when those sub-regional landfills, identified in Remaining Landfill Capacity 2019 (Environment Agency, 2020b), are estimated to cease infilling operations in Essex. This information is provided in Table 11.6.

Table 11.6 Operational landfills in Essex, 2019

Facility name	Approximate distance from the first study area (km)	Site type	Capacity end of 2019 (tonnes)	Estimated end date
East Tilbury Quarry Landfill	45	Inert	735,000	Unknown
Widdington Pit Inert landfill	45	Inert	300,366	30/09/2023
Sandon Quarry Southern Void	15	Inert	234,300	31/12/2017
Royal Oak Quarry	15	Inert	105	16/02/2027
Wivenhoe Landfill Site	50	Inert	0	Unknown
Linford Landfill	45	Inert	97,170	Unknown
Cell 5, Land at Pratts Farm Lane	10	Inert	0	Unknown
Rainbow Shaw Quarry	40	Inert	84,686	Unknown
Inworth Grange Quarry Landfill	15	Inert	0	Unknown
Highwood Quarry Inert Landfill	40	Inert	958,289	25/03/2027
Brightlingsea Inert Landfill	50	Inert	705,000	31/01/2026
Asheldham Quarry	35	Inert	36,300	Unknown
SRC Martells Quarry	35	Non-Hazardous	1,237,500	30/06/2032
Pitsea Landfill	35	Non-Hazardous	0	31/12/17

Facility name	Approximate distance from the first study area (km)	Site type	Capacity end of 2019 (tonnes)	Estimated end date
Tilbury Ash Disposal Site	50	Non-Hazardous	1,873,712	Unknown
Elsenham Landfill	45	Non-Hazardous	1,999,500	10/05/2029
Bellhouse Landfill Site	25	Non-Hazardous	6,132,315	31/03/2022
Ockendon Area II & III Landfill	50	Non-Hazardous	5,101,664	Unknown
Ugley Landfill	40	Non-Hazardous	0	Unknown
Martells Quarry Landfill	35	Non-Hazardous	15,000	30/06/2032
Barling Marsh Landfill	50	Non-Hazardous	0	31/12/2016
Mucking Landfill	40	Non-Hazardous	0	Unknown
Brittons Hall Farm Landfill site	20	Non-Hazardous Landfill and SNRHW cell	0	31/12/2019

Safeguarded waste management infrastructure

11.7.53 The first study area passes through a number of Waste Consultation Areas (WCA) as identified in Table 11.7 and Figure 11.1. Whilst the point source locations of these waste infrastructure sites are mapped on Figure 11.1, it has not been possible to map the WCAs given the absence of GIS data.

Table 11.7 Waste infrastructure and designations within the first study area

Site type	Site name	Planning application number
Waste management infrastructure	Boreham Recycling Centre	ESS/24/10/CHL/SO
	Bulls Lodge Inert Recycling	ESS/44/17/CHL
	Drovers Recycling Centre	ESS/42/11/CHL
	Winsford Way Waste Transfer Station	ESS/65/12/CHL
	Witham Recycling Centre	ESS/44/15/BTE

* The information in this table was provided by ECC in their Scoping Opinion (Planning Inspectorate, 2021) response, and is considered correct as of March 2021.

11.7.54 Policy 2 of the Essex Waste Local Plan seeks to ensure that existing and allocated waste sites and infrastructure are protected from potentially sensitive or inappropriate neighbouring developments that may prejudice their continuing efficient operation. Policy 2 defines WCAs as extending up to 250m from the boundary of the majority of existing or allocated waste infrastructure.

Future baseline

Future minerals availability and minerals safeguarding sites baseline

11.7.55 For the purpose of this assessment, it has been assumed that the size of the primary aggregate landbanks, marine aggregate reserves and the supply market for secondary and recycled aggregate would remain largely the same for the construction period (2023 to 2027) as for the baseline year (2019), as mandated by relevant national planning policy.

11.7.56 It has also been assumed that the size and location of minerals infrastructure and designations, located within 250m of the first study area, would remain unchanged from the baseline year.

Future waste treatment, recycling and recovery capacity baseline

11.7.57 Waste treatment, recycling and recovery infrastructure facilities are considered to be a beneficiary of incoming materials through driving the management of the waste hierarchy, and by creating conditions that facilitate a circular approach to the management of materials.

11.7.58 These facilities are therefore not considered to be sensitive receptors for the purposes of assessment in the same way as landfill sites, given that they are part of a recovery system that has the potential to reduce the environmental effects associated with waste generation, management and disposal. These facilities are also different to landfills, in that landfills are a finite resource.

11.7.59 Waste treatment, recycling and recovery facilities are typically characterised by large annual throughputs; consequently, large step changes in capacity (as single facilities are commissioned) have an exaggerated impact on the historical trend. Waste treatment, recycling and recovery infrastructure capacity cannot therefore be realistically projected forward to the construction phase of the proposed scheme.

11.7.60 Professional experience has shown that waste markets are flexible and adapt to changing markets within a region; and that historical trends show that waste treatment, recycling and recovery is added or removed, not least to cope with changes in waste generation. It is expected that whilst the actual waste facilities available may change over the course of constructing the proposed scheme, the overall capacity is likely to remain similar as the market responds.

11.7.61 The future waste treatment and recovery infrastructure capacity for use in the assessment would therefore be based on the most recent available Environment Agency annual capacity and input data for 2019. This suggests that there is likely to be adequate opportunity for wastes arising during the construction of the proposed scheme to be treated, recycled or otherwise recovered via appropriate means within the second study area.

Future inert, non-hazardous and hazardous landfill capacity baseline

11.7.62 Projected future inert and non-hazardous landfill void capacity has been forecast (using simple statistical trend analysis) in Table 11.8 and illustrated in 0 and Plate 11.2 for the East of England region and Essex sub-region respectively between 2023 and 2027 (anticipated construction phase). This is based on the average annual percentage change in remaining inert and non-inert landfill capacity for the years for which consistent data are available from the Environment Agency (i.e. 2005 to 2019).

11.7.63 Landfill site classifications were changed in 2005. The assessed categories therefore include inert (inert landfill only) and non-inert (non-hazardous landfill sites, non-hazardous landfill sites with a SNRHW cell and merchant hazardous landfill sites), but exclude restricted user sites (non-hazardous and hazardous restricted landfill sites) which are permitted only to accept waste from the operators of these sites.

11.7.64 The predicted changes in landfill capacity are derived from the existing Environment Agency time-based data (remaining landfill capacity at the end of each calendar year). These data have been projected forward to 2027 (target opening year), using the Microsoft Excel 'Forecast' function[14] to provide an estimate of the remaining landfill capacity that may be available during the construction phase. This does not include any additional capacity that may open in the future in the region.

Table 11.8 Forecast future baseline inert and non-hazardous landfill capacity in the East of England and Essex, 2023 to 2027

Timeline	Forecast future landfill capacity (000s tonnes)			
	East of England region (inert)	East of England region (non-hazardous)	Essex sub-region (inert)	Essex sub-region (non-hazardous)
2023	36,576	13,746	4,849	4,798
2024	38,027	11,554	5,080	3,994
2025	39,479	9,362	5,312	3,190
2026	40,930	7,171	5,543	2,385
2027	42,382	4,979	5,775	1,581
Average (2023-27) (tpa)	**39,479**	**9,362**	**5,312**	**3,190**

[14] The exponential smoothing forecasting in Microsoft Excel is based on the AAA version (additive error, additive trend and additive seasonality) of the Exponential Triple Smoothing (ETS) algorithm, which uses advanced machine learning to smooth out minor deviations in past data trends by detecting seasonality patterns and confidence intervals in non-linear data. It should be noted that forecasting cannot definitively predict future landfill capacity, only probable capacity.

Plate 11.1 Forecast future inert landfill capacity in East of England region and Essex sub-region (2020-2027) (000s tonnes)

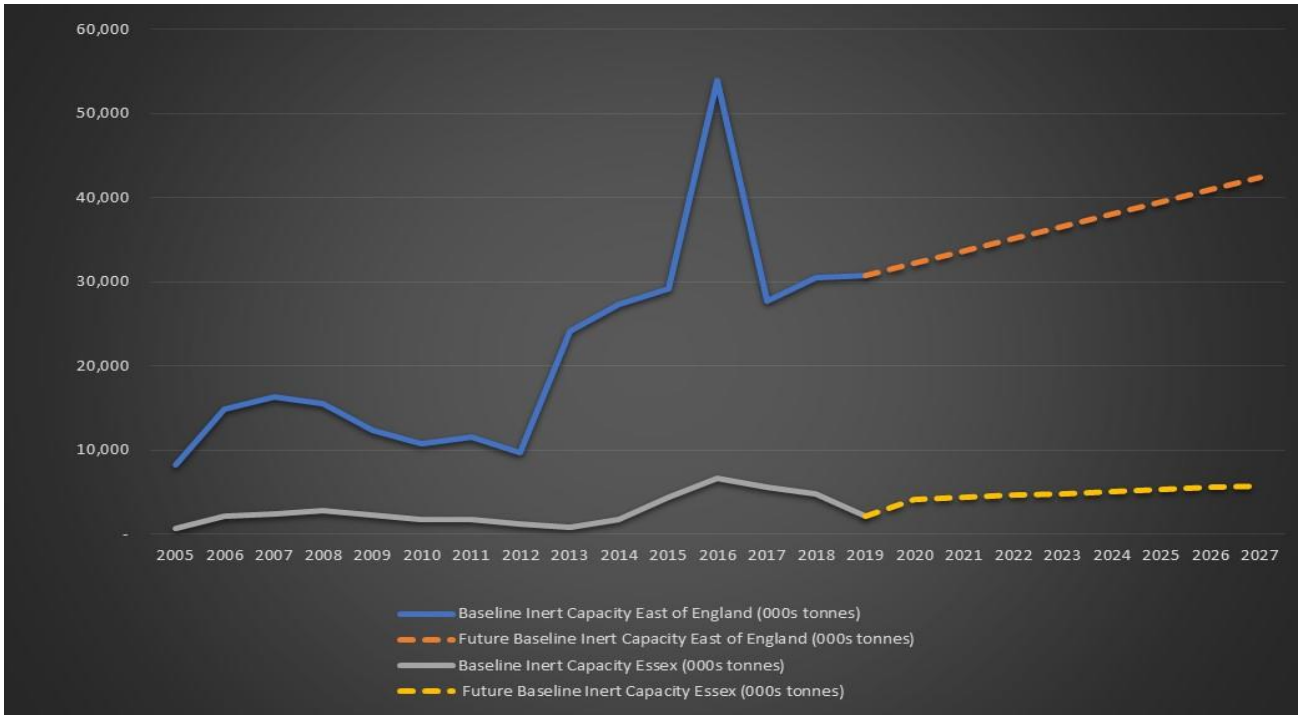
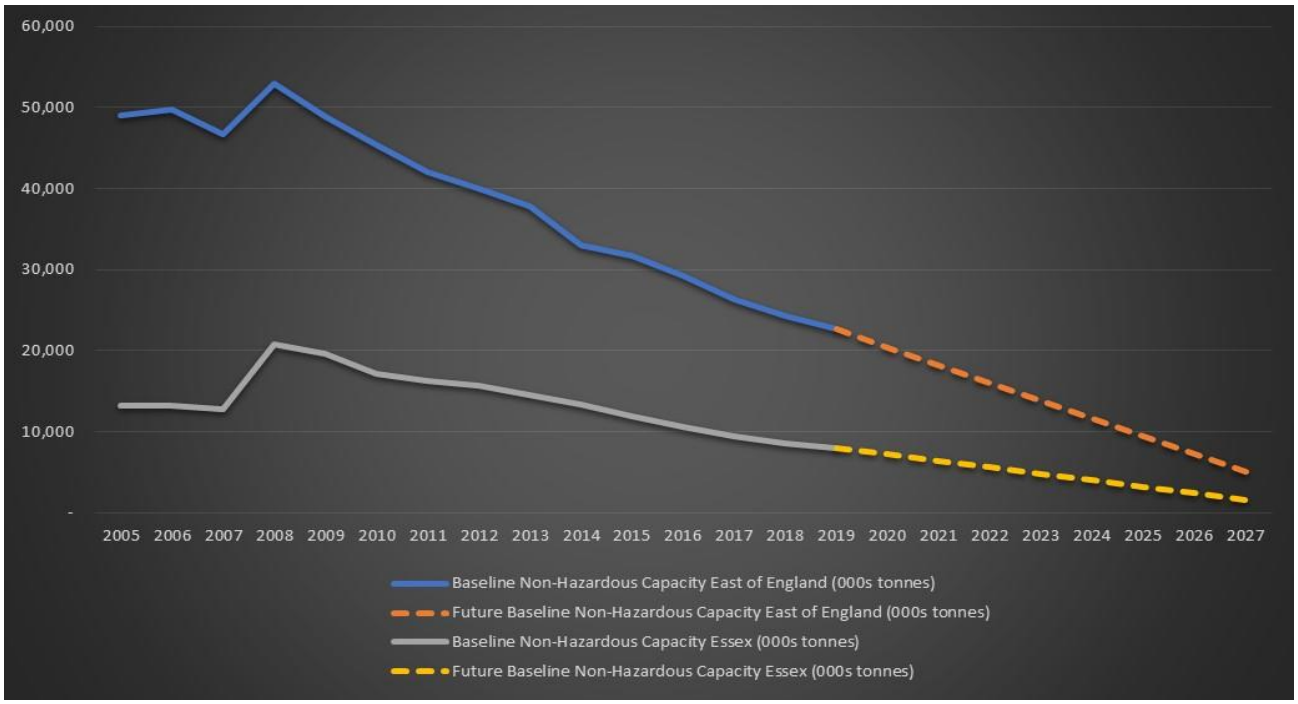


Plate 11.2 Forecast future non-hazardous landfill capacity in East of England region and Essex sub-region (2020-2027) (000s tonnes)



11.7.65 Although there is generally a reducing trend for landfill disposal in England, the forecast estimates suggest that there is likely to be both inert landfill and non-hazardous landfill capacity available in the East of England region (39,478,821 tonnes and 9,362,465 tonnes respectively) and Essex sub-region (5,311,725 tonnes and 3,189,610 tonnes respectively) to support the construction of the

proposed scheme (based on the predicted average annual capacity between 2023 and 2027). However, there is unlikely to be any hazardous landfill capacity in the study area as is currently the case in the region.

11.7.66 This means that any inert, non-hazardous and SNRHW waste that is destined for landfill would most likely find available capacity in the second study area. Even where wastes are accepted at landfill, some may, subject to their properties, be used within landfill cover or other engineering uses rather than subject to and accounted as disposal. Any landfills that have ceased infilling, at the time of construction, and are no longer accepting waste may also still require inert and non-hazardous materials for capping and restoration purposes, and therefore may be amenable to accepting any suitable surplus materials arising from construction.

11.7.67 However, at the sub-regional level, the Essex and Southend-on-Sea Waste Local Plan (ECC, 2017b) reports that a capacity gap for inert C&D waste management of 1.5Mtpa is likely to exist in Essex by 2031/32 unless suitable facilities are delivered to address this shortfall. Essex & Southend on Sea Waste Local Plan Waste Capacity Gap Update (BPP Consulting, 2015) identifies that there is likely to be a shortfall of 3.3 Mt between the baseline Essex Local Plan area projected C&D waste arisings throughout the Waste Local Plan period and Essex's current available management capacity in the form of recycling facilities, plus inert landfill and backfilling of quarries and mineral workings for restoration purposes.

11.7.68 BPP Consulting (2015) specifically identifies a capacity gap for inert C&D waste management in Essex of 1.0Mtpa in 2023, rising to 1.5Mtpa by 2027 (based on the available waste management capacity at the time of undertaking the BPP Consulting assessment). However, ECC (2017b) reports that the evidence supporting the Waste Local Plan indicates that there is sufficient non-hazardous landfill capacity in the Plan period to 2032. While there is a capacity gap for hazardous waste, ECC (2017b) notes that national policy does not require net self-sufficiency in hazardous waste as it is acknowledged provision of facilities to manage such waste may be on a sub-regional, regional or even national basis.

11.7.69 Notwithstanding this, it is envisaged that the vast majority of waste arising from constructing the proposed scheme would be re-used, recycled or otherwise recovered in accordance with legislative, policy and economic drivers. This assumption is validated by the available Defra (2020d) statistics with 92% of non-hazardous C&D waste currently being diverted from landfill in England. A high degree of waste recovery will also be required in order to demonstrate the proposed scheme's contribution to achieving the following mandatory and advisory targets in DMRB LA 110:

- At least 70% (by weight) of non-hazardous construction and demolition waste 'shall' be subjected to material recovery or diverted from landfill (constitutes a requirement of Highways England)
- At least 90% (by weight) of non-hazardous construction and demolition waste 'should' be subjected to material recovery or diverted from landfill (constitutes advice expressed as a recommendation by Highways England)

Future waste safeguarding sites baseline

11.7.70 For the purpose of this assessment, it has been assumed that the size and location of waste infrastructure and designations located within 250m of the first study area would remain unchanged from the baseline year (2019).

Value and sensitivity of receptors

11.7.71 The baseline environment comprises receptors which have been defined geographically, based on the likely impacts and effects, associated with the use and consumption of material assets and the production and management of waste, as set out in DMRB LA 110.

11.7.72 Whilst these receptors and an indication of their baseline sensitivity are summarised in Table 11.9, it should be noted that the DMRB LA 110 simplified significance framework precludes the need to assign a sensitivity rating to the identified receptors for the purposes of assessment (see Section 11.4).

11.7.73 The sensitivity of all receptors within the baseline are intrinsically considered within the significance category descriptions provided in DMRB LA 110, and as such the methodology for this aspect is not based on the method of combining the sensitivity of the receptor and the magnitude of impact to determine the significance of effect as detailed in Chapter 5: Environmental assessment methodology.

Table 11.9 Value of receptors in the study area for material assets and waste

Sensitivity	Description	Summary of baseline conditions
N/A – not required for assessment	Primary, secondary and recycled aggregate resources	Primary aggregates are, in their own right, considered as sensitive receptors. Notwithstanding this, there is likely to be a good supply of both primary and recycled aggregates within the second study area, to construct the proposed scheme. There is no information covering secondary aggregates.
N/A – not required for assessment	Mineral safeguarding sites	A significant proportion of first study area is located within a MSA for sand and gravel, and part of the eastern scheme extents also falls within a MSA for brick clay. The first study area also intersects with a number of MCAs for existing and allocated mineral sites and infrastructure.
N/A – not required for assessment	Inert, non-hazardous and hazardous landfill capacity	There is likely to be available waste management capacity within the second study area to accommodate the majority of wastes arising from the construction of the proposed scheme, and there are unlikely to be any specific constraints with regards to disposing of inert, non-hazardous and stable non-reactive hazardous waste streams. However, any hazardous waste requiring disposal to landfill is likely to require disposal outside of the East of England due to the absence of permitted merchant capacity.

Sensitivity	Description	Summary of baseline conditions
N/A – not required for assessment	Waste safeguarding sites	The first study area intersects with a number of WCAs for existing and allocated waste sites and infrastructure. Waste safeguarding sites are not considered within the DMRB LA 110 significance criteria.

11.7.74 DMRB LA 110 requires that sensitive receptors (designated sites identified in other environmental aspects) should also be considered in order to minimise the effects from material assets and waste (e.g. resulting from on-site storage or treatment activities etc). In addition to the generalised receptors identified in Table 11.9 for material assets and waste, further environmental receptors and designated sites are considered in the other aspect chapters in this PEIR.

11.8 Potential impacts

Construction

Consumption of material assets

11.8.1 Constructing the proposed scheme would require the use of large quantities of material assets which impacts upon their immediate, and in the case of primary aggregates, long-term availability, resulting in temporary or permanent adverse impacts on the environment through the depletion of natural resources.

11.8.2 Material assets include both primary materials, such as mineral aggregates, and manufactured construction products such as asphalt and concrete. Some of these materials would originate off-site, purchased as primary construction products, but it is likely that some would arise on-site, particularly from the use of borrow pits, but also excavated soils, crushed concrete or recycled asphalt planings, or recycled materials brought in from off-site, possibly from other projects or industries.

11.8.3 Whilst the precise quantities are currently unknown at this stage, the proposed scheme is anticipated to require a significant quantity of both primary materials and manufactured construction products during earthworks, demolition, main construction and activities relating to de-trunking sections of the old A12.

11.8.4 These materials are likely to include, but are not limited to:

- topsoil, general fill and landscaping fill
- aggregates for capping, sub-base, site compound hardstanding, drainage filter media and concrete
- asphalt base, binder and surface courses, including aggregates and bitumen
- concrete for use in structures, retaining walls, culverts, headwalls, piles, foundations, fenceposts, kerbs, chambers, catch pits, etc
- iron and steel for use in structures, reinforcement, safety barriers, fencing, manhole covers, cabinets, etc

- plastics for use in drainage pipes, chambers, gully pots and interceptors, traffic signs, cables, ducting and road markings, etc
- timber for use in fencing and for structural formwork and falsework

11.8.5 The largest quantity of materials to be used in construction of the proposed scheme would likely be earthworks materials, aggregates for road foundation materials, asphalt aggregates and drainage and duct aggregates. It is assumed at this stage that all these materials, except for the earthwork's mass fill materials, would be imported to site as they are unlikely to be available in the borrow pits. Borrow Pit J could potentially be used to supply aggregates for concrete. However, the chalk content that is present in the glaciofluvial deposits may deem it unsuitable for use as an aggregate in concrete production, and further testing is required to confirm suitability.

Sterilisation of mineral safeguarding sites

11.8.6 The proposed scheme would require structural works (including earthworks and concrete and steel structures) as well as imported aggregates and asphalt for new offline road construction. Constructing the proposed scheme would require land to be acquired and used outside of the existing highway boundary for both temporary (e.g. borrow pits, haul roads, site compounds and laydown areas etc.) and permanent (e.g. new highways, junctions, access roads, structures, embankments, drainage etc.) construction purposes.

11.8.7 Any land to be permanently acquired and used by the proposed scheme[15], inside the MSAs for sand and gravel and brick clay, could therefore result in partial sterilisation of the safeguarded mineral resource by constraining or preventing existing and potential future use and extraction of those resources. However, this would only occur in instances where permanent infrastructure is to be constructed over or adjacent to these minerals deposits, and where prior extraction is deemed not to be environmentally, socially or economically viable.

11.8.8 Notwithstanding this, any permanent potential sterilisation is considered to be substantial by area (approximately 595 ha and 7 ha respectively[16]) in the context of the sand and gravel MSA and brick clay MSA in which the proposed scheme would be constructed. Should prior extraction not be viable, then this would represent a marginal loss (approximately 0.5% and 3.4% respectively[17]) of the total safeguarded sand and gravel and brick clay resource in Essex.

11.8.9 If realised, then this would represent considerable additional sterilisation (387% increase) on top of the 153.9 ha of sand and gravel resource that ECC (2018a) reports as having been cumulatively sterilised in Essex between the 1 April 2014 and 31 March 2018 (see Section 11.7). No equivalent data are provided by the MPA for the brick clay MSA. It is assumed that the majority of the brick

[15] The geographic extent of the provisional Order Limits is 847 ha, and the permanent land take estimated at 735 ha.

[16] Permanent land take associated with the proposed scheme is estimated to be in the order of 735 ha, of which approximately 595 ha and 7 ha is estimated to intersect with the sand and gravel MSA and brick clay MSA respectively. This will be subject to revision as the design progresses.

[17] Based on the total area of the sand and gravel MSA (130,387 ha) and brick clay MSA (197 ha) in the Essex sub-region.

clay MSA that the provisional Order Limits intersect with in the Marks Tey area has already been sterilised by the presence of the existing A12 trunk road. There would also be limited work undertaken in this area outside of the existing highway boundary.

11.8.10 Whilst the provisional Order Limits intersect with a number of MCAs around existing, allocated and safeguarded mineral sites (Bulls Lodge, Colemans Farm, Marks Tey Brickworks and Marks Tey Rail Sidings), it is considered unlikely that the proposed scheme would result in impacts to the safeguarded infrastructure and allocations through loss of capacity or by constraining the operation of these facilities. The construction of the proposed scheme would neither temporarily nor permanently intersect with the actual boundaries of the safeguarded minerals infrastructure and allocations (only the 250m consultation buffer around these sites).

11.8.11 The notable exception to this is where the proposed scheme alignment is routed to go through the active Colemans Farm quarry site. Planning consent (ESS/40/18/BTE) was granted on 30 March 2020 to modify the quarry phasing to enable the extraction of consented mineral resources in the more northern phases of the quarry site adjacent to the proposed scheme, at an earlier timeframe to avoid these minerals being sterilised by the proposed scheme.

11.8.12 Further planning applications (ESS/36/21/BTE and ESS/51/21/BTE) were submitted on 01 April 2021 to consent the removal of any remaining minerals that are not sterilised by existing development in the provisional Order Limits area to ensure that these are not needlessly sterilised. Such an approach is consistent with national policy and the policy content of the Essex Minerals Local Plan.

11.8.13 It is assumed, for the purposes of this assessment, that these workings would be backfilled to original surface level by 2024 to facilitate the construction of the proposed scheme. Following this, quarrying would resume in the areas of the quarry site unaffected by the proposed scheme throughout the remaining consented life of the quarry operations through to 2034.

11.8.14 One of the haul routes for the proposed scheme would temporarily intersect the safeguarded site access for the operational mineral and waste infrastructure sites at Bulls Lodge; and a proposed cut-off ditch would be permanently constructed inside the southern boundary of the operational Marks Tey Rail Siding. Given the minor nature of the works at these locations, the proposed scheme is unlikely to significantly impact upon the operation of these safeguarded infrastructure sites.

11.8.15 Given the nature of the proposed scheme, it is also considered unlikely that the safeguarded minerals infrastructure and allocations would be impacted by the proposed scheme or vice versa (through noise, dust, odour, traffic, visual or light) that would prejudice the efficient operation of these sites in line with their extant planning permissions. Indirect impacts (or proximal sterilisation) are more commonly associated with more sensitive land uses such as residential developments that could limit the operation of these sites.

11.8.16 Notwithstanding the above, any sterilisation impacts to MSAs (for sand and gravel, and brick clay) and MCAs for allocated and safeguarded mineral sites are to be separately assessed as part of a Mineral Resource Assessment and Mineral Infrastructure Assessment to be prepared to accompany the Environmental Statement and DCO application (see Section 11.9).

Generation and disposal of waste to landfill

11.8.17 Constructing the proposed scheme would generate large quantities of surplus materials and waste, leading to potential impacts on the available waste management infrastructure through permanently occupying landfill capacity.

11.8.18 Landfill is a finite resource, and through the ongoing disposal of waste there is a continued need to expand existing, and develop new, landfill facilities. This loss of resources to landfill requires the extraction or production of new material assets which, in turn, accelerates the depletion of natural resources resulting in temporary or permanent adverse impacts on the natural environment.

11.8.19 The utilisation of sub-regional landfill capacity also has potential to displace (or push out) waste that would otherwise be landfilled in Essex, thus impacting upon the waste planning authority's (WPA) proximity and net self-sufficiency principles which are viewed as a key performance indicator and driver for waste planning at the sub-regional level.

11.8.20 A range of waste types, including inert, non-hazardous and small volumes of hazardous wastes, would also be generated during the construction of the proposed scheme. The majority of wastes produced would be C&D waste, a large proportion of which could be suitable for re-use, recycling or recovery on or off-site, although a proportion could require disposal to landfill. Smaller quantities of municipal waste (household like waste) would also be generated by construction workers and site welfare activities.

11.8.21 Whilst the precise quantities are currently unknown at this stage, the proposed scheme is anticipated to result in significant quantities of surplus materials and wastes during earthworks, demolition, main construction and de-trunking activities.

11.8.22 These waste streams are likely to include, but are not limited to:

- vegetation, trees, scrub and invasive plants (non-hazardous)
- surplus topsoil and unacceptable earthworks materials (inert, non-hazardous or hazardous)
- asphalt road planings (non-hazardous or hazardous (if containing road tar))
- concrete, masonry, tiles, bricks and ceramics (inert)
- insulation, gypsum etc (non-hazardous or hazardous)
- furniture, floor coverings, vinyl tiles, carpet etc (non-hazardous)
- signage, signal posts, lighting columns, steel safety barriers and other street furniture (non-hazardous)
- ferrous and non-ferrous metal waste (non-hazardous)

- treated and untreated wood waste (non-hazardous or hazardous)
- plastic waste (non-hazardous)
- mixed construction and demolition waste (non-hazardous or hazardous)
- mixed packaging (non-hazardous)
- canteen, office, ad hoc waste (non-hazardous)
- asbestos-containing materials (hazardous)
- hydraulic oils (hazardous)
- waste electrical and electronic equipment (WEEE), lamps, bulbs, etc. (hazardous or non-hazardous)
- miscellaneous hazardous waste associated with the maintenance of plant and machinery or chemicals required as part of the construction processes

11.8.23 The largest quantities of surplus materials and waste are anticipated to be unsuitable earthworks materials, demolition materials and asphalt planings from removal of existing pavement. It is assumed at this stage that the majority of the surplus earthworks materials would be used to backfill and restore the borrow pits, and that aggregate crushing and grading would be used to recycle or recover demolition and pavement arisings into the main construction works.

Impacts to safeguarded waste infrastructure

11.8.24 Whilst the provisional Order Limits intersect with a number of WCAs around existing, allocated and safeguarded waste sites (Boreham Recycling Centre, Bulls Lodge Inert Recycling, Drovers Recycling Centre, Winsford Way Waste Transfer Station and Witham Recycling Centre), it is considered unlikely that the proposed scheme would result in impacts to the safeguarded infrastructure and allocations through loss of capacity or by constraining the operation of these facilities.

11.8.25 The construction of the proposed scheme would neither temporarily nor permanently intersect with the actual boundaries of the safeguarded waste infrastructure and allocations (only the 250m consultation buffer around the sites). Given the nature of the proposed scheme, it is considered unlikely that the safeguarded waste management infrastructure and allocations would be impacted by the proposed scheme or vice versa (through noise, dust, odour, traffic, visual or light) that would prejudice the efficient operation of these sites in line with their extant planning permissions. Indirect impacts (or proximal sterilisation) are more commonly associated with more sensitive land uses such as residential developments that could limit the operation of these sites.

11.8.26 Notwithstanding the above, any sterilisation impacts to WCAs for allocated and safeguarded waste sites are to be separately assessed as part of the Waste Infrastructure Assessment to be prepared to accompany the Environmental Statement and DCO application (see Section 11.9).

Operation

11.8.27 DMRB LA 110 specifies that the assessment should only report on the first year of operational activities (opening year). It has been assumed that no significant maintenance activities would occur during the first year of operational activities (target opening year 2027), and thus no significant materials consumption or waste generation is likely to be realised. It has also been assumed that any sterilisation impacts to mineral safeguarding sites would have been mitigated as far as practicable during the design and construction phase.

11.8.28 Operational impacts have therefore been scoped out of the assessment on the basis that no likely significant effects would be realised. Although the opening year is a time period not necessarily confined to operational effects, any construction phase effects overlapping within this period will be captured within the construction phase assessment. This was agreed with both the Planning Inspectorate and ECC in the Scoping Opinion (Planning Inspectorate, 2021).

11.8.29 Notwithstanding this, the design process would inherently seek to minimise the consumption of material assets, unnecessary sterilisation of mineral and waste sites, and the generation of waste throughout the lifecycle of the proposed scheme. Design choices and the choice of materials will make a significant contribution to reducing the environmental impacts associated with material assets and waste during operation, by influencing the required method and frequency of maintenance, and facilitating opportunities to recover and regenerate materials and products at the end of first life.

11.8.30 It is also assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large-scale future maintenance, renewal, or improvement works beyond the opening year, would be undertaken by Highways England's East of England Asset Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110 (or any future environmental assessment guidance specified by Highways England).

11.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

11.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3 details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

11.9.2 Those design changes that are relevant to material assets and waste include consideration of the following, amongst others:

- optimising the cut-fill balance to reduce material requirements and waste
- the location and extent of carriageway widening
- the alignment of the new offline carriageway

11.9.3 Key examples of the design refinements undertaken at Project Control Framework (PCF) Stage 2 and 3 include, but are not limited to, the following:

- Junction 19: making greater use of existing infrastructure at junction 19 to reduce the footprint of the proposed scheme
- Junction 19 to 20a: descoping verge and central reserve works between junction 19 and junction 20a. The carriageway is already three lanes in this section
- Junction 21: avoiding the need for demolition of existing properties in Hatfield Peverel, thereby preventing waste
- Junction 22: revising the mainline alignment to reduce the impact on Colemans Farm Quarry, and modifying the vertical alignment to reduce earthworks and fill material requirements
- Junction 23: removal of the new junction 23 from the scope of the proposed scheme, with the existing A12 between junctions 22 and 23 being retained as a local access road
- Junction 24: relocating the new junction 24 to Inworth Road which improves the earthworks cut and fill balance at this location
- Prested Hall access: using part of the existing A12 northbound carriageway to provide the new access road, and reducing the number of new structures over the proposed A12 mainline from two to one
- Junction 25: maximising the use of existing infrastructure at junction 25 to facilitate improvements for walkers, cyclists, and horse riders
- River Ter Bridge: retaining the bridge width, as opposed to physically widening the bridge
- Retaining walls: in certain locations, retaining walls have been proposed instead of earthworks slopes to reduce land take
- Borrow Pits: use of borrow pits to source bulk earthworks materials instead of importing material (see Section 2.5 in Chapter 2)

11.9.4 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

11.9.5 Design, mitigation and enhancement measures will be implemented to minimise the potential impacts associated with the consumption of material assets, sterilisation of mineral safeguarding sites and the management of waste during the construction of the proposed scheme. There is significant synergy between materials assets and waste, thus there is overlap between the mitigation measures identified in this section.

Standard mitigation

11.9.6 Standard mitigation would occur as a matter of course due to legislative and policy requirements or standard sector practices. These measures would typically be implemented across the proposed scheme to avoid or reduce potential environmental effects.

11.9.7 Standard mitigation to be implemented for this aspect would include:

- Implementing Design for Resource Efficiency Principles in a systematic manner to suit the scale of the proposed scheme, to identify, prioritise and select appropriate opportunities to improve project resource efficiency and design out waste. Most opportunities to design for resource efficiency are covered by the following five principles:
  - Design for re-use and recovery: identifying, securing and using materials that already exist on site, or can be sourced from other projects.
  - Design for resource optimisation: simplifying layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content.
  - Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction.
  - Design for resource-efficient procurement: identifying and specifying materials that can be acquired responsibly, in accordance with a recognised industry standard.
  - Design for the future: identify how materials can be designed to be more easily adapted over an asset lifetime and how de-constructability and de-mountability of elements can be maximised at end of first life.
- Producing a Responsible Sourcing Plan (RSP) to maximise the responsible sourcing of construction materials and products with proven sustainability credentials that minimise adverse impacts on people and their environment during the construction of the proposed scheme. The plan would specify:
  - Use of key material elements (asphalt, concrete, aggregate, steel, aluminium and plastics) responsibly sourced from suppliers with industry recognised responsible sourcing certification for that material (e.g. certification to BES 6001 (Building Research Establishment (BRE), 2014), or membership of a sector-specific scheme that complies with BS 8902 (British Standards Institution (BSI), 2009)).
  - Use of timber and wood-derived products that are sustainably sourced from independently verifiable legal and sustainable sources (originating either from independently verified legal and sustainable sources or from a licensed Forest Law Enforcement Governance and Trade partner).

- Use of alternatives to primary materials, where available and permitted by the Specification for Highway Works. This could include materials that already exist on site, can be recovered from demolition activities, removal of existing pavement, or can be sourced from other projects and suppliers.
- Ensuring that any aggregates imported to site comprise re-used, secondary or recycled content at levels in line with the East of England regional guideline for aggregates provision 2005-2020 target of 31% where available. This target excludes site-won borrow pit material and demolition materials.
- Minimal use of hazardous materials that have the potential to harm human health or the environment; and that might cause problems for future re-use, recycling and recovery at end of first life.

- Implementing a Site Waste Management Plan, in a manner to suit the requirements of the proposed scheme, to plan, implement, monitor and review waste minimisation and management throughout the construction phase. The Site Waste Management Plan is a live document, updated at varying points during detailed design and construction. It will be used to quantify waste arisings and facilitate the identification and implementation of waste prevention at the design stage, and the re-use, recycling and other recovery opportunities during the construction stage. This would reduce the quantities of construction waste sent to landfill in line with prevailing Government and Highways England targets.
- Complying with waste 'Duty of Care' requirements during the construction of the proposed scheme, and taking all reasonable steps to ensure that surplus materials and waste are stored, treated, transferred, consigned, transported, re-used, recovered or disposed of safely without endangering human health or harming the environment. To minimise any attendant effects from storing and processing material assets and waste, ensuring that construction site compounds and on-site storage, stockpiling and processing areas are designed to minimise impacts to those designated environmental sites and sensitive environmental receptors identified in other aspect chapters of this PEIR.
- Obtaining all necessary waste carrier registrations, environmental permits, mobile plant deployments or waste exemptions in relation to the storage, sorting, treatment, use, disposal and transportation of waste during the construction of the proposed scheme; and preparing any documentation required of statutory and industry-regulated codes of practice or end of waste quality protocols for converting waste into non-waste products (e.g. CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice and Environment Agency (2013) End of Waste Criteria for the Production of Aggregates from Inert Waste).

- Ensuring that waste is stored, treated, re-used, recycled, recovered or disposed of as close as practicable to the point of origin during the construction of the proposed scheme, with consideration of the proximity principle, self-sufficiency principles and value for money principle, provided there are no unacceptable adverse impacts on people, the environment or local amenities. Locally permitted transfer, re-use, recycling, other recovery and disposal sites would be used during construction, where sufficient capacity is available, to minimise the environmental impact and cost of waste transport and to support the economic well-being of local communities.

11.9.8 Standard mitigation will be included in the first iteration of the Environmental Management Plan (EMP) which will be prepared for the Environmental Statement and DCO application (refer to Chapter 5). The second iteration of the EMP will subsequently be produced for the construction phase.

Additional mitigation

11.9.9 Additional mitigation would occur in the form of specific or bespoke mitigation to avoid or reduce effects on material assets and waste. This would typically include any locally specific measures to be implemented to reduce likely significant adverse environmental effects.

11.9.10 Additional mitigation to be implemented for this aspect would include:

- Ensuring that the construction of the proposed scheme does not unnecessarily sterilise mineral resources or prejudice the continuing efficient operation of existing, allocated and safeguarded minerals and waste sites and infrastructure:
  - Mineral Resource Assessments[18] will be prepared to establish the existence, or otherwise, of a mineral resource capable of having economic importance within the first study area. Where the proposed scheme has the potential to result in the sterilisation of mineral resources, the environmental, social and economic viability of prior extraction will be considered such that the resource is not sterilised[19]
  - Mineral and Waste Infrastructure Assessments[18] will be prepared to ensure that existing and allocated mineral and waste infrastructure, in proximity to the first study area, is protected from inappropriate developments that may prejudice their continuing efficient operation. Where the proposed scheme has the potential to result in the loss of a

[18] The Mineral Resource Assessment, Mineral Infrastructure Assessment and Waste Infrastructure Assessment will be prepared in line with ECC's generic schedule of requirements for when an application for non-minerals development is proposed in land designated as an MSA, MCA or WCA, as detailed in the Scoping Opinion (Planning Inspectorate, 2020). With regards to the Mineral Infrastructure Assessments and Waste Infrastructure Assessments, the level of detail to be provided shall be in proportion to the nature of the proposed scheme.

19 There are varying levels/degrees of prior extraction, including: (1) Large scale extraction; (2) Medium to smaller scale extraction and (3) Incidental extraction. Incidental extraction is typically the minimum level of prior extraction that the MPA would seek as part of any non-minerals development in an MSA. Please see the Glossary definitions for further explanation of these levels of prior extraction.

safeguarded minerals or waste infrastructure site or its capacity, or constrain its operation, mitigation will be considered in the form of modifying the final layout of the proposed scheme, or re-locating or providing the infrastructure elsewhere where required.

- Undertaking a pre-demolition assessment of all highway structures and assets and third-party buildings to be removed or demolished as part of the proposed scheme. This assessment would be used to determine the quantities of demolition assets, elements, components, products and materials; and to make recommendations for their re-use (on and off-site), recycling, other recovery or final disposal. This assessment would also support the production of the Site Waste Management Plan and RSP by identifying the types and quantities of each waste to be produced during demolition and any opportunities to use these site-won materials to offset the use of primary materials.

Enhancement

11.9.11 No enhancement measures have been identified at this stage. Enhancement measures will be explored throughout the design and construction of the proposed scheme as an intrinsic part of developing the RSP and Site Waste Management Plan. Examples of enhancement opportunities for material assets and waste could include, but not be limited to:

- Undertaking an assessment of local operator interest, as part of the Mineral Resource Assessment, for any material to be extracted prior to construction.
- Using surplus recycled or recovered materials in community projects, e.g. utilising recycled mulch from tree felling on adjacent community facilities.
- Recycling suitable material for construction of noise and landscape bunding within the provisional Order Limits where the need for enhancement has previously been identified (where land availability allows).

11.10 Assessment of likely significant effects

11.10.1 The likely significance of each residual effect is assessed in Table 11.10 after consideration of the proposed mitigation measures, in line with the methodology described in Section 11.4. All effects have been qualitatively assessed as being non-significant based on the application of professional judgement to the significance criteria provided in DMRB LA 110.

11.10.2 Where effects have been identified, these would be reduced where practicable by implementing the mitigation measures outlined in Section 11.9 and by ensuring that the construction of the proposed scheme responds to the national regulatory or policy standards and local policy requirements relevant to this aspect. The residual effects detailed in Table 11.10 assume the implementation of this mitigation.

11.10.3 As reported in Section 11.4, there is limited information available at this stage regarding the precise material requirements and waste quantities associated with constructing the proposed scheme. Any limitations in the current qualitative assessment approach will be addressed in the Environmental Statement through the gathering and assessment of quantified design information on material assets consumption and waste generation. Given the nature of the DMRB LA 110 significance criteria category descriptions, the resulting significance of effect is unlikely to change between the PEIR and the Environmental Statement.

11.10.4 Whilst the application of standard and additional mitigation measures has the potential to reduce the impacts from the consumption of material assets and the generation and management of waste to a certain but unspecified degree, it is unlikely that the construction of the proposed scheme would be able to deliver increased material resource efficiency at levels necessary to meet the significance category descriptors for a neutral effect for the material assets and waste matters of this aspect.

Table 11.10 Summary of likely effects after mitigation

Matter	Significance threshold	Description of potential effects from the proposed scheme	Resulting significance of effect category
Material assets	(1) Project achieves less than 70% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary materials within the first or second study areas.	Whilst it is currently unknown what percentage of C&D waste would be used to substitute the use of primary materials on or off-site, the nature of the proposed scheme means that it would inevitably require primary materials to be imported to site for the purposes of construction. Nevertheless, it is assumed that the proposed scheme would achieve an overall material recovery or recycling rate of ≥70% of non-hazardous C&D materials. Government statistics confirm that the construction industry in England is currently achieving a recovery rate of 92% for non-hazardous C&D waste. This rate has remained at similar levels since 2010 and has at all times been well above the Waste Framework Directive 2020 target of 70%. Furthermore, it has been assumed that the proposed scheme would adopt the DMRB LA 110 target of ensuring that at least 90% (by weight) of non-hazardous C&D waste be recovered or diverted from landfill. Materials would either be recovered within the provisional Order Limits or within the wider East of England region to offset the use of primary construction materials and support a circular economy.	Project is likely to achieve 70-99% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary materials in the first or second study areas. Likely significance of effect: **Slight Adverse**
	(2) Aggregates imported to site comprise re-used or recycled content below percentage target of 31%.	Some degree of re-used or recycled content is anticipated given that this is standard practice in construction, and Construction Procurement Guidance (WRAP, 2009) suggests that infrastructure projects typically exceed 10% even without explicitly trying to increase recycled content. WRAP (2009) reports that the recycled content as a percentage of the total material cost for an infrastructure project was found to be in the region of 8 - 36% using standard practice products, rising to 25 - 49% when applying cost-neutral good practice. Reference to WRAP (2013) Resource Efficiency Benchmarks for Construction Projects reports that the proportion of recycled content (RC) by total aggregates weight, for the completed infrastructure projects within its dataset, was 27% RC/tonne at the 50th percentile (median) level. Further reference to the Mineral Products Association (2020) Profile of the UK Mineral Products Industry 2018 Edition confirms that in 2017 the share of recycled aggregate materials as a proportion of total Great Britain aggregates sales was 30%. These data support the assumption that re-used or recycled aggregate content use on the proposed scheme is likely to be in line with the relevant regional percentage target of 31%.	Aggregates imported to site would likely comprise re-used or recycled content in line with the relevant regional percentage target of 31% where available. Likely significance of effect: **Slight Adverse**

Matter	Significance threshold	Description of potential effects from the proposed scheme	Resulting significance of effect category
Material assets	(3) Project sterilises ≥1 mineral safeguarding site.	The proposed scheme includes constructing within an extensive MSA for sand and gravel and a smaller MSA for brick clay. Whilst the proposed scheme may result in the partial sterilisation of those safeguarded mineral resources present within the first study area, MSAs are not considered to be mineral safeguarding sites, as per the definition provided in DMRB LA 110, and Government guidance makes it clear that there is no presumption that resources defined in MSAs will be worked. Nevertheless, any sterilisation would be minimised where feasible through the adherence to local planning policy, including preparation of a Mineral Resource Assessment. Where sterilisation of mineral resources is unavoidable, the viability of prior extraction of minerals ahead of or in conjunction with the proposed scheme would be considered where environmentally, socially and economically practicable to do so. Whilst the provisional Order Limits of the proposed scheme are located inside a number of MCAs around existing, allocated and safeguarded mineral sites, it is considered unlikely that the proposed scheme would result in impacts to the safeguarded infrastructure and allocations through loss of capacity or by constraining the operation of these facilities. The proposed scheme would neither temporarily nor permanently intersect with the boundary of the safeguarded minerals infrastructure and allocations. The notable exception is where the proposed scheme alignment is routed to go through the active Colemans Farm quarry site, and where planning consent is being sought by the site operator to enable it to extract further accessible mineral reserves from within the corridor affected by the proposed scheme. Some other minor elements of the proposed scheme are also expected to partially intersect with mineral safeguarding sites located at Bulls Lodge and Marks Tey (i.e. haul roads and drainage, respectively). Given the nature of the proposed scheme, it is considered unlikely that the safeguarded minerals infrastructure and allocations would result in indirect impacts to the proposed scheme (through noise, dust, odour, traffic, visual or light) that would prejudice the efficient operation of these sites in line with their extant planning permission. Indirect impacts (or proximal sterilisation) are more commonly associated with more sensitive land uses such as residential developments that could limit the operation of these sites.	Proposed scheme is unlikely to substantially sterilise one or more mineral safeguarding sites (in their entirety), placing their future use at risk or rendering them inaccessible for current or future use. Likely significance of effect: **Slight Adverse**

Matter	Significance threshold	Description of potential effects from the proposed scheme	Resulting significance of effect category
Waste	(1) Project leads to a greater than 1% reduction or alteration in regional landfill capacity.	The precise quantities of inert and non-hazardous C&D waste generated by the proposed scheme are currently unknown. Nevertheless, a greater than 1% reduction or alteration in regional landfill capacity is considered unlikely to occur given that the proposed scheme would need to dispose of greater than 488,413 tonnes of inert or non-hazardous C&D waste to landfill, during the construction period, for this to be realised. This is based on estimated forecast levels of combined inert and non-hazardous landfill capacity[20] in the East of England of 48,841,286 tonnes between 2023 and 2027. Professional judgement and the available Government waste management statistics would suggest that this is unlikely. Furthermore, it has been assumed that the proposed scheme would adopt the DMRB LA 110 target of ensuring that at least 90% (by weight) of non-hazardous C&D waste be recovered or diverted from landfill.	Proposed scheme leads to a less than 1% reduction or alteration in regional landfill capacity. Likely significance of effect: **Slight Adverse**
	(2) Greater than 1% of project waste requiring disposal outside of the region.	The precise quantities of C&D waste generated by the proposed scheme are currently unknown. Nevertheless, it is anticipated that the East of England region has sufficient capacity to accommodate (treat, recycle or recover) the majority of the inert, non-hazardous and hazardous waste from the proposed scheme, without compromising integrity of the receiving infrastructure (design life or capacity) within the region. The East of England region is likely to have available inert and non-hazardous landfill capacity to support the construction of the proposed scheme. Whilst there is no hazardous landfill capacity available within the East of England region, it is considered unlikely that the proposed scheme would need to dispose of >1% of project waste to landfills outside of the East of England region.	Proposed scheme disposes of <1% of scheme waste outside of the region. Likely significance of effect: **Slight Adverse**

[20] Assessing the impacts of the proposed scheme on combined inert/non-hazardous landfill accounts for the uncertainty that exists, at the PEIR stage, with regard to the waste classification (inert or non-hazardous) of certain construction wastes (i.e. specifically excavation materials). This approach is also consistent with the IEMA (2020a) methodology. Nevertheless, the assessment of residual significant effects in the Environmental Statement will endeavour to provide a split between what quantity of residual waste to landfill would be inert and non-hazardous where practicable.

12 Noise and vibration

12.1 Topic introduction

12.1.1 Noise and vibration can have an effect on the environment and on the quality of life enjoyed by individuals and communities. It may in certain circumstances lead to effects on human, ecological and infrastructure (e.g. buildings) receptors.

12.1.2 This chapter describes the findings of the noise and vibration assessment undertaken for the Preliminary Environmental Information Report (PEIR) and the likely environmental effects of the proposed scheme, during both construction and operation.

12.1.3 This chapter is supported by the following figures (see Appendix A):

- Figure 12.1 Noise Study Areas, Noise Important Areas, and Proposed Noise Monitoring Locations
- Figure 12.2 Noise Sensitive Receptors
- Figure 12.3 Do-Minimum 2027 Opening Year Noise Contours and Existing Noise Barriers
- Figure 12.4 Do-Something 2027 Opening Year Noise Contours and Existing and Proposed Noise Barriers
- Figure 12.5 Do-Minimum v Do-Something 2027 Opening Year Noise Change

12.1.4 This chapter uses some technical acoustic terminology. These terms are presented and described in a glossary at the end of this PEIR.

12.2 Stakeholder engagement

12.2.1 Stakeholder engagement has been undertaken with the four local authorities through which the proposed scheme passes. These local authorities are Colchester Borough Council, Chelmsford City Council, Maldon District Council and Braintree District Council. This engagement was undertaken in August 2020 and focused on agreeing the assessment methodology with those in the local authorities who are responsible for noise and vibration. As a result of this consultation there were no changes to the proposed assessment methodology that was outlined in the Environmental Scoping Report (Highways England, 2020d).

12.2.2 The key requirement from the Planning Inspectorate's Scoping Opinion (2021) was for more clarity in some areas to be included within the Environmental Statement and for the rationale behind the selection of noise survey locations to be provided. In addition, there was a request for noise-sensitive ecological receptors and areas where piling may take place to be shown on the figures produced for the noise assessment.

12.2.3 It was agreed by the Planning Inspectorate that significant vibration effects during operation are unlikely to arise and this matter can be scoped out of the Environmental Statement. This matter is therefore scoped out of this PEIR.

12.2.4 Table 12.1 identifies the key feedback received from the Scoping Opinion relevant to the scope and methodology of the noise and vibration assessment.

Table 12.1 Key stakeholder feedback for noise and vibration aspect

Stakeholder	Comment	Response
Planning Inspectorate	For the construction study area, haul routes and the local road network should be included in the assessment.	For this PEIR the potential impact from the use of haul routes and of construction traffic using the local road network has been described qualitatively. This is due to the information required to report this quantitatively, not being available at this stage. For the Environmental Statement, these potential impacts will be assessed quantitatively.
Planning Inspectorate	Ecological sensitive receptors should be included within the noise chapter.	Ecological receptors that are sensitive to noise are shown on Figure 12.2. The assessment of potential impacts at these receptors will be included within the biodiversity chapter of the Environmental Statement.
Planning Inspectorate	Piling locations should be described and shown on a figure.	The locations potentially requiring piling during construction have been described within this PEIR. These will be shown on a figure for the Environmental Statement once the construction methodology has been further developed.
Planning Inspectorate	Specific receptors likely to be affected by night working should be identified.	All receptors identified as likely to be affected by night working will be specified in the Environmental Statement.
Planning Inspectorate	Rationale behind the selection of baseline survey locations, including areas not selected, should be provided.	The Environmental Statement will state the rationale for selecting the proposed survey locations. This will include reasons for the omission of baseline surveys in some areas. The noise monitoring will be undertaken to a recognised standard.
Planning Inspectorate	The construction noise assessment should provide the known noise levels of construction activities and equipment, and the calculations used to determine the construction noise should also be provided.	This PEIR contains a qualitative assessment of likely construction activities and effects. The Environmental Statement will contain quantitative predictions of construction noise from the activities being undertaken. This will include details of likely equipment to be used.

Stakeholder	Comment	Response
Planning Inspectorate	The operational noise study area and sensitive receptors should be shown on a figure.	Figures 12.1 and 12.2 have been included within this PEIR to show the operational noise study area and the noise-sensitive receptors. Figure 12.2 includes the noise-sensitive ecological receptors.
Chelmsford City Council	Likely significant impacts on individual isolated properties should be assessed and reported where necessary rather than aggregated.	The likely significant effects at receptors will be reported either in groups or individually as appropriate.
Chelmsford City Council	Night working in close proximity to sensitive receptors should be avoided unless absolutely necessary.	For a scheme of this size and complexity, some night working would be required, for example when demolishing structures over the A12. Where this is required, the working times and appropriate methods to reduce noise levels would be discussed with the local authority. In addition, the local residents would be kept informed of such works.
Colchester Borough Council	Ensure that baseline monitoring takes place at sensitive properties close to the proposed bypass between junctions 24 and 25 and the new junction at Marks Tey.	Since the Environmental Scoping Report was published the proposed number of survey locations has been increased from 11 to 18. Within the list of proposed survey locations there are some between junctions 24 and 25, and these are shown on Figure 12.1.
Feering Parish Council	Noise monitoring points – there appear to be no locations indicated along the stretch of the A12 that borders Feering. Additional monitoring should be included as part of the EIA.	Proposed noise survey location LT9, shown on Figure 12.1, is located along the stretch of the A12 that borders Feering.
Maldon District Council	The sensitivity of a receptor should be considered within the assessment, and a justification provided.	The sensitivity of a receptor will be considered as one of the factors used to determine whether there is a significant effect.
Rivenhall Parish Council	The impacts of construction and the finished, operational road with respect to noise on those isolated properties that are retained close to the route and Rivenhall End should enjoy clear benefits in terms of all these criteria compared to the current situation.	In terms of construction noise, it is not possible to create a benefit from an activity that generates noise. However, the potential noise from construction activities will be calculated and mitigation measures put in place if there are found to be significant effects. For operational noise, the proposed scheme will seek to provide benefits in terms of noise reduction for Rivenhall End and the isolated properties.

Stakeholder	Comment	Response
Braintree District Council	Ensure that the dwellings within two developments recently granted planning permission (17/00973/FUL and 19/01803/FUL) are included within the noise assessment.	These two developments will be included within the noise assessment, and any subsequent consideration for mitigation or enhancement.
Public Health England	Project should meet the aims of the Noise Policy Statement for England (NPSE).	Consideration of the proposed scheme with respect to national policy on noise will be undertaken. The Environmental Statement will report against the three aims within the NPSE and describe the actions taken to support delivery of each aim.
Public Health England	Project should explore opportunities to improve the health and quality of life.	The proposed scheme will explore opportunities to improve health and quality of life in order to meet the third aim of the NPSE. This is being undertaken during the preliminary design stage, where potential environmental impacts are being taken into consideration. As an example, space has been provided to accommodate possible noise barriers and bunds in some locations.
Public Health England	Need to ensure approach is consulted on and agreed.	The proposed scheme has an ongoing process of consultation with various stakeholders. Specific to noise, the four relevant local authorities were consulted in August 2020. The approach agreed with local authorities is to follow the guidance within the Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration, as stated in paragraph 12.7.1 of the Environmental Scoping Report.
Public Health England	Values for significant observed adverse effect level (SOAEL) and Lowest observed adverse effect level (LOAEL).	The setting of values for SOAEL and LOAEL is an area where DMRB LA 111 provides example values but allows for modification to fit local circumstances. The suggested values for LOAEL and SOAEL within DMRB LA 111 are based on values that have been used for consented road schemes over the past six years. The proposed scheme is similar to many of these schemes, both in terms of the type of scheme and the surrounding environment. For these reasons it is the intention to use the example values of LOAEL and SOAEL provided in DMRB LA 111 (as stated in paragraph 12.7.3 of the Environmental Scoping Report).

Stakeholder	Comment	Response
Public Health England	Construction assessment and mitigation.	The proposed scheme already has a contractor appointed and a draft construction methodology. This information will be used to inform calculations and subsequent assessment undertaken for the Environmental Statement. This assessment will follow the methodology within DMRB LA 111. Due to the nature of the proposed scheme there will be requirement for some night working. The implications of this and actions to control the noise will be described within the Environmental Statement.
Public Health England	Noise insulation should not be used as a mitigation measure.	It is agreed that noise insulation for dwellings is not an appropriate form of mitigation. Noise insulation is mentioned within the Environmental Scoping Report (paragraph 12.5.7) only to assist describing the hierarchy approach to mitigation that will be used for the scheme, and to indicate that mitigation at the receiver is the last resort in terms of noise mitigation.
Public Health England	Use of L_{den} (in noise assessment chapter).	The values of LOAEL and SOAEL will be provided within the Environmental Statement in terms of L_{den} in order to assist other environmental topics. However, the noise assessment will focus on established indices for noise impact assessment in the UK, such as L_{Aeq} and L_{A10}.
Public Health England	Use of health metric (e.g. disability-adjusted life year (DALY)) for the noise assessment.	Paragraph 3.28 of the guidance which has informed the population and human health assessment, DMRB LA 112, states that a qualitative assessment of human health shall be undertaken, with evidence to support conclusions. The population and human health assessment has been scoped on this basis. The decision on the preferred option has already been made and so the calculation of noise-related health outcomes in terms of DALYs and monetisation is considered to be of limited value to decision-makers. The current position is therefore not to provide a quantification of health outcomes from noise for the Environmental Statement. A qualitative commentary will be provided within the population and human health assessment on the health outcomes associated with traffic noise at different levels.

Stakeholder	Comment	Response
Public Health England	Steps taken to arrive at significance.	As is described in paragraph 12.7.22 of the Environmental Scoping Report, the determination of significance will not be simply undertaken by considering the decibel change. Other factors are considered, such as the absolute noise level and the location of the noise source and whether it will change. The steps taken to arrive at significance will be reported in the Environmental Statement as required by DMRB LA 111.
Public Health England	Receptor types to consider during the assessment.	Different types of sensitive receptors will be examined as shown in Table 12.2 of the Environmental Scoping Report. These will include, but not be limited to, dwellings, schools, places of worship and community facilities.
Public Health England	Consider measures for enhancement.	Measures for enhancement will be investigated, as is noted in the Environmental Scoping Report (paragraph 12.5.9). This process has already started with environmental aspects feeding into the preliminary design of the route.
Public Health England	Qualitative characterisation of the area.	Site visits and noise surveys will be undertaken by experienced consultants and during each visit, notes will be made of the noise climate. This information will be reported in the Environmental Statement.
Public Health England	Length of noise surveys.	It is the intention for the noise surveys to be undertaken at each location over a period of one week. For the proposed scheme the noise climate in the immediate vicinity of the A12 does not change by much. A week-long survey is therefore considered sufficient length to characterise the noise climate. The surveys will cover a weekend period as there may be weekend working for the proposed scheme.
Public Health England	Use of different metrics (e.g. events) for the assessment.	Given the proposed scheme has a very dominant and near continuous noise source, it is considered very unlikely that examining further metrics would provide any assistance in the determination of a significant effect.
Public Health England	Use the mitigation hierarchy when considering mitigation.	Priority will be given to reducing noise at source, as is described in the Environmental Scoping Report (paragraph 12.5.4). When the need for mitigation is identified, or enhancement is considered, reducing the noise at source will be considered first.

Stakeholder	Comment	Response
Public Health England	Undertaking of post opening monitoring.	In accordance with DMRB LA 111 (paragraph 4.2), there is no intention to undertake post opening noise monitoring. However, noise is one of the environmental aspects that is assessed within Highways England's Post Opening Project Evaluation (POPE) process, which examines how a scheme is performing against the predicted impacts after one and five years.
Public Health England	Production of an Environmental Management Plan (EMP).	A first iteration of the EMP will be produced for the Environmental Statement. This will be produced in conjunction with the contractor who is already appointed. A second iteration of the EMP will be produced for the construction period.
Public Health England	Proposed scheme should consider the development of green spaces.	The proposed scheme has little opportunity to develop large areas of green space. Private amenity areas will not be physically changed, although the noise climate in some may change and this will be considered when determining significance.
Public Health England	Consider the step change in noise during the assessment.	The change in noise on opening of the proposed scheme will form the initial indication of likely significance of effect. Within DMRB LA 111 there is a move away from examining the long-term effects and this is noted within paragraph 12.7.21 of the Environmental Scoping Report. The potential for a perceived worsening of the noise climate on scheme opening needs to be managed. This can occur for online widening schemes, such as parts of the proposed scheme, where local residents have become used to the noise from the road when there is a reduced speed limit during construction. Then once open, and the speed limit returns to what it was before, there is a perceived increase in noise despite the assessment indicating it may have been reduced. This is not possible to quantify and so needs to be managed by stakeholder communications.

Stakeholder	Comment	Response
Public Health England	Requirement for stakeholder communications to use available technology.	The proposed scheme has a dedicated stakeholder team, and communications with key stakeholders have been ongoing for over a year. The stakeholder team will be taking full advantage of current technology, especially since some of the stakeholder engagement may be virtual due to COVID-19 restrictions. With a lot of the proposed scheme being online widening, the local residents will already be aware of the noise generated by a busy road. Therefore, the use of audio recording, while useful for some projects, is not considered to be a valuable addition to the proposed scheme. With respect to the visual impact, it is standard practice by Highways England on large schemes such as this, for a scheme fly-through to be created.

12.2.5 There were no fundamental changes to the proposed assessment methodology due to comments received in the Scoping Opinion. However, the number of proposed noise monitoring survey locations has been increased from 11 to 18 following the feedback from stakeholders. The proposed extra noise survey locations have been added to cover a wider range of receptors and to allow baseline data to be collected close to where large construction activities would be undertaken (e.g. junction works). The revised proposed survey locations are shown on Figure 12.1 and the aim is to complete these surveys in May 2021.

12.2.6 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

12.3 Legislative and policy framework

12.3.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) 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.

12.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 5.191 of the NNNPS states that operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. The prediction of road traffic noise should be based on the method described in Calculation of Road Traffic Noise. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.

- Paragraph 5.193 states that developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise.
- Paragraph 5.194 states that the project should demonstrate good design through optimisation of scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road and rail networks that have been identified as arising from the development, according to Government policy.
- Paragraph 5.195 states that the Secretary of State should not grant development consent unless satisfied that the proposals will meet the following aims, within the context of Government policy on sustainable development:
  - avoid significant adverse impacts on health and quality of life from noise as a result of the new development
  - mitigate and minimise other adverse impacts on health and quality of life from noise from the new development
  - contribute to improvements to health and quality of life through the effective management and control of noise, where possible
- Paragraph 5.200 states that applicants should consider opportunities to address the noise issues associated with the Noise Important Areas as identified through the noise action planning process.

12.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

12.4 Assessment methodology

12.4.1 The assessment of impacts from noise and vibration has been undertaken in accordance with the guidance in the DMRB LA 111 Noise and Vibration (Highways England, 2020b). By using the guidance within DMRB LA 111 it is considered that the proposed scheme can be measured against the NNNPS policy requirements.

12.4.2 For construction noise and vibration, only a qualitative assessment has been undertaken. This approach has been adopted due to the limited availability of detail required to enable calculations to be undertaken at this stage. For the Environmental Statement the assessment of potential impacts from construction will be undertaken quantitatively.

12.4.3 For the assessment of noise from the operation of the proposed scheme, the approach within DMRB LA 111 is to compare the predicted noise level with and without the proposed scheme at individual or groups of sensitive receptors. Noise levels will be calculated using the methodology contained within the Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988). The changes in these predicted noise levels at a receptor are then compared to determine the impact. This impact is then considered with other factors (e.g. absolute noise level, type of receptor) to determine the effect. If significant effects are identified, then mitigation measures are considered. This approach has been followed for this PEIR and will be followed for the Environmental Statement.

12.4.4 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for this aspect. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

12.5 Assessment assumptions and limitations

12.5.1 At this stage of the assessment there has been no baseline noise survey undertaken. This was not completed during the options selection (PCF Stage 2) since this may have resulted in some unnecessary surveys being undertaken in relation to options not taken forward. To inform this PEIR a series of noise surveys was planned. However, due to the COVID-19 pandemic in 2020 these surveys were not undertaken due to travel restrictions, and potentially low noise levels due to reduced traffic. This is not considered to be a limitation on the assessment undertaken at PEIR as the results from noise surveys are not used to inform the assessment and determination of effects. The three areas where the results from noise surveys are used are described below, together with the potential impact and risk of not having this data at PEIR:

- DMRB LA 111 suggests that baseline noise survey data can be used to compare against the results from the noise modelling. However, since there is no method or requirement to calibrate the noise model against the results from noise surveys, not having the information is not considered to be a limitation or a risk.

- There is an expectation among stakeholders that noise survey data is used for the assessment of operational impacts and the determination of mitigation. Noise survey data is not required to satisfy DMRB LA 111 assessment requirements, but having the results from noise surveys available provides stakeholder confidence. Not having this data available for this PEIR is not considered to be a limiting factor for the conclusions of this preliminary assessment.

- The results from baseline noise surveys are used within the construction noise assessment and can also be used during construction to set noise limits. Since the assessment of construction noise is being undertaken qualitatively for this PEIR, not having the baseline noise survey data is not a limitation.

12.5.2 It is the intention to undertake baseline noise surveys in May 2021 and use the results from these for the assessment that will be reported within the Environmental Statement. There is a risk that the construction noise assessment to be undertaken for the Environmental Statement may be compromised if the noise baseline survey data is not available or representative of normal conditions (e.g. due to COVID-19 restrictions). However, DMRB LA 111 does suggest that the results from the noise modelling or other available datasets can be used to assist with the setting of construction noise thresholds for the assessment.

12.5.3 The noise and vibration assessment in this chapter has been based on an early version of the traffic model for the PEIR and statutory consultation. Traffic forecasts will be updated for the Environmental Statement and DCO application. The assessment of effects presented in this PEIR should therefore be considered preliminary and subject to refinement.

12.5.4 The type of road surface is a factor that is taken into account when predicting noise levels. The existing surfacing along the A12 is known and has been taken into account within the noise model and calculation process. However, at this stage the assessment of any re-surfacing required for the proposed scheme has not been completed, and therefore the surface type for some areas of the Do-Something scenario for the noise assessment is unknown. A cautious assumption has been made of the likely surface along the route for the Do-Something scenario. This assumption is that only the new offline sections of the route will be surfaced with a low-noise surfacing and that other existing surfaces will remain. The assessment of surfacing requirements will be undertaken prior to the Environmental Statement and therefore the assumptions used at PEIR may be updated as required.

12.5.5 Existing noise mitigation in the form of noise barriers has been identified at five locations along the route, and included within the noise model. These have been identified from either existing data sources or from Google streetview, and are:

- 150m of timber noise barrier alongside the A12 at Boreham, protecting the houses on Brick House Lane. This is assumed to be 2m high and would remain in place with the proposed scheme.

- 100m of timber barrier protecting the houses on Yonge Close in Boreham. This is assumed to be 2m high and would remain in place with the proposed scheme.

- 400m of timber noise barrier alongside a new development to the south of Witham, protecting houses on Market Lane. This is assumed to be 2m high and would remain in place with the proposed scheme.

- 90m long and 2m high timber protecting houses on Benton Close in Witham. It is assumed this barrier would need to be removed for the proposed scheme but would be replaced by a new barrier of the same height.
- In Rivenhall End there is 140m of brick wall to the north of the A12, protecting houses on Foxmead. Although this is likely to have been built as a boundary wall for the houses, it will be providing a degree of noise mitigation and is assumed to be 2m high and would remain in place.

12.5.6 Along the route there are fences in some locations, but these have not been included in the noise model as they were unlikely to be providing any noticeable reduction in noise.

12.5.7 There are three buildings that have been identified as requiring demolition within the footprint of the proposed scheme. These are two residential receptors in close proximity to each other (Badgers and Hare Lodge), situated just to the north of the A12 about 750m east of Rivenhall End. The third building is an office block of Barconn Limited to the south of the A12 at Kelvedon on Inworth Road. These three buildings have been removed from the Do-Something scenario within the noise model.

12.5.8 Within Rivenhall End, to the north side of the A12, is The Fox Inn, which has the windows and doors boarded up. Although this is identified within the OS mapping data as being residential, it is assumed that it is unoccupied and is therefore not included as a sensitive receptor. However, the building has remained within the noise model since it provides screening for the receptors behind.

12.6 Study area

12.6.1 Instructions on how to set the study area for an assessment of noise and vibration is provided within DMRB LA 111 Noise and Vibration (Highways England, 2020b). The distances used for the study areas have been chosen based on professional judgement and correspond to the distance where it is considered that receptors could potentially be affected by noise or vibration.

12.6.2 For construction noise, although calculations have not been undertaken for this PEIR, receptors up to 300m from construction activity have been considered for potential effects. For construction vibration, any receptors within 100m of an activity likely to generate a noticeable level of vibration have been considered.

12.6.3 The study area for operational road traffic noise has been chosen as the area within 600m of new road links or road links physically changed or bypassed by the project. For the Environmental Statement, any roads outside of this area where there is a change in the short term of more than 1.0dB(A) as a result of the proposed scheme will also be considered, and on these links the receptors within 50m of the road will be included within the assessment.

12.6.4 These study areas for construction and operation will be defined using the same methods for the Environmental Statement.

12.7 Baseline conditions

Baseline sources

12.7.1 The following sources have been used to inform the baseline:

- England Noise Map Viewer (Extrium, 2019)
- Google Street View

Baseline conditions

12.7.2 The process of describing the baseline conditions surrounding the proposed scheme would normally be assisted by having the results from noise surveys. As has been noted in Section 12.5, at this stage of the assessment there have been no baseline noise surveys undertaken. These baseline noise surveys are now planned for Spring / Summer 2021 and are described below.

12.7.3 The existing noise climate near the proposed scheme is dominated by road traffic noise, predominantly from the A12. The Great Eastern Main Line (GEML) is close to the alignment of the A12 in places. Rail noise would therefore contribute to the local noise climate in some locations. Other noise sources include road traffic noise from local roads and noise associated with urban and rural activities.

12.7.4 There are 18 Noise Important Areas (NIA) along the A12 between junctions 19 and 25. In addition, there are three other NIA on roads that are within the study area. There is one on the A130 adjacent to junction 19, one on the A120 adjacent to junction 25, and one between junctions 25 and 26 on the A12. These 21 NIA are listed in Table 12.2 and shown on Figure 12.1.

Table 12.2 Noise Important Areas within the study area

NIA number	Road	Number of dwellings within NIA	Noise source asset owner	Noise receiving authority
6141	A12	364	Highways England	Chelmsford
5411	A12	39	Highways England	Chelmsford
5412	A12	13	Highways England	Chelmsford & Braintree
6191	A12	4	Highways England	Braintree
5413	A12	210	Highways England	Braintree
6192[1]	A12	0	Highways England	Braintree
5414	A12	1	Highways England	Braintree
5415	A12	95	Highways England	Braintree
6144	A12	3	Highways England	Braintree
5419	A12	1	Highways England	Braintree

NIA number	Road	Number of dwellings within NIA	Noise source asset owner	Noise receiving authority
6145	A12	32	Highways England	Braintree
14874	A12	3	Highways England	Braintree
5416	A12	2	Highways England	Colchester
6142	A12	12	Highways England	Colchester
6143	A12	3	Highways England	Colchester
5417	A12	2	Highways England	Colchester
4759	A12	6	Highways England	Colchester
4760	A12	261	Highways England	Colchester
6173	A130	1	Essex	Chelmsford
4758	A120	80	Highways England	Colchester
4761	A12	1	Highways England	Colchester

[1] The group of approximately six dwellings that would have caused this location to be classed as an NIA have been demolished. These dwellings are not considered within the noise assessment, but the NIA is listed in this table since it is still included within Highways England datasets as an NIA.

12.7.5 A series of baseline noise surveys is planned to be undertaken prior to the Environmental Statement. These surveys will be undertaken at a selection of locations representative of individual, or groups of, sensitive receptors. A description of the reasons for choosing each location will be provided within the Environmental Statement, together with the results from the noise surveys.

12.7.6 It is proposed to undertake unattended week-long noise measurements at 18 locations along the route of the proposed scheme. With the locations chosen being close to the A12 and the noise climate dominated by noise from the A12, a duration of one week, including a weekend, is considered to be sufficient to gain an understanding of the noise climate within the area. While installing and collecting the equipment the survey staff will also undertake a qualitative characterisation of the noise climate at each location. This will be reported within the Environmental Statement.

12.7.7 Figure 12.1 shows the proposed noise survey locations. These are subject to change due to reasons such as access and safety. The noise surveys will follow the procedures set out in British Standard 7445-1:2003 Description and Measurement of Environmental Noise - Guide to Quantities and Procedures (British Standards Institution, 2003).

12.7.8 There will be no baseline vibration surveys undertaken as the guidance within DMRB LA 111 states *'the construction vibration baseline shall be assumed to be zero due to the absence of construction work prior to project commencement'*.

Future baseline

12.7.9 The Do-Minimum traffic scenario is representative of the predicted growth in traffic, accounting for local and regional development. Cumulative impacts are implicit in the future Do-Minimum and Do-Something scenarios because committed developments are included in the traffic model.

12.7.10 Traffic growth aside, the future noise baseline around the proposed scheme is likely to be similar to the existing baseline.

12.7.11 There are areas of housing development alongside the A12 and within the surrounding area, either currently being constructed or with planning approval to be constructed. Some of these developments have been included within the noise assessment and will be considered as sensitive receptors. Where dwellings within these developments are not included within the mapping datasets used to construct the noise model, they have been manually added to ensure they are included within the assessment. The developments considered are listed in Table 12.3.

Table 12.3 Proposed housing developments included within the noise assessment

Planning application reference	Location	Proposed number of dwellings
15/00799/OUT, Land at north-east Witham	Witham (east)	222
15/00430/OUT, Land adjacent to Lodge Farm	Witham (west)	750
17/00973/FUL, Land at Bury Lane	Hatfield Peverel (north-west)	50
19/01803/FUL, Bury Farm	Hatfield Peverel (north-west)	50
16/02096/OUT, Land at Station Road	Hatfield Peverel (north-west)	145
16/01813/OUT, Land south of Stonepath Drive	Hatfield Peverel (south-west)	140
14/01552/OUT, Land east of Plantation Road	Boreham (south-east)	145
09/01314/EIA, Greater Beaulieu Park	Chelmsford (north-east)	3,600*

* A large part of this development is some distance from the A12. Therefore only 200 dwellings have been assumed on a parcel of land that borders the A12.

12.7.12 Developments have been selected where it is considered the receptors may experience significant effects (adverse or beneficial) or be in areas where noise mitigation or enhancement may be considered. This selection process is based on professional judgement and only dwellings from the developments have been considered. For the Environmental Statement it is not the intention to add any more further future developments to the noise assessment.

12.7.13 The potential impact at any large areas of land that may be marked for development, but where no permission has been granted, will be presented within the Environmental Statement if considered appropriate, but these potential receptors will not be included within assessment tables or considered for mitigation or enhancements.

12.7.14 Future climate change has the potential to alter the noise climate, as rainfall, temperature and wind are factors that can influence the generation or propagation of noise. However, none of these factors are used within the NNNPS stated calculation methodology for the prediction of road traffic noise (i.e. CRTN). In addition, the weather conditions are not considered within the assessment methodology contained within DMRB LA 111.

Value and sensitivity of receptors

12.7.15 DMRB LA 111 does not provide a scale of value or sensitivity for receptors. A receptor is considered either to be sensitive or not sensitive to noise and/or vibration. With no scale of value, it is therefore not possible for the noise and vibration assessment to use the matrix-based approach to determine potentially significant effects. However, the value of a receptor has been taken into consideration as a factor when determining whether an effect is significant or not.

12.7.16 DMRB LA 111 provides examples of receptors that are potentially sensitive to noise and vibration. A summary of these is provided in Table 12.4. Figure 12.2 shows the sensitive receptors within the noise study area. Also shown on Figure 12.2 are biodiversity areas and features that are sensitive to noise. The extent of these biodiversity areas is not limited to the study area for the noise assessment. The impact from noise and/or vibration on these receptors will be considered within the Environmental Statement and reported in the biodiversity chapter.

Table 12.4 Value of receptors in the study area for noise and vibration

Value and sensitivity	Description	Examples within the study area
Sensitive	Dwellings, hospitals, healthcare facilities, education facilities, community facilities, quiet areas or potential quiet areas as defined by the Environmental Noise Directive, international and national or statutorily designated sites, public rights of way, buildings containing vibration-sensitive equipment and cultural heritage assets.	Dwellings within Boreham, Hatfield Peverel, Witham, Rivenhall End, Kelvedon, Feering, Gore Pitt, Pott's Green, Long Green, and Marks Tey. Boreham Primary, Hatfield Peverel Infant School, Gershwin Park Day Nursery, Chipping Hill Primary, Holy Family Roman Catholic Primary, Howbridge Infants, Rivenhall Church of England Primary, Easterford Pre-School, Kelvedon St Mary's Academic School, Feering Church of England Primary and Tadpoles Pre-School. Prested Hall grounds, Benton Hall Golf and Country Club.

12.8 Potential impacts

12.8.1 In this section the potential impacts from noise and vibration on the sensitive receptors during both construction and operation are described. For construction this considers only adverse impacts since it is not possible for a construction activity to reduce the ambient noise level at a receptor. However, the presence of a reduced speed limit along the route can cause a reduction in noise that is often noticeable to nearby residents when works are not taking place in the immediate vicinity.

12.8.2 For construction impacts, the main activities taking place that are likely to generate noise and/or vibration are described below for each of the main construction areas.

12.8.3 The main construction phase is expected to start in 2023 and finish in 2027. The peak year of construction activity is expected to be 2025. It should be noted that 2025 may not necessarily be the peak in terms of impacts from noise and vibration.

12.8.4 For the potential impacts from the operation of the new road (i.e. when it is open for traffic), only noise is considered.

Construction

Junction 19 (Boreham interchange) to junction 20a (Hatfield Peverel South interchange), including Boreham

12.8.5 This part of the route is already three lanes and therefore the works required would consist of signage and technology improvements. Junction improvements and bridge widening works would be required at junction 19 and this work would involve vegetation clearance, earthworks, concreting, lifting and paving activities. Some of this work may need to be carried out under full closures of the carriageway and probable lane closures with night working.

Junction 20a (Hatfield Peverel South interchange) to junction 21 (Witham South interchange), including Hatfield Peverel

12.8.6 This part of the route is currently two lanes in each direction and would require online widening to three lanes in each direction. Along the A12 past Hatfield Peverel there would be vegetation clearance, earthworks, demolition of existing structures, construction of new structures (i.e. bridges) and paving. Some of these works, such as the construction of new structures, would need to be undertaken at night and/or over a weekend with a full road closure. The earthworks would require sheet piles to be inserted in some locations for embankment stabilisation. The type of piling method to be used is subject to ground investigations but is likely to be percussive (i.e. hammer) or vibratory piling; either method would elevate the noise level above the existing. As well as adverse noise impacts, the activity of piling has the potential to generate adverse vibration impacts at those receptors that front the A12.

12.8.7 Within Hatfield Peverel there is the possibility that underground utilities which currently pass alongside the A12 may be diverted to pass under The Street in Hatfield Peverel (subject to ongoing studies). These works may be undertaken in advance of the main construction works.

12.8.8 The construction of the new junction 21 and associated slip roads would require extensive earthworks and structural work, and for the final phases of construction is likely to require night works or works with a full closure of the A12.

Junction 21 (Witham South interchange) to junction 22 (Colemans interchange), including Witham

12.8.9 This part of the route is currently two lanes in each direction and would require online widening to three lanes in each direction. Along all of the route there would be vegetation clearance, earthworks and paving.

12.8.10 Within this section there are also some locations where earthworks would require sheet piles to be inserted to create retaining walls for embankment stabilisation. The area around Maldon Road and alongside Market Lane are locations identified as likely to require retaining walls. The type of piling method to be used is subject to ground investigations but is likely to be percussive (i.e. hammer) or vibratory piling; either method would elevate the noise level above the existing. As well as adverse noise impacts, the activity of piling has the potential to generate adverse vibration impacts at those receptors immediately adjacent to the A12.

Junction 22 (Colemans interchange) to junction 23 (Kelvedon South interchange), including Rivenhall End

12.8.11 This part of the route consists of a new offline section of the A12, together with the construction of a new junction 22.

12.8.12 The construction of the new junction 22 and associated slip roads would require extensive earthworks and structural work. With these works being offline it is unlikely that any night working would be required except for tie-ins back to the main existing A12.

12.8.13 Construction of the offline sections of the A12 would initially involve vegetation clearance and then extensive earthworks along the line of the proposed road. Following this, the construction of the new road would be undertaken, which would include drainage, signage installation and ultimately paving.

12.8.14 The realignment of Braxted Road would create a road that passes over the new A12 via a new bridge. The construction of this would require earthworks and structural work.

Junction 23 (Kelvedon South interchange) to junction 24 (Kelvedon North interchange), including Kelvedon

12.8.15 This part of the route is currently two lanes in each direction and would require online widening to three lanes in each direction. Along all of the route there would be vegetation clearance, earthworks and paving.

12.8.16 The construction of the new junction 24 and associated slip roads would require extensive earthworks and structural work. With these works being offline it is unlikely that any night working would be required except for tie-ins back to the main existing A12.

12.8.17 Highfields Bridge, where Maldon Road passes over the A12 south of Kelvedon, is due to be demolished and a replacement built. Similarly, the existing bridge for Ewell Hall Chase that passes over the A12 is due to be demolished and a replacement built. For some of the works associated with the demolition and construction of this bridge, there may be the requirement for a full closure of the A12, night-time and weekend working.

Junction 24 (Kelvedon North interchange) to junction 25 (Marks Tey interchange), including Marks Tey

12.8.18 This part of the route consists of a new offline section of the A12, together with the construction of an upgraded junction 25. The improvements to junction 25 and associated slip roads would require extensive earthworks and structural work.

12.8.19 Construction of the offline sections of the A12, starting just to the south of the existing junction 24, would initially involve vegetation clearance and then extensive earthworks along the line of the proposed road. Following this, the construction of the new road would be undertaken, which would include drainage, signage installation and ultimately paving.

12.8.20 New access tracks would be constructed for some locations along the route, which would involve bridges being constructed over the new alignment of the A12. Since the works associated with this would be offline there should be no requirement for night working.

12.8.21 Easthorpe Road would be realigned and a bridge would be constructed over the new alignment of the A12. These works would be offline and so there should be no requirement for night working.

12.8.22 The access for properties on Easthorpe Green and Terlingfair Kennels and Cattery would be severed by the new alignment of the A12 and therefore a single access track would be constructed that would include a bridge over the new alignment of the A12. These works would be offline and so there should be no requirement for night working.

12.8.23 There may be a requirement for sheet piling to the east of junction 25 due to the need for retaining walls to be constructed. The piling method to be used is subject to ground investigations but is likely to be percussive (i.e. hammer) or vibratory piling; either method would elevate the noise level above the existing. As well as adverse noise impacts, the activity of piling has the potential to generate adverse vibration impacts at nearby receptors.

Borrow Pits

12.8.24 The locations of the proposed borrow pits are shown on Figure 2.2. Initially a borrow pit area would require fencing and then topsoil stripping. Once the borrow pit is ready for use, the material would be excavated, loaded to dumpers, and transported along haul routes to the point of use. It is also possible that aggregate processing plant would form part of the allocated borrow pit areas. At nearby sensitive receptors there is the possibility of moderate or major adverse noise impacts from the activities associated with the construction and operation of the borrow pits.

Diversion routes

12.8.25 It is assumed that the existing A12 would be kept open at peak hours during construction of the proposed scheme. However, if closures are required to undertake certain phases of the construction, then the diversion route for traffic is proposed to be via the A130, A131 and the A120 for northbound traffic. For southbound traffic it would be this route in reverse. It is assumed within DMRB LA 111 that any diversion at night would generate a major magnitude of impact at any sensitive receptors within 25m of the route. Along this route there are sensitive receptors within 25m, either as isolated receptors or on urban fringes, for example at north-east Chelmsford, Notley Green, Great Leighs, Braintree, Bradwell and Long Green.

Advanced works

12.8.26 Advanced works are those undertaken before the start of the main construction phase and are likely to take place throughout the route of the proposed scheme. These would include archaeological mitigation, the diversion and protection of utilities services and the mitigation of environmental constraints.

12.8.27 The full extent of these advanced activities is still unknown, but it is only likely to be the works undertaken for the diversion of utilities that would generate noise that would cause adverse impacts.

Construction compounds

12.8.28 Along the route there are planned to be two main construction compounds and various smaller satellite compounds. The work associated with the construction of these compounds is likely to include topsoil stripping, laying a temporary surface, installation of cabins, trenching work for utilities, and fencing. The day-to-day activities at each compound would vary but are likely to involve vehicle movements for the workforce and for the delivery and storage of materials.

12.8.29 Laydown areas are likely to be distributed throughout the construction area, especially close to main work areas and structures. These are unlikely to be in place in every location for the duration of the construction work, and the activities at these would be mainly the storage of materials and vehicles, together with welfare units for the workforce.

12.8.30 The proposed locations of the construction compounds, satellite compounds and laydown areas are shown in Figure 2.2.

Aggregate processing facilities

12.8.31 It is possible that there would be one main aggregate processing facility within the proposed scheme and this is likely to be located in the main construction compound at junction 20b, which lies adjacent to borrow pit E. The activities undertaken at such a facility would be aggregate crushing and grading of material from demolition. There would also be movement of heavy vehicles transporting the material to and from the facility. There is the possibility of moderate to major adverse noise impacts if located close to sensitive receptors.

Haul routes

12.8.32 Haul routes are used to transport materials and the workforce from one part of the construction site to another, without the need to use the public highway. These would often be used by large vehicles that have the potential to generate higher levels of noise. The haul routes for the proposed scheme are likely to be close to the existing A12 to avoid unnecessary transporting of materials, and also positioned away from large groups of sensitive receptors. However, there may be some that pass close to isolated sensitive receptors where there would be the possibility of negligible to minor adverse noise impacts. The indicative haul routes are shown on Figure 2.2.

Construction traffic

12.8.33 The traffic generated by the construction of the proposed scheme would be from the workforce and also the delivery and removal of materials. Provisional estimates of construction-generated vehicle movements have shown that this increase in traffic would be a negligible or minor adverse impact.

De-trunked sections

12.8.34 The parts of the existing A12 that would no longer be used as a trunk road would be passed to the control and management of Essex County Council's Highway Authority Control. These sections of road are likely to require some works such as new signage and junction modifications. The extent of this work is unknown at this stage but is not expected to produce high levels of noise or vibration, and will be for short periods of time.

Technology installations

12.8.35 Gantries and technology installations would be installed along the route. The works associated with these would involve localised earthworks, piling, concreting, directional drilling and lifting operations. The piling method to be used is likely to be auger piling which does not generate high levels of noise or vibration. The final part of the installation of these features is likely to require full or partial closure at night as the signs are lifted into position.

Operation

12.8.36 The impacts from the operation of the road (i.e. when open to traffic) are discussed in this section. The required operational noise impact tables from DMRB LA 111 are provided as Table 12.5 and Table 12.6. The calculation undertaken for these tables includes the existing noise barriers and embedded mitigation in the form of earth bunds. It does not include noise barriers in the locations where these will be examined for mitigation or enhancement.

12.8.37 These tables report the maximum noise change on any façade of a sensitive receptor. This change may be positive or negative. While this may provide an indication of the number of significant effects, it should not be used to report the number of receptors with a significant effect. The determination of whether an impact is significant considers other factors and these are discussed in Section 12.10, with the number of significant effects from the proposed scheme being summarised in Table 12.13.

12.8.38 A description of potential impacts from junction to junction is then provided. For this PEIR, the description focuses on the short-term impacts (i.e. on opening) within the study area and daytime only. For the Environmental Statement the description will include long-term impacts where appropriate, and also night-time impacts.

Table 12.5 Operational noise impacts – short term

		Daytime		Night-time	
Change in noise level		Number of dwellings	Number of other noise-sensitive receptors	Number of dwellings	Number of other noise-sensitive receptors
Increase in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	2,447	16	4,729	34
	1.0 – 2.9	5,321	40	227	5
	3 – 4.9	22	2	6	2
	>5	18	3	4	1
No change		63	0	1,247	8
Decrease in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	1,204	16	2,713	25
	1.0 – 2.9	512	16	605	18
	3 – 4.9	182	3	168	1
	>5	137	4	207	6

12.8.39 Table 12.5 shows 40 dwellings would experience an increase in noise of above 3dB(A) in the short term (i.e. on opening). A change of noise of 3dB(A) or more is considered in DMRB LA 111 as the change in noise level where significant effects may start to occur. These changes in noise level would be moderate (3 to 5dB(A)) or major (>5dB(A)) adverse impacts. These impacts are at isolated or small groups of dwellings where the new alignment would bring the A12 closer, and are mainly between junction 24 and 25.

12.8.40 The 319 moderate or major decreases in noise at dwellings are mainly in Rivenhall End, Feering, south-west Marks Tey, and at isolated or small groups of dwellings where the new alignment of the A12 would move the road away from them.

12.8.41 Changes in noise for both dwellings and other sensitive receptors at night are less than during daytime. This is due to the effect of the increase in traffic flow and speed, and hence noise, being less pronounced at night.

Table 12.6 Operational noise impacts – long term

		Daytime		Night-time	
Change in noise level		Number of dwellings	Number of other noise-sensitive receptors	Number of dwellings	Number of other noise-sensitive receptors
Increase in noise level dB $L_{A10,18h}$ / L_{night}	<3.0	8,383	66	8,470	69
	3.5 – 4.9	62	3	29	2
	5 – 9.9	18	3	3	2
	>10	2	0	2	0
No change		141	3	143	1
Decrease in noise level dB $L_{A10,18h}$ / L_{night}	<3.0	1,067	19	954	20
	3.0 – 4.9	111	2	153	3
	5 – 9.9	88	3	94	2
	>10	34	1	58	1

12.8.42 The long-term changes (i.e. 15 years after opening) in noise levels presented in Table 12.6 follow generally the same pattern as the short-term changes with the same sensitive receptors experiencing the changes. The general change in noise over the 15 years after opening would be an increase of around 0.5dB(A), which is due to an increase in traffic flow but a reduction in vehicle speed. This small increase in noise has therefore meant that there are more receptors within the lowest increase category for the long term than there were for the short term.

12.8.43 The following paragraphs discuss the potential short-term impacts along the route, with a focus on those areas where there are impacts that could generate significant adverse or beneficial effects.

12.8.44 Along with the change in noise, the absolute noise level is also used to determine whether there is a likely significant effect. Noise thresholds for the onset of adverse effects in terms of overall levels of exposure are defined within DMRB LA 111. These thresholds, or effect levels, are defined within the NPSE (Defra, 2010) as:

- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur

12.8.45 Example noise levels assigned to these effect levels are provided in DMRB LA 111, and these are shown in Table 12.7.

Table 12.7 Operational LOAEL and SOAEL values

Time period	LOAEL	SOAEL
Day (06:00 to 24:00)	55dB $L_{A10,18h}$ (façade) (equivalent to 52.5dB $L_{A10,18h}$ free-field)	68dB $L_{A10,18h}$ (façade) (equivalent to 65.5dB $L_{A10,18h}$ free-field)
Night (23:00 to 07:00)	40dB $L_{night, outside}$ (free-field)	55dB $L_{night, outside}$ (free-field)

12.8.46 Although DMRB LA 111 allows these example values to be modified, they are considered to be appropriate for the proposed scheme and have been used for the assessment.

12.8.47 In the following paragraphs, unless stated otherwise, all noise levels quoted are from the façade, in the $L_{A10,18h}$ noise index, and at a calculated height of 4m above local ground level.

Junction 19 (Boreham interchange) to junction 20a (Hatfield Peverel South interchange), including Boreham

12.8.48 There is predicted to be an increase in noise of just over 1dB(A) at the closest sensitive receptors to the A12 within Boreham. This increase is caused by an increase in both traffic flow and speed on the A12. The increase in noise would be a minor impact. For the receptors directly facing the A12 the daytime noise level is above the SOAEL.

12.8.49 Within Boreham there is predicted to be an increase in noise of around 2dB(A) at the sensitive receptors along Main Road, which would be a minor adverse impact. The absolute noise level at these receptors is between the LOAEL and SOAEL. This increase in noise is caused by an increase in traffic flow.

12.8.50 To the south of Main Road within Boreham, away from the sensitive receptors immediately alongside Main Road, there is generally an increase in noise of between 0.5 and 1.5dB(A). These would be negligible and minor impacts. At these sensitive receptors the absolute noise level is either between the LOAEL and SOAEL or below the LOAEL.

12.8.51 The groups of sensitive receptors, mainly to the south of the A12 between Boreham and Hatfield Peverel, would experience an increase in noise of between 1 and 3dB(A). This would be a minor impact caused by an increase in traffic flow and speed on the A12. Some of these sensitive receptors are above the SOAEL, with the others being between the LOAEL and SOAEL.

Junction 20a (Hatfield Peverel South interchange) to junction 21 (Witham South interchange), including Hatfield Peverel

12.8.52 Throughout Hatfield Peverel there are predicted to be negligible decreases (<1dB(A)) and minor increases (1 to 3dB(A)) in noise. The increases are caused by a combination of the road widening, bringing the noise source closer to receptors, and also a small increase in traffic flow and speed. The decreases in noise are mainly to the south of the A12. Despite the A12 moving closer to sensitive receptors, the existing embankment is closer to the noise source and therefore more effectively screens the noise. Some of the sensitive receptors closest to the A12, both the north and south, are above the SOAEL.

12.8.53 A reduction in traffic along most of the B1137 The Street causes a reduction in noise for those receptors fronting this road. This is a negligible impact. However, between the junction with Maldon Road and the far eastern end of the town, there are approximately 15 sensitive receptors that would experience an increase in noise between 2 and 4dB(A). This increase would be a minor or moderate adverse impact and is caused by an increase in traffic along this section of The Street due to the closure of the nearby Wellington Bridge over the A12 that forms the northbound on-slip at the existing junction 20b. Due to the proximity to The Street, some of these receptors are above the SOAEL.

Junction 21 (Witham South interchange) to junction 22 (Colemans interchange), including Witham

12.8.54 The noise level at the receptors immediately to the north of the new junction 21 would experience noise levels below the SOAEL and an increase in noise of around 1.5dB(A) which would be a minor adverse impact. This increase in noise would be due to the changes in the alignment and the increase in traffic flow and speed on the A12.

12.8.55 To the south of the proposed new junction, at the start of the Witham bypass, is the residential receptor of Latneys, which includes Latneys Kennels, Cattery and Grooming Parlour. This single receptor is predicted to experience an increase in noise just over 2dB(A) which would be a minor adverse impact. The increase in noise is due to the alignment of the A12 moving closer to the receptor and also an increase in traffic flow and speed on the A12. The absolute noise level at this receptor is between the LOAEL and SOAEL.

12.8.56 To the south of the Witham bypass is the single residential receptor of Dengie Farmhouse. The predicted noise level at this receptor is above the SOAEL and there is predicted to be a maximum increase in noise of 1.8dB(A). This increase would be a minor impact caused by the carriageway of the A12 moving closer to the receptor and an increase in traffic flow and speed.

12.8.57 Receptors within 30m of the A12 in the area where Maldon Road passes under the A12 are above the SOAEL and are predicted to experience an increase in noise of between 0 and 2dB(A). This would be a negligible to minor impact caused by the carriageway of the A12 moving closer to the receptors and an increase in traffic flow and speed.

12.8.58 The large area of residential receptors to the west of Maldon Road in the south of Witham are predicted to experience an increase in noise of between 1 and 3dB(A) which would be a minor adverse impact. The absolute noise level at most of these receptors is between the LOAEL and SOAEL, with a few being just above the SOAEL.

12.8.59 The sensitive receptors along Market Lane, to the east of Maldon Road north of the A12, are predicted to experience an increase in noise of between 1 and 3dB(A) which would be a minor adverse impact. This increase is due to an increase in traffic flow and speed on the A12. Due to the presence of the existing noise barrier at this location, the absolute noise levels are below the SOAEL.

12.8.60 In Little Braxted and along Little Braxted Lane to the north, the sensitive receptors close to the road would experience noise levels between the LOAEL and SOAEL. Due to an increase in traffic on Little Braxted Lane, these sensitive receptors would experience an increase in noise of above 5.0dB(A) which would be a major adverse impact. The sensitive receptors that are set back from the road would experience a moderate adverse impact.

Junction 22 (Colemans interchange) to junction 23 (Kelvedon South interchange), including Rivenhall End

12.8.61 Immediately to the east of the new junction 22 there are two sensitive receptors south of the existing A12 and two to the north. The sensitive receptors to the north, Burghey Brook Farm and Whitelands, would experience a decrease in noise of more than 5dB(A) which would be a major beneficial impact. The two sensitive receptors to the south, 1 and 2 Burghey Brook Cottages, would also experience a decrease in noise of more than 5dB(A) on the front of the dwellings. Despite the new alignment of the A12 moving to the south of these dwellings there is still predicted to be a reduction in noise of between 3 and 5dB(A) due to screening provided by the earthworks for the slip roads of the new junction 22. These four dwellings would all move from being above the SOAEL to below.

12.8.62 In Rivenhall End, the sensitive receptors to the north of the existing A12 would all experience a decrease in noise, with some of these being over 10dB(A) which would be a major beneficial impact. Dwellings closest to the A12 would move from being above the SOAEL to below.

12.8.63 In Rivenhall End, to the south of the A12, there is a group of four residential sensitive receptors on The Drive. These would experience a decrease in noise of around 10dB(A) on the front façade of the dwellings, which would be a major beneficial impact. However, due to the realignment of the A12, there would be an increase on the rear facades of these dwellings of up to 4dB(A), which would be a moderate adverse impact.

12.8.64 The Rivenhall Hotel would experience a reduction in noise of around 10dB(A) on the front façade (major beneficial impact) but an increase in noise of 7dB(A) on the rear façade (major adverse impact).

12.8.65 To the south of the realigned A12 there is a group of residential sensitive receptors, which includes some mobile homes that are permanent residences. Although traffic using Braxted Road would be moved further to the west, the proximity of the realigned A12 would increase the noise at these dwellings by between 5 and 10dB(A), which would be a major adverse impact. However, the absolute level at these dwellings would remain below the SOAEL. Slightly further south, around 120m from the realigned A12, is Rose Cottage. At this dwelling there would be an increase in noise of 4.5dB(A) which would be a moderate adverse impact.

12.8.66 To the east of Rivenhall End there is a group of four dwellings which would experience a decrease in noise of between 2 and 4dB(A) due to the carriageway of the A12 moving further away. This decrease in noise would be a minor to moderate beneficial impact and would change two of the dwellings from being above SOAEL to below.

Junction 23 (Kelvedon South interchange) to junction 24 (Kelvedon North interchange), including Kelvedon

12.8.67 At the start of the Kelvedon bypass there are two sensitive receptors within 100m of the A12 (Camelot House and Stanwick House). Both these dwellings would experience an increase in noise of just over 1dB(A) which would be a minor adverse impact. The absolute noise level at both dwellings would be between the LOAEL and SOAEL.

12.8.68 To the north of the A12 there are 14 sensitive receptors along Ewell Hall Chase. These dwellings are all predicted to experience an increase in noise of between 1 and 3dB(A), which is due to the increase in traffic flow and speed. The closest of the dwellings to the A12, Ewell House, is above the SOAEL. Despite the dwelling being around 140m from the A12, the absolute level of noise is high due to the concrete surfacing of the A12. The remaining 13 dwellings are between the LOAEL and SOAEL.

12.8.69 Further back from these dwellings towards Kelvedon, the large group of sensitive receptors is expected to experience an increase in noise of between 1 and 2dB(A) which would be a minor adverse impact. These dwellings would be below the SOAEL.

12.8.70 To the south of the Kelvedon bypass, along Highfields Lane, there are three sensitive receptors at Koorbaes Cottages. All three of these are expected to experience an increase in noise of between 1 and 3dB(A) which would be a minor adverse impact. These dwellings are all above the SOAEL.

12.8.71 Where the proposed new junction 24 joins Inworth Road there is a small group of sensitive receptors. These are predicted to experience increases in noise between 1 and 3dB(A), which would be a minor adverse impact. This increase in noise is caused by an increase in traffic on Inworth Road, the alignment of the new junction and associated slip roads, and an increase in flow and speed on the mainline of the A12. Some of these sensitive receptors are above the SOAEL.

12.8.72 Further south along Inworth Road, towards Inworth, there are increases in noise at nearby sensitive receptors of between 1 and 2dB(A), which would be a minor adverse impact. This increase in noise is caused by an increase in traffic on Inworth Road, and some of the sensitive receptors are above the SOAEL.

12.8.73 Just to the north of where Inworth Road passes under the A12 there are three dwellings. These are predicted to experience a decrease in noise due to the realigned A12 and the offline part of the road being surfaced with a low-noise surface as opposed to the existing concrete, so less noise would be generated from the surface.

12.8.74 Towards the existing junction 24 the new alignment of the A12 moves closer to a small group of dwellings and also Prested Hall, which is a wedding venue, hotel and health spa. These sensitive receptors would experience a change in noise of between -1 and +1dB(A) which would be a negligible impact. This change in noise is due to several factors. The A12 is moving closer to the sensitive receptors, but the new offline route would have a low-noise surface, which generates less noise than the existing concrete surface that is further away. There would normally be more of a reduction in noise from this change in

surface, however, the increase in traffic flow and speed offsets this to some extent.

12.8.75 The closest sensitive receptors on the eastern side of Gore Pit along London Road would experience a reduction in noise of more than 5dB(A), which would be a major beneficial impact. Further into Gore Pit the reduction in noise at most sensitive receptors would be between 1 and 5dB(A) which would be a minor or moderate beneficial impact.

Junction 24 (Kelvedon North interchange) to junction 25 (Marks Tey interchange), including Marks Tey

12.8.76 Along New Lane there is predicted to be a reduction in noise of between 5 and 10dB(A) for the dwellings nearest the A12, and a reduction of between 3 and 5dB(A) for the remaining. These would be major and moderate beneficial impacts and are due to the alignment of the A12 moving further away. In Long Acres, within Feering, there would be reductions in noise at dwellings of between 3 and 5dB(A). This is a moderate beneficial impact due to the alignment of the A12 moving further away.

12.8.77 To the immediate east of the existing junction 24 there are eight dwellings, three to the north (St Christopher Bungalow, St Patricks, Trewlands) and five to the south of the A12 (Prested Hall Cottages, Heathfield, Prested Hall Farm Cottages). Those to the north would experience a reduction in noise of around 10dB(A) which would be a major beneficial impact. This would be caused by the realignment of the A12 and would mean these dwellings are no longer above the SOAEL. Those dwellings to the south would also experience a major beneficial impact on the front and the side of the dwellings. Despite the realigned A12 moving to the rear of these dwellings, there is predicted to be a reduction (negligible) in noise on this façade. The existing alignment of the A12 contributes to noise at the rear of these dwellings as this section of the road is currently surfaced with concrete. The new alignment of the A12 would have a low-noise surface and there would be an earth bund, resulting in a predicted noise level that is less than the existing situation.

12.8.78 Around 850m to the east of the existing junction 24 there is another group of dwellings to the north and south of the existing A12. Those to the north, including Freebourne House and The Tree House, would experience a reduction in noise of more than 5dB(A) which would be a major beneficial impact and would mean that those dwellings that were above the SOAEL would fall to below the SOAEL. The dwellings to the south (Sherwood Cottage, Maple House, 1 and 2 Little Domsey Cottages) would experience a reduction in noise on the front and side of the dwelling that would be either a moderate (3 to 5dB(A)) or major (>5dB(A)) beneficial impact. However, to the rear of these dwellings there would be increases in noise due to the realigned A12. At Sherwood Cottage and Maple House this increase in noise would be around 1.5dB(A) which would be a minor adverse impact. At Little Domsey Cottages the increase would be between 5 and 7dB(A) which would be major adverse impact. This increase is due to these two dwellings being within 70m of the new alignment of the A12.

12.8.79 Approximately 2km to the west of junction 25 the proposed new alignment of the A12 moves further from the existing alignment and closer to the dwellings on Easthorpe Green (1 and 2 The Lodge, Easthorpe Green Farm, Church View House). These would all experience an increase in noise of over 5dB(A) on at least one façade of the dwelling. This would be a major adverse impact but the absolute noise level at all four dwellings would remain below the SOAEL.

12.8.80 Further along the alignment towards junction 25 is Wishingwell Farm and Terlingfair Kennels and Cattery. The increase in noise at Wishingwell Farm would be above 8dB(A) which would be a major adverse impact, caused by the realigned A12 being within 70m of the dwelling. The absolute noise level would be just below the SOAEL.

12.8.81 The two dwellings on Doggetts Lane (Hammer Farm and Doggetts) would experience increases in noise on the rear facades due to the realigned A12. At Hammer Farm the increase would be 4.5dB(A) which would be a moderate adverse impact. At Doggetts the increase would be 14dB(A). This would be a major adverse impact and the absolute noise levels at Doggetts would change to being above the SOAEL.

12.8.82 All of the sensitive receptors to the north of the existing A12 as the route approaches junction 25, would experience a decrease in noise. These are receptors along Old London Road and within The Crescent. Some of these decreases in noise would be up to 10dB(A) which would be a major beneficial impact.

12.8.83 Along Hall Chase is the single dwelling of Hall Chase Farm House. This dwelling would experience an increase in noise on all facades, with the highest being 4dB(A) on the rear of the dwelling. The cause of this increase in noise is the realignment of the A12 around junction 25 and also traffic using the southbound entry slip road. This increase would be a moderate adverse impact and would put some facades of the dwelling above the SOAEL.

12.8.84 For the remainder of Marks Tey there are predicted to be negligible adverse and beneficial impacts. The dwellings along London Road where it is parallel to the A12 have absolute noise levels on the front façade above the SOAEL.

12.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

12.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts and provide enhancements through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3 details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

12.9.2 Embedded mitigation relevant to this aspect includes:

- Earth bunding to reduce noise levels. For the assessment at PEIR these bunds have been included within the design at a height of 2.5m near to the alignment of the A12 at the following locations:
  - Four dwellings on The Drive, Rivenhall End

- Dwellings (e.g. Heathfield) to the east of junction 24, to the south of the A12
- Dwellings on Easthorpe Green, south of the A12 between junctions 24 and 25
- Terlingfair Kennels and Cattery, to the south of the A12 between junctions 24 and 25
- Dwellings on Doggetts Lane, to the south of the A12 between junctions 24 and 25
- Hall Chase Farm House, Hall Chase, to the south of the A12 at Marks Tey

- Space within the design for the provision for noise barriers, which are considered in the 'additional mitigation' section of this assessment.
- The provision of low-noise surfacing on the new offline sections of the route.

12.9.3 The decision on whether to include bunding within the design or to include space for a potential noise barrier was based on the likely effectiveness of the measure, engineering constraints and the visual impact. For example, in a location where the A12 would be 100m from a small group of receptors, a noise barrier is unlikely to meet the sustainability (i.e. value for money) criteria. However, an earth bund that may be required for visual mitigation would also provide noise mitigation.

12.9.4 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

12.9.5 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect includes the following:

- Prior to construction, the first iteration of the EMP would be updated and implemented. The EMP would include the relevant construction noise criteria and any proposed monitoring during construction.
- The use of Best Practicable Means (BPM) during construction. This is standard sector practice in accordance with British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (British Standards Institution, 2014a); and British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (British Standards Institution, 2014b). Examples of these BPM are as follows:

- Appropriate selection of plant and construction methods: only plant conforming with or better than relevant national or international standards, directives or recommendations on noise or vibration emissions would be used. Construction plant would be maintained in good condition with regard to minimising noise and vibration output.
- Construction plant would be operated and maintained appropriately, following manufacturer's written recommendations or using other appropriate operation and maintenance programmes that reduce noise and vibration emissions.
- Use of audible reversing warning systems on mobile plant and vehicles would be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact.
- Choice of routes and timings for the transport of construction materials, waste materials and personnel to reduce the risk of increased noise and vibration impacts due to the construction of the proposed scheme.
- Haul roads would be well maintained and avoid, where feasible, the use of steep gradients.
- All site employees would be reminded of their obligation to minimise noise on site.
- Community liaison would keep residents updated about works via letter, email or a virtual information hub.

12.9.6 Standard mitigation will be included in a first iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5).

Additional mitigation

12.9.7 The construction of the new junctions and some of the offline structures would look to utilise ‘design for manufacture and assembly’ solutions over traditional *in situ* concrete methods of construction. The use of these solutions would allow sections of the structures to be constructed offsite and therefore save time onsite, resulting in less noise and reducing the amount of night working and road closures.

12.9.8 During preparation of areas for compounds and borrow pits there is often a layer of material that needs to be stripped off before the location can be used. It may be practicable to stockpile this material so it can act as noise screening for nearby receptors. The extent of any material is currently unknown for all compound and borrow pit locations and so any potential noise screening cannot be determined at this stage. For the Environmental Statement, further information will be available that may allow any noise screening to be considered.

12.9.9 For the mitigation of operational effects, at this stage only the provision of noise barriers has been considered. This is because the surfacing assessment has yet to be completed. The potential use of low-noise surfacing as a mitigation measure for online sections will be considered within the Environmental Statement.

12.9.10 As is required by DMRB LA 111, the suitability of each potential mitigation measure for use shall be determined based on the following criteria:

- For residential noise receptors only, a comparison of the monetised noise benefit of a mitigation measure against the cost of the measure over the anticipated design life of the project
- The likely perceived benefit of the measure at any noise-sensitive receptors
- The benefit of a measure in terms of elimination of likely significant effects
- Practicality of the measure, for example, in terms of safety considerations and engineering constraints
- The impact of the measure across other environmental factors, for example the visual impact of a noise barrier

12.9.11 The noise barriers described in Table 12.8 have been considered to mitigate significant adverse effects. Only two barrier heights (i.e. 2m and 3m) have been considered for this PEIR as these were considered sufficient to determine if a noise barrier is likely to provide value for money. For the Environmental Statement, further barriers will be examined in some locations to determine if they provide an increased value-for-money ratio.

Table 12.8 Noise barrier options considered to mitigate significant adverse effects

Location and area	Approximate length of barrier	Estimated number of receptors to benefit[1]	Height and value for money ratio[2]	Included within the proposed scheme and justification
Junction 21 to 22, Dengie Farmhouse	85m	2m = 0 3m = 1	2m = 0.12 3m = 0.30	Barrier not included due to not providing value for money and not considered to meet other criteria.
Junction 21 to 22, Hodges Holt, near Maldon Road	100m	2m = 5 3m = 7	2m = 1.23 3m = 2.15	Barrier included at 3m due to being value for money.
Junction 21 to 22, Maldon Road	190m	2m = 4 3m = 8	2m = 0.82 3m = 1.05	Barrier included at 3m due to being value for money.
Junction 22 to 23, Braxted Road	230m	2m = 5 3m = 5	2m = 1.52 3m = 1.43	Barrier included at 2m due to being value for money.

Location and area	Approximate length of barrier	Estimated number of receptors to benefit[1]	Height and value for money ratio[2]	Included within the proposed scheme and justification
Junction 23 to 24, Highfields Lane	180m	2m = 0 3m = 1	2m = 0.07 3m = 0.14	Barrier not included due to not providing value for money and not considered to meet other criteria.

[1] Receptors with a reduction in noise of 1dB(A) or more with the inclusion of the noise barrier.

[2] The monetised benefit, or value-for-money, is calculated by comparing the cost of the noise barrier against the monetised benefit in terms of health as calculated by the appraisal method contained within the Government's Transport Appraisal Guidance (Department for Transport, 2021). If the ratio of cost to benefit is greater than 1 then the barrier is considered to be within the context of sustainable development.

12.9.12 The noise barriers identified in Table 12.8 as being value for money have been included within the noise assessment presented in Section 12.10.

Enhancement

12.9.13 In accordance with DMRB LA 111 and to meet the aims of the NPSE, opportunities for enhancement have been explored. Enhancement is not where a reduction in noise is required to mitigate a significant adverse effect, but where it would reduce the level of noise and provide betterment. Enhancement measures are assessed against the same criteria as measures being considered to provide mitigation.

12.9.14 Enhancement in the form of new surfacing (i.e. resurfacing existing sections of the A12) has not been considered at this stage of the assessment. This is because the surfacing assessment has yet to be completed. The possible enhancement that can be achieved from resurfacing will be considered within the Environmental Statement.

12.9.15 The noise barriers described in Table 12.9 have been considered to reduce increases in noise and to provide enhancement.

Table 12.9 Noise barriers considered to reduce noise and provide enhancement

Location and area	Approximate length of barrier	Estimated number of receptors to benefit[1]	Height and monetised benefit[2]	Included within the proposed scheme and justification
Junction 20a to 21, Hatfield Peverel, north side of A12.	1,270m	2m = 25 3m = 33	2m = 0.47 3m = 0.93	Barrier not included due to not proving value for money. A barrier of shorter length will be examined for the Environmental Statement.
Junction 20a to 21, Hatfield Peverel, south side of A12.	900m	2m = 203 3m = 210	2m = 4.21 3m = 4.66	Barrier included at 3m due to being value for money.

Location and area	Approximate length of barrier	Estimated number of receptors to benefit[1]	Height and monetised benefit[2]	Included within the proposed scheme and justification
Junction 21 to 22, Pantile Close, near Maldon Road.	110m	2m = 11 3m = 15	2m = 3.15 3m = 3.51	Barrier included at 3m due to being value for money.

[1] This is the receptors with a reduction in noise of 1dB(A) or more with the inclusion of the noise barrier.

[2] The monetised benefit is calculated by comparing the cost of the noise barrier against the monetised benefit in terms of health as calculated by the appraisal method contained within the Governments Transport Appraisal Guidance (Department for Transport, 2021). If the ratio of cost to benefit is greater than 1 then the barrier is considered to be within the context of sustainable development.

12.9.16 The noise barriers identified in Table 12.9 as being sustainable have been included within the noise assessment presented in Section 12.10.

12.10 Assessment of likely significant effects

Construction

12.10.1 In accordance with DMRB LA 111, construction noise and construction traffic noise shall constitute a significant effect where it is determined that a moderate or major magnitude of impact would occur for a duration exceeding either of the following:

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months

12.10.2 Where there is the potential for moderate or major impacts from noise and vibration during construction from the activities that have been identified in Section 12.8, the potential for significant effects is considered below. The determination of a likely significant effect takes into account the expected duration of the activity but at this stage does not consider any specific mitigation.

12.10.3 The expected duration of the activity also considers the time that an individual receptor or group of receptors is exposed to the certain noise level during the activity. For example, the construction of the offline sections of the route is an activity that would take months, but since this work is transient, receptors may only be exposed to high levels of noise for a short period of time. On the other hand, the construction of a structure or a junction could be deemed as static, and a receptor could be exposed to noise for the entire duration of the activity.

12.10.4 With the determination of a significant effect being based on the noise level at a receptor and the duration of the activity, at this stage there is uncertainty both in terms of noise level and programme. For the Environmental Statement, calculations of construction noise will be undertaken using the noise model, which will enable quantitative assessment to be undertaken and the specification of any mitigation measures that may be required. In addition, the programme of works will be more advanced which will allow for a better understanding of the duration of certain activities and hence the significance of effects.

Junction 19 (Boreham interchange) to junction 20a (Hatfield Peverel South interchange), including Boreham

12.10.5 The junction improvements and bridge widening works at junction 19 have the potential to generate moderate or major noise impacts. The works associated with the bridge widening works are static and nearby sensitive receptors could be exposed for durations exceeding those stated in DMRB LA 111. Therefore, this is considered to be a likely **significant adverse effect** for the two sensitive receptors directly to the east of junction 19. These are the flat at the Grange Public House and Little Generals.

Junction 20a (Hatfield Peverel South interchange) to junction 21 (Witham South interchange), including Hatfield Peverel

12.10.6 The works associated with the demolition of existing structures and then the construction of new structures has the potential to generate moderate or major adverse noise impacts. These works would be relatively static and so individual or groups of receptors could be exposed to high levels of noise for durations exceeding those stated in DMRB LA 111. Therefore, this is considered to be a likely **significant adverse effect** for receptors within Hatfield Peverel that are within 50m of a structure to be demolished. These would include residential receptors along Bury Lane and within Meadow Bank, on Station Road, and those on The Street close to junction 20b.

12.10.7 For the sheet piling required for embankment stabilisation, this activity is unlikely to exceed the durations stated in DMRB LA 111 at any one receptor or group of receptors. Therefore, this construction activity is not considered likely to be a significant effect. This would be the situation for both noise and vibration.

12.10.8 The utility diversion works that may be required through Hatfield Peverel would be transient and unlikely to be present at any one location for long enough to exceed the durations stated in DMRB LA 111. Therefore, this construction activity is not considered to be a likely significant effect.

12.10.9 The construction of the new junction 21 and associated slip roads would take place in one location for a long period, and therefore is a likely **significant adverse effect**. Receptors likely to be affected on the southern side of the A12 are those on the far eastern end of The Street, on Gleneagles Way, Wentworth Close, Birkdale Rise and Ferndown Way. To the north of the A12 the small group of receptors on The Vineyards may also be affected.

12.10.10 Although the works associated with the construction of the main compound to the north-east of Hatfield Peverel would be in one place, the compound is large so it is unlikely that the nearby sensitive receptors on The Vineyard would be exposed to noise for long enough to exceed the durations stated in DMRB LA 111. Therefore, this construction activity is not considered to be a likely significant effect. If the batching plant were to operate at night then it is unlikely to be required for a duration that would exceed the durations stated in DMRB LA 111 and would therefore not be a likely significant effect.

12.10.11 The works associated with the construction and use of borrow pit E that is directly to the east of the main compound to the north-east of Hatfield Peverel, are unlikely to be in one place for long enough for Woodend Farm to be exposed to noise exceeding the durations stated in DMRB LA 111. Therefore, the construction and use of the borrow pit is unlikely to cause a significant effect.

Junction 21 (Witham South interchange) to junction 22 (Colemans interchange), including Witham

12.10.12 Along the length of this part of the route the widening would be a transient activity and unlikely to be in any one place for a length of time exceeding the durations stated in DMRB LA 111. Therefore, the works associated with this construction activity are unlikely to cause a significant effect.

12.10.13 Earthworks required for embankment stabilisation in the area around Maldon Road and alongside Market Lane and Benton Close would generally not be in any one place for a length of time exceeding the durations stated in DMRB LA 111. Therefore, this construction activity is considered unlikely to be a significant effect. This would be the situation for both noise and vibration that may arise from piling operations. However, should this activity take place in a time period close to the works required at Maldon Road then these could be a likely **significant adverse effect**.

12.10.14 The works associated with the construction and use of borrow pit F that is to the south of the A12 at junction 21 are unlikely to be in one place for long enough for Dengie Farmhouse, Latneys and Latneys Boarding Kennels and Cattery to be exposed to noise exceeding the durations stated in DMRB LA 111. Therefore, the construction and use of the borrow pit is unlikely to cause a significant effect.

Junction 22 (Colemans interchange) to junction 23 (Kelvedon South interchange), including Rivenhall End

12.10.15 The construction of the new junction 22 and associated slip roads would take place in one location for a long period, and therefore is a likely **significant adverse effect**. Receptors likely to be affected are 1 and 2 Burghey Brook Cottages and Burghey Brook Farm.

12.10.16 Although the construction of the offline sections of the A12 would be transient, the works to construct a new section of road are extensive and nearby sensitive receptors could be exposed to noise for longer than the periods stated in DMRB LA 111. The four receptors in The Drive (The Manse, The Old Chapel, The Firs and The Ivy) on the south-east side of the existing A12 at Rivenhall End and

those along Braxted Road directly to the south of the proposed new alignment could experience **significant adverse effects**.

12.10.17 Constructing the earthworks and bridge over the A12 for the realigned Braxted Road would be an operation that would generate noise for longer periods than those stated within DMRB LA 111. Receptors nearby along Braxted Road, such as Fair Rest and Kennels Cottage, may experience **significant adverse effects**.

12.10.18 The construction of the second main compound near junction 22 is unlikely to generate noise levels at the two nearby sensitive receptors (Whitelands and Burghey Brook Farm) that would exceed the periods stated in DMRB LA 111. Therefore, it is unlikely there would be significant effects from the construction of this compound.

Junction 23 (Kelvedon South interchange) to junction 24 (Kelvedon North interchange), including Kelvedon

12.10.19 Along the length of this part of the route the widening would be a transient activity and unlikely to be in any one place for a length of time to exceed the durations stated in DMRB LA 111. Therefore, the works associated with this construction activity are unlikely to cause a significant effect.

12.10.20 The construction of the new junction 24 and associated slip roads would take place in one location for a long period, and therefore is a likely **significant adverse effect**. Receptors likely to be affected are The Laurels, Westacre, Stonefields Farm, Hillside, Rowan Lodge, Park Farm House, Columbyne Cottage, Belmont, Tugela and The Bungalow. All of these receptors are on Inworth Road.

Junction 24 (Kelvedon North interchange) to junction 25 (Marks Tey interchange), including Marks Tey

12.10.21 The construction of the new junction 25 and associated slip roads would take place in one location for a long period, and therefore is a likely **significant adverse effect**. Receptors likely to be affected are those to the west along Old London Road, those to the north-east along London Road, Hall Chase Farm House and 241 London Road. Although the sheet piling works that may be required to the east of junction 25 would be transient, the complexity of the work site may require them to be in locations for durations exceeding those stated in DMRB LA 111, and therefore there is a likely **significant adverse effect** from this activity for noise and vibration.

12.10.22 Although the construction of this offline section would be transient, the works to construct a new section of road are extensive and nearby sensitive receptors could be exposed to noise for longer than the periods stated in DMRB LA 111. The receptors likely to experience **significant adverse effects** are 1 and 2 Little Domsey Cottage, 1 and 2 The Lodge, Doggetts, Wishingwell Farm and Terlingfair Kennels and Cattery.

Diversion routes

12.10.23 The proposed diversion route of A130, A131 and the A120 passes many sensitive receptors that are close to the route. Some activities of the construction work (e.g. demolition and re-construction of structures) may

require closures for longer periods than those stated in DMRB LA 111, and therefore there is the potential for likely **significant adverse effects** due to an increase in traffic on these routes. Potentially affected receptors are isolated dwellings along the diversion route and on urban fringes, for example in north-east Chelmsford, Notley Green, Great Leighs, Braintree, Bradwell and Long Green.

Construction summary

12.10.24 Table 12.10 provides a summary of the likely significant adverse effects from the construction activities of the proposed scheme. Due to the construction methodology and programme still being developed, and ongoing site investigation, this list is likely to be revised for the Environmental Statement. In addition, the construction noise and vibration assessment to be undertaken for the Environmental Statement will be quantitative, which may cause changes to areas of likely significant adverse effects.

Table 12.10 Likely significant adverse effects from construction of the proposed scheme

Location	Construction activity	Receptors likely to be affected
Junction 19	Junction improvements and bridge widening at junction 19	Flat and the Grange Public House and Little Generals
Junction 20a to 21, Hatfield Peverel	Demolition of existing structures and construction of new structures	Residential receptors along Bury Lane and within Meadow Bank, on Station Road, and those on The Street close to junction 20b.
	Construction of the new junction 21	Residential receptors on the far eastern end of The Street, on Gleneagles Way, Wentworth Close, Birkdale Rise and Ferndown Way. Residential receptors within The Vineyards to the north of the A12.
Junction 21 to 22, Maldon Road area	Retaining walls (significant effect only likely if this activity is undertaken in a time period close to the bridge widening works)	Residential receptors on Maldon Road, Benton Close and Market Lane.
Junction 22 to 23	Construction of the new junction 22	1 and 2 Burghey Brook Cottages and Burghey Brook Farm.
	Construction of the offline section of the route	The Manse, The Old Chapel, The Firs and The Ivy. Receptors on Braxted Road directly to the south of the proposed new alignment.
	Realigned bridge for Braxted Road	Receptors on Braxted Road directly to the south of the proposed new alignment.

Location	Construction activity	Receptors likely to be affected
Junction 23 to 24	Construction of the new junction 24	The Laurels, Westacre, Stonefields Farm, Hillside, Rowan Lodge, Park Farm House, Columbyne Cottage, Belmont, Tugela and The Bungalow.
Junction 24 to 25	Construction of the new junction 25	Receptors to the west along Old London Road, to the north-east along London Road, Hall Chase Farm House and 241 London Road.
	Construction of the offline section of the route	1 and 2 Little Domsey Cottage, 1 and 2 The Lodge, Doggetts, Wishingwell Farm and Terlingfair Kennels and Cattery.
A130, A131, A120	Diversion route	Isolated dwellings along the diversion route and also on the edge of cities, towns or villages, such as north-east Chelmsford, Notley Green, Great Leighs, Braintree, Bradwell and Long Green.

Operation

12.10.25 The required output tables showing operational noise impacts from DMRB LA 111 are provided as Table 12.11 and Table 12.12. These are an update of Table 12.5 and Table 12.6 to show the results with the inclusion of the noise barriers that have either been found to be value for money for mitigation or enhancement, as shown in Table 12.8 and Table 12.9.

Table 12.11 Operational noise impacts – short term including mitigation and enhancement

		Daytime		Night-time	
Change in noise level		Number of dwellings	Number of other noise-sensitive receptors	Number of dwellings	Number of other noise-sensitive receptors
Increase in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	2,476	16	4,629	33
	1.0 – 2.9	5,285	40	214	6
	3 – 4.9	21	2	7	2
	>5	16	3	3	1
No change		61	0	1,155	7
Decrease in noise level dB $L_{A10,18h}$ / L_{night}	<1.0	1,206	16	2,912	27
	1.0 – 2.9	517	16	606	17
	3 – 4.9	182	3	170	1
	>5	142	4	210	6

12.10.26 Table 12.11 shows a reduction from 40 to 37 (compared to Table 12.5) in the number of dwellings with an increase in noise of more than 3dB(A). This is due to the presence of the noise barriers in some locations.

Table 12.12 Operational noise impacts – long term including mitigation and enhancement

		Daytime		Night-time	
Change in noise level		Number of dwellings	Number of other noise-sensitive receptors	Number of dwellings	Number of other noise-sensitive receptors
Increase in noise level dB $L_{A10,18h}$ / L_{night}	<3.0	8,386	66	8,466	68
	3.0 – 4.9	65	3	28	2
	5 – 9.9	15	3	3	2
	>10	2	0	2	0
No change		134	2	136	2
Decrease in noise level dB $L_{A10,18h}$ / L_{night}	<3.0	1,066	20	961	20
	3.5 – 4.9	113	2	153	2
	5 – 9.9	90	3	199	3
	>10	35	1	58	1

12.10.27 Table 12.12 shows a reduction from 20 to 17 (compared to Table 12.6) in the number of dwellings with an increase in noise of 5dB(A) or more. This is due to the presence of the noise barriers in some locations.

12.10.28 In the following paragraphs the impacts described in Section 12.8 that are likely to cause significant beneficial and adverse effects along the route are discussed. The absolute noise level and the predicted change in noise are initially used to determine whether a significant effect is likely to occur. This provides only a likely indication of a significant effect, as a smaller change in noise when above the SOAEL may cause a significant effect when it may not if the change occurred between the LOAEL and SOAEL. In addition, other factors are also considered in determining whether a significant effect may occur, such as the change in noise in the long term and the acoustic context of any change. The following paragraphs also describe the effect of noise barriers and bunds, either for mitigation or enhancement.

12.10.29 Three figures have been produced to aid the explanation of noise impacts. Figure 12.3 provides noise contours for the situation without the proposed scheme; Figure 12.4 shows the noise contours with the proposed scheme. Figure 12.5 then shows the noise change as a result of the proposed scheme. All three figures show the situation in the daytime in the short term.

Junction 19 (Boreham interchange) to junction 20a (Hatfield Peverel South interchange), including Boreham

12.10.30 Along this part of the proposed scheme, no significant effects are predicted.

Junction 20a (Hatfield Peverel South interchange) to junction 21 (Witham South interchange), including Hatfield Peverel

12.10.31 Throughout Hatfield Peverel, negligible or minor impacts between a change of -1 and +2dB(A) are predicted. This is not considered to be a significant adverse effect. However, due to the presence of many dwellings close to the A12 and the noise level at some being above the SOAEL, this area has been considered for enhancement with the inclusion of noise barriers. On the northern side, a noise barrier was not found to be value for money. However, smaller sections of barrier on this northern side will be further examined for the Environmental Statement. On the southern side, a 3m high noise barrier was found to provide value for money and has been included within the scheme design. The 3m high noise barrier on the southern side would remove any increases in noise and generate decreases in noise of over 5dB(A) at some receptors. This would create a **significant beneficial effect** for around 40 dwellings.

12.10.32 Increases in noise of between 2 and 4dB(A) are predicted for approximately 15 receptors between the junction with Maldon Road and the eastern end of the town. This is considered to be a **significant adverse effect** due to this level of increase in noise, especially with some of these increases being on a façade of the receptor that is already exposed to a high noise level. Due to the location of these receptors (i.e. along a residential street) mitigation in the form of a noise barrier would be ineffective due to the requirement for breaks in the barrier for access. At the low traffic speeds on this road, around 30mph, a low-noise surface is ineffective at reducing the noise since a higher proportion of noise is from the vehicle engine and other components than from the interaction of the vehicle tyres with the road surface.

Junction 21 (Witham South interchange) to junction 22 (Colemans interchange), including Witham

12.10.33 The absolute noise level at the single residential receptor of Dengie Farmhouse is above the SOAEL, and above this level even a small change in noise may be considered to cause a significant adverse effect. Given a predicted absolute noise level of 74dB(A), which is 6dB(A) above the SOAEL, and an increase in noise of 1.8dB(A), this is considered to be a significant adverse effect. Mitigation for this has been considered in form of a noise barrier, but as reported in Table 12.9 this has been found not to be value for money and so has not been included within the proposed scheme. In addition, the inclusion of a barrier would remove a large amount a vegetation, and the benefit from the barrier may be perceived as less than that from the vegetation. This section of the road already has a low-noise surface and there is therefore no additional noise reduction to be gained from resurfacing. The increase in noise at this dwelling would therefore remain as a **significant adverse effect**.

12.10.34 The area to the west of where Maldon Road passes under the A12 is considered to be a possible significant adverse effect due to the high existing noise level (up to 75dB(A)) and the predicted increase in noise (up to 2dB(A)). Mitigation in the form of noise barriers has been examined in two locations: one to the north for receptors on Hodges Holt and Ashby Road; the other to the south of the A12 for receptors on the western side of Maldon Road. Both of these barriers at 3m have been found to provide value for money and would remove the possible significant adverse effect. To the south-east, for sensitive receptors on Pantile Close, a 3m noise barrier has been included for enhancement. All three of these barriers remove any increase in noise and create a decrease in noise of over 5dB(A) at some dwellings, which would be a **significant beneficial effect**. The Church of Jesus Christ of Latter Day Saints would experience a reduction in noise of around 2dB(A). However, given the reduced noise level, some dwellings would still experience noise levels above the SOAEL. Options for increasing the height of the barriers and/or extending the length will be considered for the Environmental Statement.

12.10.35 The large increase in traffic along Little Braxted Lane has caused a **significant adverse effect** at sensitive receptors within Little Braxted and also to the north along Braxted Lane. Within Little Braxted these receptors are St Nicholas Church, Little Braxted Hall, Little Braxted Mill and Mill House. Those to the north along Braxted Lane are Colemans Cottages, Colemans Farm and the clubhouse for Colemans Cottage Fishery. Providing noise mitigation in the form of noise barriers for these receptors would be impractical due to them either being within 1m of the road or back far enough from the road where a noise barrier would be ineffective. In addition, for single receptors a noise barrier is unlikely to be sustainable. At the low traffic speeds on this road, around 30mph, a low-noise surface is ineffective at reducing the noise since a higher proportion of noise is from the vehicle engine and other components than from the interaction of the vehicle tyres with the road surface.

Junction 22 (Colemans interchange) to junction 23 (Kelvedon South interchange), including Rivenhall End

12.10.36 The four dwellings to the east of the new junction 22 (Burghey Brook Farm, Whitelands, 1 and 2 Burghey Brook Cottages) would experience a **significant beneficial effect** due to reductions in noise of over 3dB(A).

12.10.37 In Rivenhall End, there are approximately 40 sensitive receptors to the north of the existing A12 that would experience a reduction in noise of more than 3dB(A) which would be a **significant beneficial effect**. The affected receptors would generally be those on Oak Road and Foxmead.

12.10.38 The four dwellings along The Drive to the south of the A12 would experience a reduction in noise on the front and side but an increase in noise on the rear. Although the increase in noise at the rear is of a lower magnitude than the decrease on the front, it is still at a level that would be noticeable (i.e. >3dB(A)). Given that the rear of these dwellings is where the gardens are located and the occupiers are likely to spend most time in rooms to the rear of the dwelling, this increase in noise is considered to be a **significant adverse effect** as it is likely to alter the quality of life of the occupiers. An earth bund 2.5m high has been examined to reduce the noise at the rear of these dwellings. However, even with the earth bund the significant effect remains. Options for providing more mitigation will be considered in the Environmental Statement.

12.10.39 A significant adverse effect is likely for the dwellings on Braxted Road to the south of the realigned A12. Mitigation in the form of noise barriers has been considered for these dwellings, and a 2m high barrier has been found to provide the best value for money. Although this barrier reduces the noise at some receptors, it is not sufficient to remove the **significant adverse effect**. Further mitigation options will be examined for the Environmental Statement.

12.10.40 To the east of Rivenhall End there is a group of four dwellings around Hole Farm which would experience a decrease in noise of between 2 and 4dB(A) due to the carriageway of the A12 moving further away. This decrease in noise would be a **significant beneficial effect** and would change two of the dwellings from being above SOAEL to below.

Junction 23 (Kelvedon South interchange) to junction 24 (Kelvedon North interchange), including Kelvedon

12.10.41 To the north of the A12 there is considered to be a **significant adverse effect** at Ewell House on Ewell Hall Chase. This is due to the increase in noise at a receptor that is around 5dB(A) above the SOAEL. At a distance of over 100m from the A12 a noise barrier would not be effective, and is very unlikely to pass the value for money test. The most effective noise reduction measure for this location would be to reduce the noise level at source through a change from concrete to a low-noise surface. Options for re-surfacing will be considered for the Environmental Statement.

12.10.42 To the south of the Kelvedon bypass, along Highfields Lane, there would be a **significant adverse effect** at the three dwellings of Koorbaes Cottages. This is due to the increase in noise at dwellings that are around 6dB(A) above the SOAEL. At a distance of about 70m from the A12 a noise barrier has been shown not to provide value for money, as the noise reduction provided by a barrier at this distance from the A12 is small. The most effective noise reduction measure for this location would be to reduce the noise level at source through a change from concrete to a low-noise surface. Options for re-surfacing will be considered for the Environmental Statement.

12.10.43 The small group of sensitive receptors where the proposed new junction 24 joins Inworth Road are considered to experience a **significant adverse effect**. Although the absolute noise level is only just above the SOAEL for some of the dwellings, and the increase in noise would be between 1 and 3dB(A), other factors need to be considered. Due to the junction, the character of the noise is likely to change from that of a continuous noise source to multiple noise sources with characteristics from accelerating and decelerating vehicles. There would also be increases in noise on facades of the dwellings that are currently subject to noise levels close to the LOAEL. Mitigation options will be considered for the Environmental Statement, and options will include the re-surfacing of the A12 and/or noise barriers and bunds.

12.10.44 For dwellings directly alongside Inworth Road to the south there would be a **significant adverse effect** due to the increase in noise and these dwellings already experiencing high levels of noise due to their proximity to Inworth Road. Mitigation options for this effect will be difficult as noise barriers or the use of low-noise surfacing would likely be ineffective. However, these will be considered for the Environmental Statement.

12.10.45 For the eastern side of Gore Pit, especially for sensitive receptors along London Road, there would be a **significant beneficial effect**. The closest sensitive receptors on the eastern side of Gore Pit along London Road would experience a reduction in noise of more than 5dB(A), which would be a major beneficial impact. Further into Gore Pit the reduction in noise at most sensitive receptors would be between 1 and 5dB(A) which would be a minor or moderate beneficial impact.

Junction 24 (Kelvedon North interchange) to junction 25 (Marks Tey interchange), including Marks Tey

12.10.46 The majority of Feering is considered to experience a **significant beneficial effect**, caused by the realignment of the A12. In addition, all the individual or small groups of sensitive receptors between the existing junction 24 and Easthorpe Lane are predicted to experience a **significant beneficial effect**. These include St Christopher Bungalow, St Patricks, Trewlands, Prested Hall Cottages, Heathfield, Prested Hall Farm Cottages, Freebourne House, The Tree House, Sherwood Cottage and Maple House.

12.10.47 At 1 and 2 Little Domsey Cottages there is considered to be a possible significant adverse effect. Despite a 10dB(A) reduction in noise on the front of these two dwellings, there is an increase of over 5dB(A) on the rear facades. The rear of these dwellings is where the gardens are located, and the occupiers are likely to spend most time in rooms at the rear of the dwelling. This increase in noise is therefore considered to be a **significant adverse effect** as it is likely to alter the quality of life of the occupiers. Options for mitigation in the form of noise bunds will be considered for the Environmental Statement.

12.10.48 The four dwellings on Easthorpe Green (1 and 2 The Lodge, Easthorpe Green Farm, Church View House), Wishingwell Farm and Terlingfair Kennels and Cattery, and the two dwellings on Doggetts Lane (Hammer Farm and Doggetts) would all experience a **significant adverse effect** due to the increase in noise caused by the realignment of the A12. Noise bunds have been considered at these locations, but these have not eliminated the significant effect. Options for further mitigation in the form of higher or longer noise bunds, or noise barriers, will be considered for the Environmental Statement.

12.10.49 A **significant beneficial effect** would be experienced by the group of six dwellings (no. 280 to 286 London Road) approximately 1km to the west of junction 25. Those sensitive receptors to the north of the A12 as the route approaches junction 25, will experience a similar effect. This includes some dwellings within The Crescent.

12.10.50 Hall Chase Farm House on Hall Chase would experience a **significant adverse effect** due to the realignment of the A12 around junction 25. A noise bund has been considered here but this has not removed the significant effect. Options for further mitigation in the form of higher or longer noise bunds, or noise barriers, will be considered for the Environmental Statement.

12.10.51 Table 12.13 provides a summary of the likely significant beneficial and adverse effects from the operation of the proposed scheme. This will be revised for the Environmental Statement following further assessment.

Table 12.13 Likely significant effects from the operation of the proposed scheme

Location and receptors	Likely significant effect
J20a - J21. South Hatfield Peverel. Approximately 40 dwellings and some other non-residential receptors	Beneficial
J20a – J21. Eastern Hatfield Peverel on The Street. Approximately 15 dwellings	Adverse
J21 – J22. Dengie Farmhouse. One dwelling	Adverse
J21 – J22. Dwellings around Maldon Road to the south of Witham. Approximately 12 dwellings	Beneficial
J21 – J22. Dwellings along Little Braxted Lane. Five dwellings and two other sensitive receptors	Adverse
J22 – J23. Four dwellings to the immediate east of the new junction 22.	Beneficial
J22 – J23. Approximately 40 dwellings within Rivenhall End	Beneficial
J22 – J23. Four dwellings on The Drive, Rivenhall End	Adverse
J22 – J23. About five dwellings located around the new alignment of Braxted Road	Adverse
J22 – J23. A group of four dwellings around Hole Farm, to the east of Rivenhall End	Beneficial
J23 – J24. Ewell House to the north of the A12 on the Kelvedon bypass. One dwelling	Adverse
J23 – J24. Three dwellings of Koorbaes Cottages to the south of the Kelvedon bypass	Adverse
J23 – J24. Dwellings on Inworth Road around the new junction 24, and along Inworth Road towards Inworth. Approximately 20 dwellings	Adverse
J23 – J24. Approximately 40 dwellings on the eastern side of Gore Pit	Beneficial
J24 – J25. A large area of Feering and isolated dwellings or small groups of dwellings close to the existing A12. Approximately 40 dwellings	Beneficial
J24 – J25. 1 and 2 Little Domsey Cottages	Adverse
J24 – J25. Four dwellings on Easthorpe Green, Wishingwell Farm and Terlingfair Kennels and Cattery, and the two dwellings on Doggetts Lane	Adverse
J24 – J25. Dwellings to the west of the new junction 25 at Marks Tey. Approximately 45 dwellings	Beneficial
J24 – J25. Hall Chase Farm House	Adverse

12.10.52 The expected change in noise at each NIA is presented in Table 12.14. As required by DMRB LA 111, this table also lists what noise mitigation the proposed scheme would deliver for each NIA. The change in noise provided in Table 12.14 in the third column is in relation to the change in noise on the façade of the dwelling(s) that would have been used to define the location as an NIA. The environmental effects at some NIA are different from what the change in noise presented in Table 12.14 may suggest. For example, where Table 12.14 states a decrease in noise, the receptor could experience a significant adverse effect due to an increase on another facade. This is due to a different façade of the dwelling being used to determine the environmental effect from that used to classify the location as an NIA. These situations are described in the paragraphs following the table.

Table 12.14 Noise mitigation at each Noise Important Area within the study area

NIA number	Road	Change in noise[1]	Noise mitigation and justification
6141	A12	No change	No mitigation considered, due to extensive vegetation that would be lost to accommodate a noise barrier. Removing the vegetation and installing a barrier may be perceived as no benefit and would introduce visual impacts.
5411	A12	No change	No mitigation considered, due to extensive vegetation that would be lost to accommodate a noise barrier. Removing the vegetation and installing a barrier may be perceived as no benefit and would introduce visual impacts.
5412	A12	No change	No mitigation considered, due to extensive vegetation that would be lost to accommodate a noise barrier. Removing the vegetation and installing a barrier may be perceived as no benefit and would introduce visual impacts.
6191	A12	No change	No mitigation considered, due to extensive vegetation that would be lost to accommodate a noise barrier. Removing the vegetation and installing a barrier may be perceived as no benefit and would introduce visual impacts.
5413	A12	Decrease / minor increase	Noise barriers proposed for the southern side of Hatfield Peverel and will be examined further for the Environmental Statement, for the northern side.
6192[2]	A12	N/A	N/A
5414	A12	Increase	Mitigation considered. Noise barrier found to be not sustainable.
5415	A12	Decrease	Noise barriers proposed in three locations to remove significant adverse effect.

NIA number	Road	Change in noise[1]	Noise mitigation and justification
6144	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
5419	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwelling.
6145	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
14874	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
5416	A12	Decrease	Mitigation not considered due to low number of dwellings meaning noise barriers are unlikely to prove value for money. Slight alignment change and resurfacing on the offline section would cause a decrease in noise.
6142	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
6143	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
5417	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
4759	A12	Decrease	Mitigation considered. Road alignment change to remove high noise level on front façade of dwellings.
4760	A12	Decrease, Increase and no change	Mitigation considered where possible. Road alignment change to remove high noise level on front façade of some dwellings. Noise bunds considered. Mitigation in other areas of the NIA not considered due to no change in noise and/or engineering constraints or a noise barrier not being practical in this location.
6173	A130	No change	Mitigation not considered as engineering constraints would prevent noise mitigation from being effective.

NIA number	Road	Change in noise[1]	Noise mitigation and justification
4758	A120	No change	Mitigation not considered as engineering constraints would prevent noise mitigation from being effective.
4761	A12	No change	Mitigation not considered due to low number of dwellings meaning noise barriers are unlikely to be sustainable.

[1] This change is presented in terms of 'no change', increase' or 'decrease' to avoid confusion with environmental effects.

[2] The group of approximately six dwellings that would have caused this location to be classed as an NIA have been demolished. These dwellings are not considered within the noise assessment, but the NIA is listed in this table since it is still included within Highways England datasets as an NIA.

12.10.53 NIA 6145 is within Rivenhall End and contains approximately 30 dwellings to the north and four to the south. All of these dwellings would experience a reduction in noise on the façade of the dwelling that would have caused them to be classed as an NIA (i.e. the façade facing the A12). However, the four dwellings to the south would now experience an increase in noise on the rear façade that would cause an adverse significant effect.

12.10.54 The NIA 5417 is approximately 1.5km to the east of junction 24 and contains two dwellings, both of which are to the south of the A12. Both these dwellings would experience a reduction in noise on the façade of the dwelling that would have caused them to be classed as an NIA (i.e. the façade facing the A12). However, they would now experience an increase in noise on the rear façade that would cause an adverse significant effect.

12.10.55 NIA 4760 covers a large part of Marks Tey and is mainly centred around junction 25. Some dwellings within this NIA would experience a decrease in noise on the façade of the dwelling that would have caused them to be classed as an NIA (i.e. the façade facing the A12). However, there are others that would experience an increase in noise.

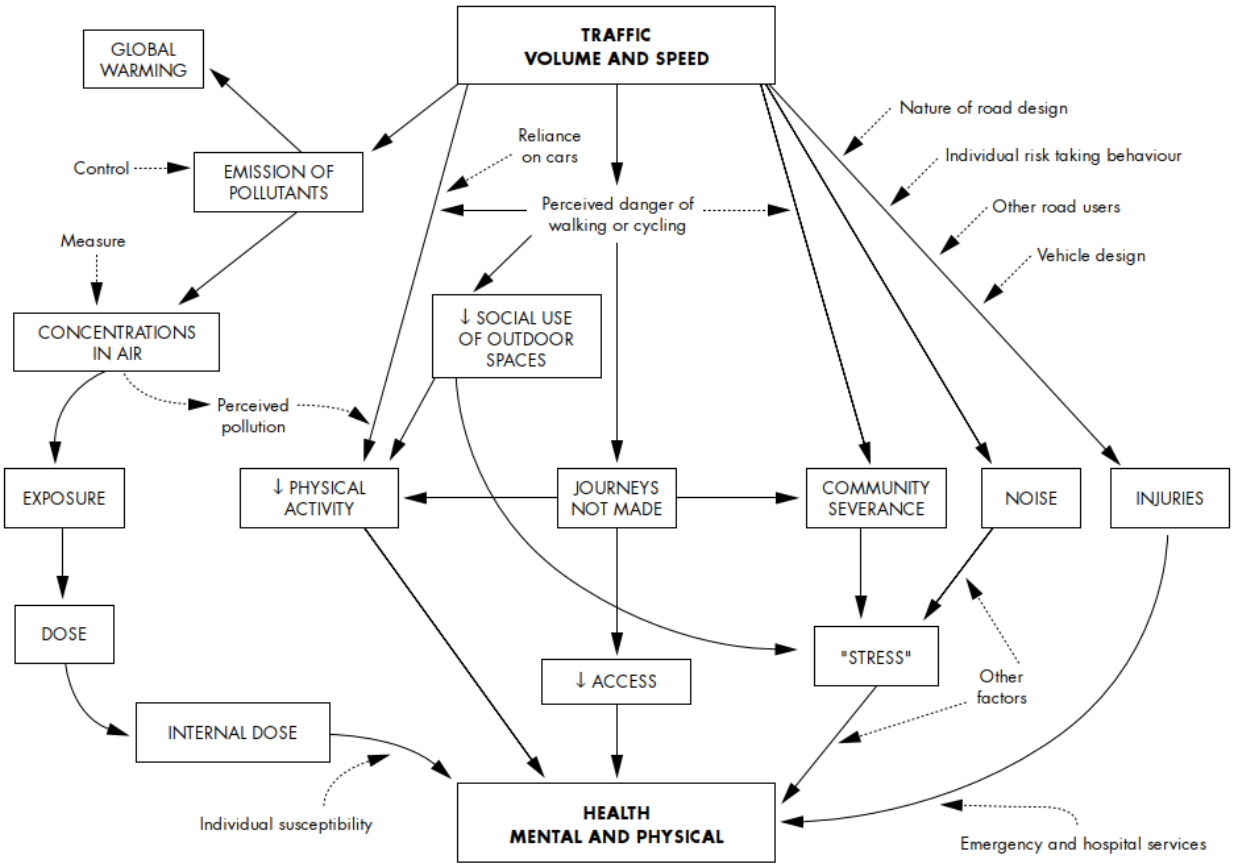
13 Population and health

13.1 Topic introduction

13.1.1 This chapter provides a preliminary assessment of the interrelated aspects of population and human health. The World Health Organization (WHO) constitution defines health as '*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*' (WHO, 1948).

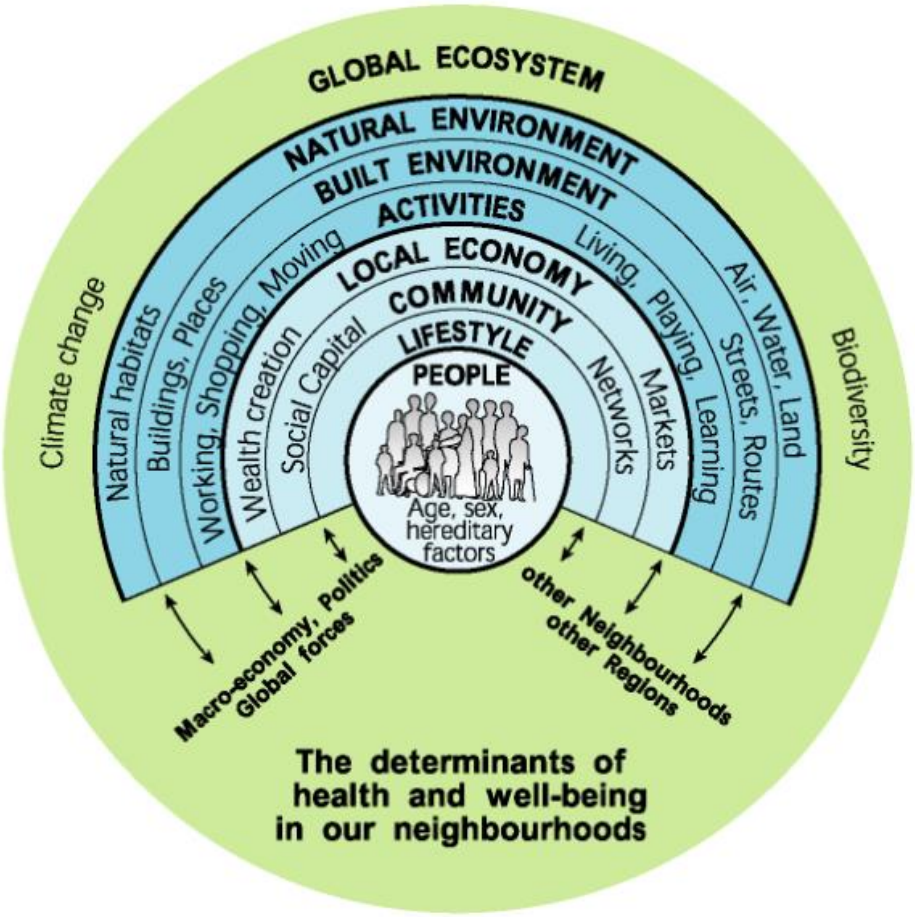
13.1.2 Highway projects can affect human health in a variety of direct and indirect ways. Plate 13.1 provides an illustration of some of the pathways through which a highway scheme, and its associated traffic, can affect physical and mental health.

Plate 13.1 Pathways from transport policy to health outcomes (Source: Joffe and Mindell, 2002)



13.1.3 Health is determined by a complex interaction between individual characteristics, lifestyle and the physical, social and economic environment. Most public health experts agree that these 'wider determinants of health' have a greater influence than formal healthcare for ensuring a healthy population. Plate 13.2 provides a conceptual illustration of wider determinants of health in our natural and built environment.

Plate 13.2 Determinants of health and wellbeing in our neighbourhoods (Source: Barton and Grant, 2006)



13.1.4 A related issue, of key importance to public health, is the issue of health inequalities. The Marmot Review into health inequalities (Marmot, 2010) looked at differences in health and wellbeing between social groups and described how the social gradient on health inequalities is reflected in the social gradient on educational attainment, employment, income, quality of neighbourhood and other issues. Understanding the wider determinants of health is seen as an important means of tackling health inequalities and improving population health as a whole.

13.1.5 This assessment therefore takes account of the findings from other aspects within this Preliminary Environmental Information Report (PEIR) to understand how the proposed scheme is likely to affect environmental determinants of health. It also addresses effects on wider determinants relating to the themes of access; traffic and transport; socio-economic conditions; and land use (see Section 13.4 for further detail on the scope of matters covered within this assessment).

13.1.6 This chapter is supported by the following figures:

- Figure 13.1 Population and Health Context
- Figure 13.2 Human Health Baseline and Impacts
- Figure 13.3 Communities, Land Use and Accessibility Impacts

13.1.7 Reference is also made to relevant figures from the air quality and noise and vibration chapters.

13.2 Stakeholder engagement

13.2.1 Table 13.1 sets out key themes and issues from the Planning Inspectorate's Scoping Opinion which was received in December 2020 (and updated with an errata in 2021).

Table 13.1 Key stakeholder feedback for population and human health aspect

Stakeholder	Comment	Response
Planning Inspectorate	Human health effects associated with large-scale earthworks can be scoped out of assessment in population and health.	This matter has been scoped out of the assessment.
Planning Inspectorate	The assessment should include figures showing where temporary or permanent loss of land would occur, where demolition of residential properties would be required, and where temporary or permanent diversions to public rights of way (PRoW) and other routes would be required during construction and operation of the proposed scheme. Locations of sensitive community assets and equestrian routes should be shown on a figure.	These figures will be provided in the forthcoming Environmental Statement. The figures provided with the PEIR also identify some key impacts of the proposed scheme associated with land take, and to routes used by walkers, cyclists and horse riders (WCH).
Planning Inspectorate and Public Health England	The assessment should consider increasing the length and changing the amenity of PRoW. Alternative access for agricultural vehicles should be provided where necessary, and any permanent severance should be justified. Temporary traffic management proposals should make provision for WCH.	The preliminary assessment for this PEIR takes account of these issues and further detail will be reported in the Environmental Statement.
Essex County Council and Public Health England	The assessment of health impacts should consider health inequalities and should assess effects on both physical and mental health.	The assessment considers impacts on both physical and mental health and notes the issue of health inequalities. The assessment will be further developed and reported in the Environmental Statement to take account of further information being sought on vulnerable groups in the local area.
Essex County Council and Public Health England	The proposed scheme should make a positive contribution to active travel, physical activity levels and access to greenspace.	The current design includes provision for WCH. The design is ongoing and further benefits are being explored.

Stakeholder	Comment	Response
Essex County Council	Reference was made to specific community assets that should be described in the baseline, including Beaulieu Central, Maltings School, Rivenhall C of E Primary School, Hatfield Peverel Infant School, St Andrews Junior School, Little Bears Nursery and Hatfield Peverel Nursery.	The identified assets are described within the baseline of this chapter and shown on Figure 13.1.
Essex County Council	Impacts on bus services and on 'blue light' services should be considered.	Potential impacts on bus stops, in terms of accessibility for walkers and cyclists, are considered in this chapter. Impacts on bus services are a commercial matter for consideration by the operator. Potential impacts on emergency services are assessed.
Essex County Council	Impacts on socioeconomics should be considered. Specifically, opportunities for local employment and training opportunities.	The assessment considers impacts on socio-economics as one of the wider determinants of human health. The applicant is considering opportunities to provide social value such as local employment and training. If secured, these will be assessed and reported in the Environmental Statement.
Public Health England	• Support for design development that minimises public exposure to air quality pollutants, addresses inequalities of exposure and maximises opportunities for physical activity • Identification of wider determinants of health that the assessment should address, and of vulnerable groups that should be considered • Suggested guidance to follow for assessment of health impacts associated with noise, which involves quantification approaches.	A follow up meeting was held with Public Health England to discuss the scoping response and the approach to the assessment. Further clarification of the scope of wider determinants and the methodology for assessing impacts on mental health has been provided and will be reported as an appendix to the Environmental Statement.

13.2.2 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

13.2.3 Specific stakeholder engagement has been undertaken with Public Health England on 29 January 2021 to further discuss and clarify the approach to health assessment in the EIA. One of the recommendations made by Public Health England in its scoping response was to consider the use of a methodology that allows quantification of health outcomes associated with exposure to noise. At this preliminary assessment stage, the assessment of health effects has adopted a qualitative approach in accordance with Highways England's standard for the assessment of population and human health (Design Manual for Roads and Bridges (DMRB) LA 112) and as set out in the Environmental Scoping Report.

13.2.4 Further pre-application engagement with stakeholders will be undertaken to inform the ongoing assessment and the understanding of the local population health circumstances. Any revised approaches to the assessment of likely significant effects on population health outcomes which are adopted as a result of this ongoing pre-application engagement will be reported in the Environmental Statement.

13.3 Legislative and policy framework

13.3.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) 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.

13.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 3.22 of the NNNPS states that severance can be a problem in some locations. Where appropriate, applicants should seek to deliver improvements that reduce community severance and improve accessibility.
- Paragraph 5.205 states that applicants should consider reasonable opportunities to support other transport modes in developing infrastructure, and that the applicant should provide evidence that they have used reasonable endeavours to address any existing severance issues that act as a barrier to non-motorised users.
- Paragraph 4.82 states that the applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, and the Secretary of State (in determining an application for development consent) should consider the cumulative impact on health.
- Paragraph 5.166 states that existing open space, sports and recreational buildings and land should not be developed unless the land is surplus to requirements or the loss would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location. Applicants considering proposals which would involve developing such land should have regard to any local authority's assessment of need for such types of land and buildings.

- Paragraph 5.184 states that public rights of way, National Trails and other rights of access to land (e.g. open access land) are important recreational facilities for WCH. Applicants are expected to take appropriate mitigation measures to address adverse effects on coastal access, National Trails, other public rights of way and open access land and, where appropriate, to consider what opportunities there may be to improve access. In considering revisions to an existing right of way, consideration needs to be given to the use, character, attractiveness and convenience of the right of way.
- Paragraph 5.206 states that for road and rail developments, if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the applicant's environmental statement should describe those impacts and mitigating commitments.

13.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

13.4 Assessment methodology

Scope of assessment

13.4.1 In accordance with DMRB LA 112 Population and human health (Highways England, 2020o), the assessment of population and health is split into two interrelated parts: 1) land use and accessibility, and 2) human health.

13.4.2 Table 13.2 sets out the scope of the assessment as identified in the Environmental Scoping Report (Highways England, 2020d) and subsequently expanded in response to scoping comments received to clarify the human health matters included within the scope.

Table 13.2 Scope of assessment

Matter	Scoped in - construction	Scoped in - operation
Land use and accessibility		
Residential property and housing	✓	✓
Community land and assets	✓	✓
Development land and business	✓	✓
Agricultural land holdings	✓	✓
Walkers, cyclists and horse riders	✓	✓
Human health		
Noise, air and other environmental pollutants	✓	✓

Matter	Scoped in - construction	Scoped in - operation
Road traffic collisions	✓	✓
Active travel	✓	✓
Community severance and social networks	✓	✓
Access to services, facilities and employment	✓	✓
Physical and visual access to greenspace and outdoor recreation	✓	✓
Health inequalities[1]	✓	✓

[1] Note that health inequalities have not been assessed in this PEIR as further evidence and local information is required to inform the assessment. All other assessment is preliminary at this stage.

Land use and accessibility

13.4.3 The approach to the assessment is based on guidance set out in DMRB LA 112. Effects are assessed for the construction phase and the first year of operation.

13.4.4 The assessment sets out predicted quantities of land use and accessibility resources that would be affected to provide an indication of the magnitude of impact. The magnitude of impact and the sensitivity of the resources are then taken into account to assess the significance of effects (as per the approach outlined in Section 5.6 of Chapter 5: Environmental assessment methodology).

13.4.5 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for the assessment of effects on land use and accessibility. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

13.4.6 It should be noted that significance is assessed in relation to each sub-matter under land use and accessibility, rather than for each impact on each specific resource. For example, while a major magnitude of impact may be assessed on an individual residential property, which would be significant for the individual home-owners concerned, this would not necessarily translate as an overall significant effect on the sub-matter for residential property and housing as consideration would be given to whether the effect would be significant in terms of overall availability of residential land use for the community.

13.4.7 Professional judgement has been applied in the interpretation of the guidance in DMRB LA 112, particularly for the sensitivity criteria provided in the Environmental Scoping Report. The judgement of likely significant effects on land use and accessibility has regard for the sensitivity and magnitude criteria adapted from DMRB LA 112 combined with professional judgement as to whether:

- several receptors are affected to the extent that effects are noticeable at a community level (rather than individual level)
- the function of a land use and accessibility resource, such as factors required to support a population (for example services, employment, recreation, local economy, community cohesion), are likely to be lost, severely degraded or greatly enhanced

13.4.8 Further information regarding current ownership and use of agricultural land within the provisional Order Limits is required to assess the sensitivity of the identified agricultural land holdings, and to understand the impacts of the proposed scheme on the continued viability of the existing land uses. The additional information required will be sought through consultation with the identified landowners over the coming months, and this information will inform the assessment of the impacts on agricultural land holdings which will be presented within the Environmental Statement.

Human health

13.4.9 The approach to the assessment on human health applies DMRB LA 112 and is supported by further guidance, including a primer by the Institute of Environmental Management and Assessment (Cave *et al*., 2017) and recent guidance by the International Association of Impact Assessment and European Public Health Association (2020). As the assessment is developed further it will also take on board guidance by the National Mental Wellbeing Impact Assessment Collaborative (2011) for opportunities to support mental wellbeing.

13.4.10 The assessment relates to population health, which is concerned with the health outcomes of groups of people. Matters considered within the assessment of effects on human health are set out in Table 13.2. Table 13.3 lists the wider determinants of health as identified by Public Health England in its response to the Environmental Scoping Report, which have been scoped into the assessment for the proposed scheme. The table identifies how these are integrated within the assessment of the matters listed in Table 13.2.

Table 13.3 Wider determinants of health

Determinant	Method of assessment
Access	
Access to local public and key services and facilities	Informed by the land use and accessibility (residential housing, community land and assets, and WCH) assessment with a qualitative commentary on population health outcomes provided under the heading ‘Access to services, facilities and employment’.
Access to the natural environment	Informed by the land use and accessibility assessment (community land and assets, and WCH) with qualitative commentary on associated health outcomes provided under the heading ‘Physical and visual access to greenspace and outdoor recreation’.

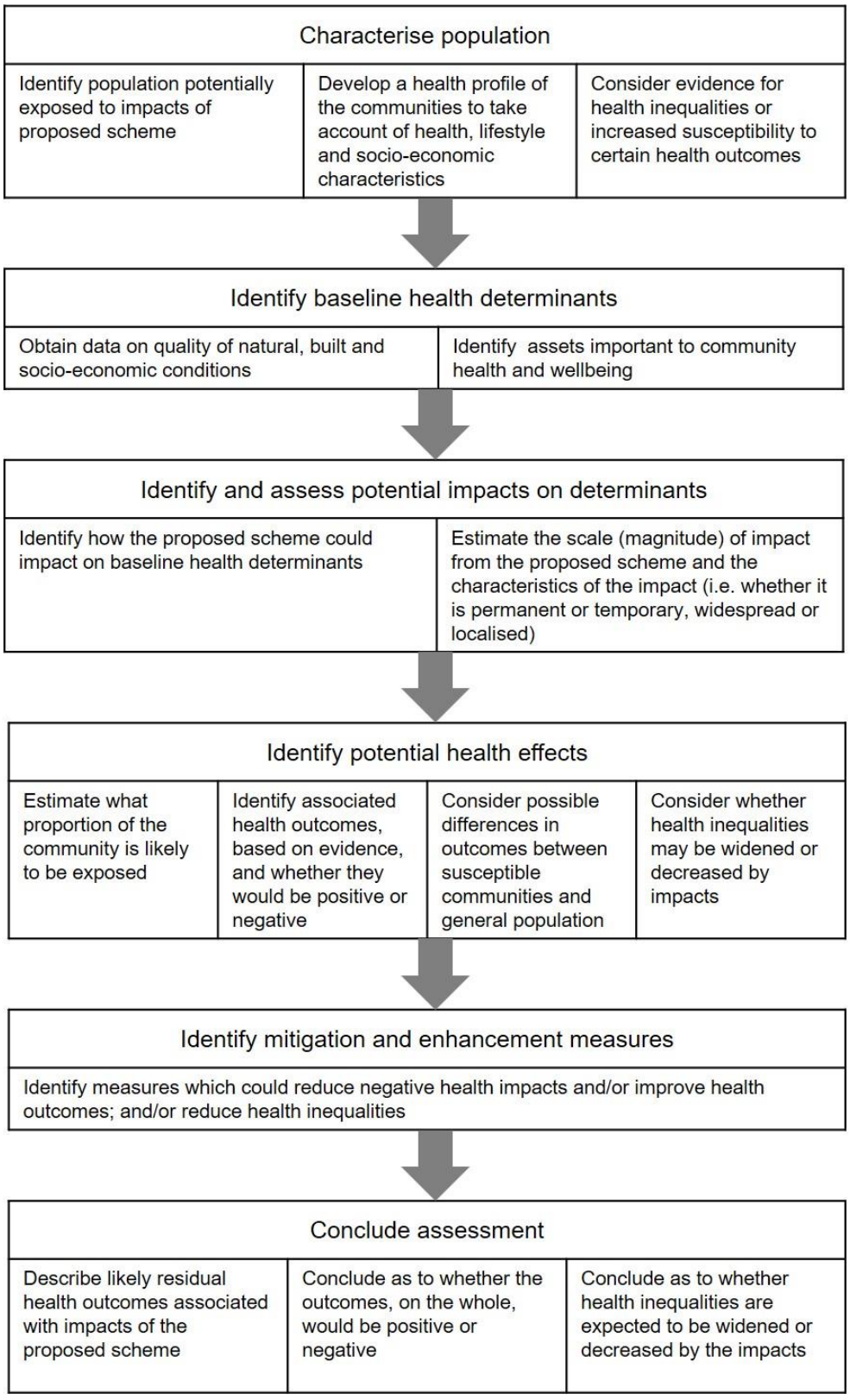
Determinant	Method of assessment
Access to the natural environment within the urban environment	The main pathway through which the proposed scheme may affect this wider determinant is through land take from residential gardens or from the loss of green features (trees, grassland, hedgerows) on the urban edge. Land take from residential properties is assessed as part of the land use and accessibility assessment (residential property and housing). A qualitative commentary on health outcomes associated with loss of greenspace from residential properties is provided under the heading 'Access to facilities, services and employment' and an assessment of health outcomes associated with loss of green features on the urban edge is provided under the heading 'Physical and visual access to greenspace and outdoor recreation'.
Access to leisure, recreation and physical activities within the urban and natural environments	Informed by the land use and accessibility assessment (community land and assets, and WCH). Qualitative commentary on associated health issues is provided under heading 'Access to services, facilities and employment' (for formal leisure facilities such as gyms or sports pitches) and under the heading 'Physical and visual access to greenspace and outdoor recreation' for informal outdoor recreation in natural environments.
Traffic and transport	
Accessibility	Assessed as part of the land use and accessibility assessment (WCH) with qualitative commentary on associated health outcomes provided under the headings 'Active travel'; 'Access to services, facilities and employment'; 'Physical and visual access to greenspace and outdoor recreation'; and 'Health inequalities'.
Access to/by public transport	Assessed as part of the land use and accessibility assessment (public transport) with qualitative commentary on associated health outcomes provided under the headings 'Active travel'; and 'Access to services, facilities and employment'.
Opportunities for access by cycling and walking	Assessed as part of the land use and accessibility assessment (WCH) with qualitative commentary on associated health outcomes provided under the headings 'Active travel'; 'Access to services, facilities and employment'; and 'Physical and visual access to greenspace and outdoor recreation'.
Links between communities	Assessed as part of the land use and accessibility assessment (WCH) with a qualitative commentary on population health outcomes provided under the heading 'Community severance and social networks'.
Community severance	Assessed as part of the land use and accessibility assessment (WCH) with a qualitative commentary on population health outcomes provided under the heading 'Community severance and social networks'.
Connections to jobs	Informed by the land use and accessibility (development land and business) assessment with a qualitative commentary on population health outcomes provided under the heading 'Access to services, facilities and employment'.

Determinant	Method of assessment
Connections to services, facilities and leisure opportunities	Informed by the land use and accessibility assessment (community land and assets, and WCH) with a qualitative commentary on population health outcomes provided under the headings 'Access to services, facilities and employment' and 'Physical and visual access to greenspace and outdoor recreation'.
Socio-economic	
Employment opportunities, including training opportunities	A qualitative assessment drawing on information on employment opportunities likely as part of the construction of the proposed scheme is provided under the heading 'Access to services, facilities and employment'.
Local business activity	Informed by the land use and accessibility (development land and business) assessment with a qualitative commentary on population health outcomes provided under the heading 'Access to services, facilities and employment'.
Community/social cohesions and access to social networks	Informed by the land use and accessibility assessment (community land and assets, and WCH) with a qualitative commentary on population health outcomes provided under the heading 'Community severance and social networks'.
Land use	
Land use in urban and/or rural settings	Assessed under the land use and accessibility assessment (residential property and housing, community land and assets; development land and businesses; and agricultural land holdings) with a qualitative commentary on associated health issues under the headings 'Access to services, facilities and employment'; 'Community severance and social networks'; and 'Physical and visual access to greenspace and outdoor recreation'.
Quality of urban and natural environments	Informed by assessments for other environmental aspects reported in this PEIR (Chapter 6: Air quality; Chapter 8: Landscape and visual; Chapter 9: Biodiversity; Chapter 10: Geology and soils; Chapter 12: Noise and vibration; and Chapter 14: Road drainage and the water environment) and addressed under the headings: 'Noise, air and other environmental pollutants'; 'Physical and visual access to greenspace and outdoor recreation'; and 'Access to services, facilities and employment'.

13.4.11 The assessment of effects on population health outcomes is primarily qualitative, following the process outlined in Plate 13.3. Health outcomes are reported as positive, neutral, negative or uncertain, and no judgement of significance is made.

13.4.12 As identified in Table 13.2, health inequalities have not been assessed in this PEIR as further evidence and local information is required to inform the assessment. An assessment of impacts on health inequalities will be provided in the Environmental Statement.

Plate 13.3 Health assessment approach



13.5 Assessment assumptions and limitations

13.5.1 The following timescales are used for this assessment: temporary effects are those that would typically last minutes or hours, or up to two days, such as disruption caused in the case of a weekend road closure. Short-term effects are those lasting up to six months. Medium-term effects are those lasting six months to five years. Long-term effects are those lasting more than five years.

13.5.2 The assessment considers health effects and data at a population level, rather than health data and effects relating to individuals. The aggregated data and statistics used to support the assessment cannot be used to make inferences about the health of individuals within the communities assessed.

13.5.3 Although the assessment refers to research that demonstrates evidence of association between changes in health determinants and effects on health, this should not be interpreted as causation. It is not possible to draw conclusions on cause and effect relationships for human health using aggregated population-level data.

13.5.4 The assessment does not draw conclusions on the viability of any individual businesses, including farm businesses, that may be affected by changes in land or access from the proposed scheme. Such matters would relate to the relevant margins that support the businesses and any impacts on business viability would require direct negotiation between the interested parties and their representatives. Instead, the assessment will present effects in relation to whether the current land use can feasibly be maintained in light of impacts such as land take or alterations to access.

13.5.5 The use of the Strava Heatmap to inform cycling and running activity in the area has the limitation that it is likely to be a selective group of cyclists and runners who use the app. The app is likely used more by very keen and more competitive cyclists and runners and may not reflect the activities of occasional cyclists and runners, family rides with younger children or short regular commutes. Nevertheless, the app is widely used and provides an indication of routes regularly used and routes which tend to be avoided.

13.5.6 It is proposed to engage with the local Director of Public Health to understand the main public health concerns for the area and to discuss and agree the evidence base and assessment approach. However, is understood that current public health priorities are in tackling COVID-19 outbreaks associated with the coronavirus pandemic. It is therefore not guaranteed that public health teams will have the availability and capacity to participate in consultation for the EIA while the public health emergency continues.

13.5.7 It is proposed to undertake site visits to particular locations to further understand the context in terms of access provision and amenity. Furthermore, engagement with WCH groups and council public right of way (PRoW) and cycling officers will further inform the understanding of current use and demand for WCH provision.

13.5.8 Chapter 14: Road drainage and the water environment, assesses potential effects associated with increases in flood risk. At this stage it is assessed that there would be no flood risk to residential property, however, land currently or

proposed for business and amenity uses may be affected should Boreham Brook culvert require extension during future design stages, as well as current or proposed WCH routes. Mitigation measures will be required, but have not yet been developed. For this reason, potential flood risk effects are not considered within the assessment of effects on land use and accessibility or human health for the PEIR. Such potential effects will be reviewed and reported within the Environmental Statement if relevant.

13.5.9 The assessment of effects on human health draws upon the preliminary air quality assessment provided in Chapter 6: Air quality, which assesses selected receptors within 200m of the affected road network (ARN) which are representative of worst-case impacts.

13.6 Study area

13.6.1 The study areas for the assessment of effects on population and health are set out below and shown in Figure 13.1.

Land use and accessibility

13.6.2 The study area for land use and accessibility is the provisional Order Limits plus a buffer of 500m as set out in the DMRB LA 112.

13.6.3 A wider context has also been considered to understand the sensitivity of routes within the study area used by WCH that could potentially be affected by the proposed scheme. For WCH, consideration is given to possible origins and destinations of up to 10km from the construction footprint of the proposed scheme, while a distance of up to 2km is considered for regular walking journeys. The consideration of this wider context is deemed sufficient to provide insight into the likely purpose of journeys that cross the footprint of the proposed scheme since typical regular walking distances are up to 2km, while cycle commutes are typically up to 10km (Department for Transport (DfT), 2017). It is also considered sufficient to capture the context for horse riders and long-distance walkers who would typically travel more than 2km as part of a recreational journey.

Human health

13.6.4 The study area for human health consists of the following:

- The study area for operational effects on air quality i.e. the ARN for air quality plus a buffer of 200m from the edge of the carriageway as set out in Chapter 6: Air quality.
- The study area for the operational effects on noise. For the purposes of the PEIR this has been defined as the area within 600m of new road links or road links physically changed or bypassed by the scheme as set out in Chapter 12: Noise and vibration.
- The study area for land use and accessibility as set out above.

13.6.5 The area defined above captures potential direct effects on human health associated with changes in air and noise pollution, temporary and permanent changes in land use and access, and also indirect effects associated with changes in traffic volumes, speed or composition which could indirectly affect active travel or recreational journeys undertaken by WCH.

13.7 Baseline conditions

Baseline sources

13.7.1 Key sources used to inform the understanding of baseline conditions are set out in Table 13.4.

Table 13.4 Baseline sources for population and health

Data source	Baseline information obtained
Braintree District Council Local Plan: Publication Draft June 2017	Development allocations and planning policies
Braintree District Cycling Action Plan – Draft, January 2018 (Essex Highways, 2018)	Local cycling priorities
Chelmsford Cycling Action Plan, March 2017 (Essex Highways, 2017)	Local cycling priorities
Chelmsford Local Plan, Full Council Version, May 2020	Development allocations and planning policies
Colchester Emerging Local Plan 2017 – 2033	Development allocations and planning policies
Essex County Council Rights of Way Improvement Plan, 2009	Public rights of way priorities
Essex Highways Interactive Map	Public rights of way
Essex Joint Health and Wellbeing Strategy 2018-2022 (Essex County Council, 2018b)	Local health priorities
Essex Joint Strategic Needs Assessment and Area Profiles (Essex County Council, 2019b)	Local health priorities
Information on agricultural land holdings, businesses and other landowners from the developer's land agents	Land holdings data
Maldon District Approved Local Development Plan 2014 – 2029	Development allocations and planning policies
Ordnance Survey 1:25,000 mapping	Spatial data including regional trails
Ordnance Survey AddressBase Plus vector map data	Data on numbers of residential properties in the study area and other community facilities
Ordnance Survey National Cycle Network Map	National cycle network data
Public Health England's public health profiles	Local health data for key indicators
Strava Global Heatmap	Data on patterns of cycle use
The Propensity to Cycle Tool: An open source online system for sustainable transport planning (Lovelace et al. 2017)	Data on patterns of cycle use

Baseline conditions

Land use and accessibility

Residential property and housing

13.7.2 The main settlements along and around the A12 corridor are Chelmsford, Boreham, Hatfield Peverel, Witham, Rivenhall End, Kelvedon, Tiptree, Feering, Marks Tey and Copford. The city of Colchester is within 2km of the easternmost point of the study area, Maldon is located within 6km to the south-east, and Braintree within 10km north of the study area. The populations of these settlements, based on 2011 census data, are set out in Table 13.5.

13.7.3 There are many farms, country lodges, and cottages located close to the A12 in the open countryside. The closest residential areas to the existing A12 are in Rivenhall End (Oak Road and Foxmead), Hatfield Peverel and Marks Tey (residential properties along Old London Road and London Road). There are seven residential properties within the area covered by the provisional Order Limits and 9,509 within the study area. There are also individual residential properties and businesses along the corridor, that directly access the A12, including on the slip roads at junction 25 (Marks Tey).

Table 13.5 Settlements and usual resident population

Settlement	Distance from land use and access study area	Population size
Chelmsford	Partially within the study area (easternmost extents of Chelmsford only), central Chelmsford is approximately 2.9km west of the study area	111,511
Boreham	Within the study area	3,244
Hatfield Peverel	Within the study area	3,950
Braintree	Approximately 8km north of the study area	53,477
Maldon	Approximately 6km south-east of the study area	21,462
Witham	Partially within the study area (southern and eastern parts of the settlement)	25,353
Rivenhall End (parish level data)	Within the study area	742
Kelvedon	Partially within the study area (central and southern parts of the settlement)	5,322
Feering	Within the study area	2,035
Tiptree	Approximately 1km south-east of the study area	9,182
Marks Tey	Partially within the study area (central and southern parts of the settlement)	2,551
Copford	Within the study area	1,689

Settlement	Distance from land use and access study area	Population size
Colchester	Outskirts within 2km east of the study area, central Colchester is approximately 6km from the study area	121,859

N.B. Data is from the National Census 2011 and represents the usual resident population for built up areas, with the exception of Rivenhall End, Feering, Marks Tey and Copford where parish-level data has been used.

13.7.4 The larger settlements of Chelmsford, Colchester and Braintree are likely to provide places of employment for a sizeable proportion of residents within the study area and may therefore attract regular commuting journeys by various modes across the study area.

13.7.5 Socio-demographics and health data for communities within the land use and access study area are provided below in the 'Human health' baseline.

13.7.6 There are several housing allocations in the emerging local plans for Chelmsford, Braintree and Colchester. The Chelmsford Local Plan has recently been adopted so weight can be given to the allocations within the plan. There are also approved planning applications for housing for most of the allocations, meaning there is committed development. Table 13.6 includes housing allocations and applications within the study area which coincide with the provisional Order Limits, or require access directly from the highway within the provisional Order Limits.

Table 13.6 Housing allocations and applications partially within the provisional Order Limits

Allocation/ application	Location	Number of residential properties	Notes
Planning application	Greater Beaulieu Park, White Hart Lane, Springfield, Chelmsford	3,600	Approved planning application in place
Braintree Publication Draft Local Plan (2017)	Hatfield Peverel	Up to 200	Comprehensive redevelopment of former Arla Foods dairy site, approved planning application in place
Planning application	Land north-east of Gleneagles Way, Hatfield Peverel	120	Outline application for residential development
Braintree Publication Draft Local Plan (2017)	Wood End Farm, Witham	Up to 450	Strategic growth location, approved planning application in place
Braintree Publication Draft Local Plan (2017)	Land at Feering	750	Strategic growth location

Allocation/ application	Location	Number of residential properties	Notes
Braintree Publication Draft Local Plan (2017)	Feering	30	Strategic growth location
Planning application	Foundry Lane, Copford	4	Site not allocated for housing

13.7.7 Of the four local authority areas which intersect the land use and access study area, three have a projected increase in household numbers between 2018 and 2043 which is significantly above the average for both Essex (17.6%) and England (16.2%). These are Chelmsford (20.1%), Maldon (20.2%) and Colchester (22.4%). In contrast, Braintree is projected to see an increase of only 13.4% (ONS, 2020a).

13.7.8 Areas projected to experience greater increases in household numbers over the coming 20 years may be more affected by losses of existing residential properties and any reduction in land available for future housing as they are at increased risk of housing scarcity.

Community land and assets

13.7.9 Community land and assets include land, buildings and infrastructure which provide a service or resource to a community, for example open spaces, village greens, village halls, healthcare and education facilities. Community land and assets play an important role in supporting healthy communities and social networks.

13.7.10 Community land identified within the study area includes Boreham recreation ground, Hatfield Peverel cricket ground and Strutt Memorial recreation ground (Hatfield Peverel). Beaulieu Park recreation ground is located at the western end of the study area, approximately 150m west of junction 19 (Boreham). Marks Tey recreation ground is located immediately north of Old London Road between the A120 and A12 near to junction 25 (Marks Tey). A further recreation ground is located in Copford within 150m, south of the existing A12.

13.7.11 The Whetmead local nature reserve (see Chapter 9: Biodiversity) abuts the A12 corridor east of Witham and can be reached by residents of Witham via an underpass beneath the A12, alongside the River Brain. This underpass also provides for the Witham River Walk which is an area of open space designated as green corridor which runs through Witham either side of the River Brain and is accessible by foot from central Witham. Also, of note is the Blackwater Rail Trail Country Park which follows the route of a disused railway track in Witham, passing underneath the A12 approximately 500m west of the River Brain underpass.

13.7.12 There are two allotment sites at the eastern edge of Rivenhall End, one of which abuts the north side of the A12 corridor.

13.7.13 No green belt land, registered common land or open access land has been identified within the study area.

13.7.14 Registered parks and gardens within the study area include Boreham House and Braxted Park (see Chapter 7: Cultural heritage). Both of these are privately owned and offer wedding venues and other corporate and recreational pursuits. Prested Hall, approximately 750m south-east of junction 24 (Kelvedon North) also provides a venue for weddings, health spa and tennis. Private golf clubs in the study area include Benton Hall Golf and Country Club (300m south of the A12 corridor, south of Witham) and Rivenhall Oaks Golf Course (north of the Great Eastern Main Line (GEML), some 360m from the A12 corridor). There are also some fishing lakes and reservoirs used for recreational fishing, located between 100m and 500m south of the A12 at Hatfield Peverel, Witham and Little Braxted.

13.7.15 The Church of Jesus Christ Latter-Day Saints is located within 50m of the A12 along the B1018 in Witham. Additional places of worship in the study area are located at Hatfield Peverel, Witham, Little Braxted, Kelvedon, Prested Hall, Feering, Stocks Green, Marks Tey and Copford.

13.7.16 Gershwin Park Nursery and Chipping Hill Primary School are located approximately 80m and 180m north of the A12 at Witham. Additional nurseries and schools are located within the settlements of Boreham, Copford, Rivenhall, Hatfield Peverel, Witham, Feering, Kelvedon, and Marks Tey.

13.7.17 Care homes within the study area have been identified in Hatfield Peverel, Witham, Kelvedon, Feering, Marks Tey and Copford. The closest of these to the existing A12 is at Marks Tey, within 70m of junction 25.

13.7.18 While these schools and care homes are unlikely to be directly impacted on by the proposed scheme, their close proximity is an important consideration for human health since children and resident populations of care homes are more likely to be vulnerable to health effects associated with air pollution and noise.

13.7.19 Other community facilities, such as dentists, doctors' surgeries, public houses, post offices, convenience stores and supermarkets are located in the settlements within and close to the study area, so the proximity and potential impacts on access to these facilities will be an important consideration for the assessment.

Development land and business

13.7.20 Larger areas of business in the study area include the Springfield Business Park on the north-east side of Chelmsford close to junction 19. Within this area there is a variety of retail and commercial assets including a large supermarket, retail outlets and distribution depots. Also located in the vicinity of junction 19 are the Boreham service station, a Premier Inn hotel and a public house.

13.7.21 Boreham Industrial Estate is located off Waltham Road within 20m of the A12 corridor, separated by the GEML. There is no direct access from this industrial estate to the A12 trunk road.

13.7.22 Springfield Industrial Estate and Boreham Industrial Estate, as well as the business park included within the Greater Beaulieu Park proposals, all have potential to generate walking and cycling journeys to and from the communities of Springfield and Chelmer Village in Chelmsford and from Boreham. Access from Chelmer Village is unlikely to be affected by the proposed scheme,

however access from Springfield would be via Drover's Road Roundabout on the A130 and from Boreham likely via the Main Road and junction 19 of the A12. Further detail regarding existing walking and cycling provision at these locations is given in the 'Walking, cyclists and horse riders' subsection below.

13.7.23 There is a large area (approximately 90 hectares) of industrial and commercial use along the south-eastern edge of Witham abutting the northern side of the A12 corridor. Within this area is a sewage treatment works as well as offices, builders' merchants, warehousing, distribution and manufacturing units. The industrial estate is connected to the A12 via junction 22 (Colemans interchange). There is a 6.8-hectare employment allocation in the Braintree Publication Draft Local Plan (2017) for an extension to this industrial estate. The majority of walking and cycling journeys to and from this area are likely to arise from residential areas to the north within Witham, although Rivenhall End is within walking distance and Hatfield Peverel, Wickham Bishops and Kelvedon are within a reasonable cycle commuting distance. Further detail regarding provision for walkers and cyclists along the existing A12 and adjoining roads is provided in the 'Walkers, cyclists and horse riders' subsection below.

13.7.24 A hotel, service station, car sales and retailer all have direct access onto the A12 in Rivenhall End. The Essex County Fire and Rescue Headquarters at Rivenhall End also has direct access onto the A12. There is a 3.3-hectare allocation for special employment land to support the fire and rescue services at this location set out in the Braintree Publication Draft Local Plan (2017).

13.7.25 Threshelfords Business Park in Kelvedon is located approximately 120m north of the A12. It does not have direct access onto the A12 so traffic to and from this site is likely to regularly travel through the Feering village centre to access the A12 via junction 24, which could create difficult traffic conditions for pedestrians, including schoolchildren, to negotiate at peak times. However, since the business park mainly comprises offices, it is unlikely to generate much in the way of heavy goods vehicle traffic.

13.7.26 There are several other individual businesses with direct access onto the A12 along the A12 corridor through the study area. There is a hotel and service station some 450m east of junction 24 and there are several shops and businesses located around junction 25. These include a food retailer, post office and hotel.

Agricultural land holdings

13.7.27 The area is generally arable cropping with pockets of other farming types. There are a number of large commercial plots (over 100ha in size) along the route. Smaller plots are located at either end of the study area and around the fringes of the towns and villages.

Walkers, cyclists and horse riders

13.7.28 Walkers and cyclists can be considered as two types - those who walk or cycle as part of an active travel journey (e.g. as part of a regular commute or to access services); and those who are walking or cycling for recreational purposes. The first type will typically be more interested in an efficient, convenient route while the second type would be more interested in the recreational amenity of the route. Equestrian activity is dominated by recreational horse riding and therefore horse riders are assumed to be recreational unless there is clear evidence otherwise.

13.7.29 Although WCH are not prohibited from using the A12, the current road is not suitable for this type of use for the majority of the length due to high traffic volumes and speeds. Therefore, the A12 is a barrier for WCH in many locations.

13.7.30 There are approximately 15km of footways and cycleways between junctions 19 and 25 that run parallel to the A12 and provide alternative access along the corridor. These include:

- Hatfield Peverel to Witham: footways between junction 20b (Hatfield Peverel North) and junction 21 (Witham South)
- Witham to Kelvedon: shared-use footway/cycleway between junction 22 and junction 23 (Kelvedon South) on the north-west side of the carriageway. Footway on the south-east side of the carriageway
- Kelvedon to Marks Tey: shared-use footway/cycleway on the north-west side of the carriageway. Footway on the south-east side of the carriageway

13.7.31 These routes are not continuous and the volume and speed of traffic on the A12 can act as a disincentive to their use as there is limited physical segregation provided. They are also relatively narrow, unclear, inconsistently marked and poorly signed. Nevertheless, evidence from the Strava Global Heatmap webpage suggests high cycle use between Chelmsford and Colchester, with many cyclists generally following the A12 but taking the B1389 through Witham and the B1024 through Kelvedon. The route also appears to be regularly used by runners.

13.7.32 There are three dedicated cycle routes that cross perpendicular to the A12:

- National Cycle Network (NCN) National Route 16 starts in Birchanger near Stansted and finishes in Great Totham where it connects with NCN Route 1. NCN Route 16 is an on-road route which crosses the A12 at junction 22 via Coleman's Bridge.
- NCN Regional Route 50 starts in Rickling Green and is routed in a south-easterly direction towards Wickham Bishops where it connects with NCN Route 1. NCN Regional Route 50 is an on-road route which crosses the A12 via the Terling Hall Road overbridge.
- A local traffic-free route in Witham passes under the A12 via a designated combined cycle/footpath using the old Maldon Branch railway line. It links two residential areas, Witham and Wickham Bishops, which are divided by the A12. This links with NCN Route 16.

13.7.33 NCN Route 16 and the local traffic-free route are likely to be used for both active travel and recreational purposes, while NCN Regional Route 50 is predominantly used for recreational purposes.

13.7.34 Minor roads with footways traverse the A12 via overbridges or underbridges at several locations and are important for providing connectivity across the A12. These include Waltham Road (east of Boreham); Terling Hall Road (between Boreham and Hatfield Peverel); Bury Lane, Station Road and the junction 20b slip road at Hatfield Peverel; Maldon Road and Blackwater Lane (Witham); Henry Dixon Road (Rivenhall End); and Maldon Road, Ewell Hall Chase and Inworth Road (B1023) (Kelvedon).

13.7.35 The baseline review has considered the public rights of way (PRoW) and other routes which cross or meet the A12 within the study area. The wider context has then been checked to make assumptions on the likely reasons for people using these routes.

13.7.36 Over 30 PRoW have been identified which meet or cross the A12 within the study area. PRoW are likely to be used mainly for recreational purposes. Some PRoW, such as those routed between Copford and Marks Tey, Tiptree and Kelvedon, and Wickham Bishops and Witham, may be used for active travel journeys by walkers and cyclists. There are known areas of historic severance of rights of way along the A12 as a result of previous schemes which hinder access between settlements located around and immediately north of the A12 and the more rural areas to the south.

13.7.37 Eleven riding schools have been identified within 10km of the study area, the nearest of which is at Tiptree, approximately 3.7km south of the study area. There is therefore potential for horse riders to be using the lanes and bridleways which cross the A12.

Public transport

13.7.38 Public transport has been considered in the assessment scope to provide further context of local accessibility and where walkers and cyclists may need to access public transport hubs as part of a longer journey.

13.7.39 The A12 is currently used by a number of local and regional bus services, and national coach services, which provide links between the major settlements along the corridor. National Express operates regional services between London and Ipswich, Felixstowe and Walton-on-the-Naze.

13.7.40 Local bus services operate along or adjacent to the A12 between Brentwood and Colchester, as well as more limited services to neighbouring towns, rural areas, and towns and cities outside the county. There are existing bus stops located on the A12 between junctions 22 and 23, and between junctions 24 and 25. However, due to safety concerns for both the operators and for users who have to cross the road at-grade at these locations, these bus stops are no longer serviced. The bus services which are affected by this are:

- Route 71, 71A and 71X – Chelmsford to Colchester. These services use the A12 in both directions and are operated by FirstGroup (Essex).
- Route 71C – Chelmsford to Colchester via Witham and Kelvedon. This service uses the A12 in both directions and is operated by Regal Busways on Sundays only.

13.7.41 There are some other bus services which use junctions of the A12, including Route 91 (Tollesbury to Witham), operated by Hedingham, which uses junction 19; and various services which use junction 25.

13.7.42 The GEML runs parallel to the A12 for much of its length, which runs from London Liverpool Street to Ipswich and Norwich. Existing stations are located in Chelmsford, Hatfield Peverel, Witham, Kelvedon and Marks Tey. A further station is proposed at the Beaulieu Park development which is anticipated to become operational in 2025 or 2026.

Human health

Human health, vulnerable groups and health inequalities

13.7.43 Health data has been obtained from Public Health England for the wards which coincide with the study area for human health, including those communities identified above, to provide an indication of local health issues. This is based on aggregated population-level data. The health of individuals within the study area will vary considerably and cannot be inferred from these data. Table 13.7 sets out data for physical health indicators by ward within the human health study area which are most affected by the proposed scheme, including those relevant to the matters and associated health outcomes described in the following paragraphs (refer to the glossary for explanation of measures of health used in the table). Table 13.8 sets out data for mental health indicators, which are provided at either local authority or Clinical Commissioning Group level depending on availability.

13.7.44 The Marmot Review into health inequalities (Marmot, 2010) looked at differences in health and wellbeing between social groups and described how the social gradient on health inequalities is reflected in the social gradient on educational attainment, employment, income, quality of neighbourhood and other issues. Addressing the wider determinants of health is seen as an important means of tackling health inequalities and improving population health as a whole.

13.7.45 The health baseline therefore considers factors such as income deprivation as well as indicators for certain types of health condition in the area, before considering the specific resources and receptors within the study area.

13.7.46 Cells in Table 13.7 which are shaded indicate health values which are significantly worse than the average for England. As can be seen, some of the communities within Witham score significantly worse than average for England, for indicators of chronic obstructive pulmonary disease (COPD) emergency admissions, long-term illness, life expectancy and income deprivation. Communities within Witham score worse than average across a number of the other health indicators as well, including premature deaths. This indicates that communities in Witham, particularly those in Witham Central ward, may be more sensitive to pollution and problems of traffic than other communities. However, there will be sensitive individuals in all communities, regardless of each community's average level of health.

13.7.47 There may also be a greater dependency on public transport, taxis, walking and cycling among people in income-deprived communities, to access services and employment.

13.7.48 It is acknowledged that there are groups other than income and age-related vulnerable groups who may be more susceptible to poorer health and wellbeing outcomes for a variety of reasons. This includes potential differences in vulnerabilities relating to sex, gender or ethnicity, or geographical groups (for example people living in rural areas, or in key settings such as hospitals or prisons). Further consultation with the local Director of Public Health will be undertaken to inform an understanding of any additional groups within the study area who are particularly vulnerable to the matters scoped into the health assessment (see Section 13.4), and the outcomes of these discussions will be included within the Environmental Statement for the proposed scheme.

Table 13.7 Physical health baseline data

Indicator (England value)	Ward															
	Chelmer Village and Beaulieu Park	Boreham and The Leighs	Hatfield Peverel and Terling	Great Totham	Witham South	Witham Central	Witham West	Witham North	Silver End and Cressing	Wickham Bishops and Woodham	Kelvedon and Feering	Marks Tey and Layer	Tiptree	Lexden and Braiswick	Rural North	Mile End
Percentage of total resident population aged 0-15 years (2017) (19.1)	21.8	20.5	15.9	17.6	22.5	18.6	19.8	20.5	20.1	15.2	18.1	18.5	15.7	18.1	17.1	22.6
Percentage of total resident population who are 65 and over (2017) (18.0)	10.2	17.8	25.5	27.3	13.3	20.3	18.1	15.7	19.6	29.8	21.7	21.8	25.0	23.3	22.3	9.6
Emergency hospital admissions for COPD (2013/14 – 2017/18) (Standardised Age Ratio (SAR)) (100)	55.8	56.3	83.6	23.5	99.0	121.7	151.8	123.5	112.3	23.5	68.4	41.5	63.4	41.4	64.0	81.7

Indicator (England value)	Ward															
	Chelmer Village and Beaulieu Park	Boreham and The Leighs	Hatfield Peverel and Terling	Great Totham	Witham South	Witham Central	Witham West	Witham North	Silver End and Cressing	Wickham Bishops and Woodham	Kelvedon and Feering	Marks Tey and Layer	Tiptree	Lexden and Braiswick	Rural North	Mile End
Percentage of people who reported long-term illness or disability (2011) (17.6)	9.2	12.9	17.7	16.2	14.5	19.6	16.5	16.4	17.2	13.7	15.0	15.9	17.7	17.0	15.5	12.2
Deaths from respiratory diseases, all ages, (2013-2017) (Standardised Mortality Ratio (SMR)) (100)	49.3	85.8	115.3	88.0	70.7	129.2	75.5	120.1	105.9	62.3	67.2	67.0	99.7	74.4	80.6	97.9
Deaths from coronary heart disease, all ages, (2013-2017) (SMR) (100)	64.3	86.5	71.3	79.9	91.2	119.5	103.4	122.9	87.4	73.8	98.9	76.2	82.8	81.7	80.5	100.2

Indicator (England value)	Ward															
	Chelmer Village and Beaulieu Park	Boreham and The Leighs	Hatfield Peverel and Terling	Great Totham	Witham South	Witham Central	Witham West	Witham North	Silver End and Cressing	Wickham Bishops and Woodham	Kelvedon and Feering	Marks Tey and Layer	Tiptree	Lexden and Braiswick	Rural North	Mile End
Incidence of all cancer (Standardised Incidence Ratio (SIR)) (100)	98.1	94.1	86.0	97.1	87.5	90.8	93.8	87.6	101.9	97.1	97.2	91.0	98.5	100.3	91.5	108.6
Income deprivation (English Indices of Deprivation 2015) (%) (14.6)	6.5	9.6	8.5	6.7	10.0	16.0	15.3	16.2	12.4	5.0	8.3	6.2	8.1	6.8	7.0	9.5
Life expectancy at birth (male) (2013-2017) (years) (79.5)	85.7	82.2	81.0	80.3	82.4	75.8	82.9	78.1	81.4	83.3	80.0	82.3	80.5	81.4	81.6	79.0
Life expectancy at birth (female) (2013-2017) (years) (83.1)	85.8	84.2	81.9	87.3	86.3	79.8	83.5	84.0	83.0	84.4	84.2	84.9	84.2	85.2	84.3	81.8

Table 13.8 Mental health baseline health data

Indicator	Chelmsford	Braintree	Maldon	Colchester
Estimated prevalence of common mental disorders: percentage of population aged 16 years and over (2017)	13.1	14.7	14.0	15.1
Depression and anxiety prevalence: percentage of population aged 18 years and over (2016/2017)	11.2			14.3

Noise, air quality and other environmental pollutants

13.7.49 Poor air quality is the largest environmental risk to public health in the UK (Public Health England, 2018). Health outcomes associated with poor air quality, as identified through a range of research studies (from the UK and abroad), are discussed in Box 1 below. There is one air quality management area (AQMA) within 200m of the ARN for the proposed scheme, located on the eastern outskirts of Colchester (Lucy Lane North, Stanway).

13.7.50 There are a large number of communities within 200m of the ARN including:

- Chelmsford District: Chelmsford, Writtle, Broomfield, Boreham, Sandon, Howe Green, Margaretting
- Braintree District: Hatfield Peverel, Witham, Rivenhall End, Kelvedon, Feering, Coggeshall, Bradwell, Braintree, Great Notley, Silver End
- Maldon District: Little Braxted, Nounsley, Great Totham, Tolleshunt Knights, Tolleshunts D'Arcy and Salcott-cum-Virley
- Colchester District: Tiptree, Inworth, Heckford Bridge, Copford, Marks Tey, Colchester, Horkesley Heath, Eight Ash Green, Copford Green, Langham

Box 1: Air quality and health

There is evidence for associations between exposure to air pollutants generated by vehicle traffic, including particulate matter (PM) and nitrogen dioxide (NO_2), and the following health outcomes:

- Onset of asthma in children and exacerbation of asthma in children and adults
- Incidence of cardiovascular disease and risk of hospitalisation or death from heart failure
- Incidence of lung cancer, and mixed evidence for associations with other cancers including bladder cancer and breast cancer
- Adverse birth outcomes, including low birthweight, pre-term births and small for gestational age births
- Markers of reduced fertility in men and women
- Rates of all-cause mortality

(WHO, 2006; Public Health England, 2018)

13.7.51 Rates of hospital admissions for COPD (SAR) are significantly higher than the England rate in the Witham West and Witham North wards of Witham, and the SMR for deaths from respiratory diseases is higher than the England rate for Stanway ward in Colchester.

13.7.52 Noise from road traffic is considered the second greatest environmental risk to population health in Europe (WHO, 2011). Health outcomes associated with exposure to road noise are set out in Box 2. The noise environment in proximity to the proposed scheme is dominated by road noise, predominantly from the A12. There are 18 Noise Important Areas (NIA) along the A12 between junction 19 and junction 25, and a further three NIAs located on the A130 and A120 close to where they join the A12, and on the A12 between junction 25 and junction 26. Further detail regarding the existing noise environment for the proposed scheme is provided in Chapter 12: Noise and vibration. Communities currently likely to be affected by noise associated with the A12 include Boreham, Hatfield Peverel, Rivenhall End, Marks Tey and Copford.

Box 2: Noise and health

There is good evidence for associations between exposure to noise from road traffic and levels of sleep disturbance and annoyance.

At present there is only limited evidence for the impact of exposure to road traffic noise on the cardiovascular system, but the results of current studies indicate further investigation is warranted.

Exposure to road noise has also been linked to cognitive impairment in children, particularly reading comprehension and long-term memory, but again further studies are needed to investigate this fully.

(WHO, 2018)

Community severance and social networks

13.7.53 The baseline understanding of traffic flows is based on 24-hour Annual Average Daily Traffic data (AADT24). Currently there are high traffic flows (>16,000 AADT):

- along the A12 between junctions 17 and 29, including those sections which are routed through Hatfield Peverel and Rivenhall End
- the A130 and A138 in the Chelmer Village and Springfield areas of Colchester
- the A120 through Marks Tey
- the A1124 and A133 through Fordham Heath, Eight Ash Green and the Lexden and Stanway areas of Colchester

13.7.54 Traffic flows are also relatively high (between 8,000 and 16,000 AADT) in the following locations:

- the B1137 The Street and the B1019 Maldon Road in Hatfield Peverel

- the B1018 Maldon Road and B1389 Colchester Road, in south-west Witham
- the B1023 Inworth Road where it passes through Kelvedon and Feering
- the B1024 between Feering and Tiptree (and through the village of Inworth)

13.7.55 Community severance and social networks are important for the wellbeing of communities (see Box 3).

Box 3: Community severance and health

Community severance refers to the situation when transport infrastructure or road traffic separates people from places in their communities, limiting mobility and opportunities for social interaction. There is a growing concern about its effects on the wellbeing of local communities (Anciaes et al., 2016) yet this is an under-researched area of population health. There are limited studies that demonstrate measurable short or long-term health outcomes from reduced community severance, however, there is substantial evidence of the importance of social contacts to improved health outcomes (Mindell and Karlsen, 2012).

Access to facilities, services and employment

13.7.56 The 'Land use and accessibility' baseline subsection above, sets out land use patterns (residential property and housing, development land and business and agricultural holdings), as well as identifying key community facilities and services within the study area such as places of employment and study, healthcare facilities, and the walking and cycling routes or public transport access points that are used to access these facilities or services.

13.7.57 Access to community facilities, services and employment is an important wider determinant of health as described in Box 4.

Box 4: Access to community facilities and services and employment, and associated impacts on health

Access to good education, training and employment are extremely important wider determinants of health. The average time for an Essex resident to access eight key local services (including employment centres, education facilities, GP surgeries and hospitals) was 19.4 minutes by public transport or walking. This varies substantially across the county with the more rural areas of Braintree average being 23.7 minutes and Maldon 28.5 minutes (Department for Transport data reported by Essex County Council, 2019).

Active travel

13.7.58 Increased physical activity levels are linked to a range of better health outcomes (see Box 5) and for many people, switching to active travel modes for regular journeys is an effective way of including regular physical activity in daily life. Table 13.7 provides data relevant to these health outcomes for local communities, where available.

13.7.59 The 'Land use and accessibility' baseline subsection above identifies and describes facilities such as footways, cycleways and PRoW within the study area which are likely to be used for active travel purposes, including NCN Route 16, a local cycle route in Witham, and PRoW routed between Copford and Marks Tey, Tiptree and Kelvedon, and Wickham Bishops and Witham.

Box 5: Physical activity levels and health

At a population level, higher levels of physical activity are associated with:

- Reduced risk of many types of cancer, as well as cancer mortality
- Reduced risk of cardiovascular disease and cardiovascular disease mortality (for moderate to high levels of physical activity)
- Reduced risk of poor mental wellbeing and mental ill-health
- Reduced risk of all-cause mortality

There is also more limited evidence for associations between higher levels of physical activity and better academic achievement, as well as reduced risk of dementia, diabetes and obesity.

Physical and visual access to greenspace and outdoor recreation

13.7.60 The presence, type and accessibility of local greenspace plays a role in good mental and physical health (see Box 6). The 'Land use and accessibility' baseline subsection above, identifies existing areas of greenspace located within the provisional Order Limits and their usage within communities, as well as describing routes within the study area which are predominantly used by WCH for recreational purposes.

13.7.61 Health outcomes associated with physical activity levels and exposure to greenspace are set out in in Boxes 5 and 6, and Table 13.7 provides data relevant to these outcomes for local communities (where available).

Box 6: Greenspace and health

Mental health

There is emerging evidence for positive associations between exposure to greenspace and improved mental health or mental wellbeing in adolescents and children. A recent study has also shown that the amount of greenspace in the local area, and less reliably the frequency of visits to greenspace, are also positively associated with mental wellbeing in adults.

Physical health

There is relatively limited research into associations between greenspace and physical health, however there is evidence for a negative association between exposure to greenspace and the following outcomes:

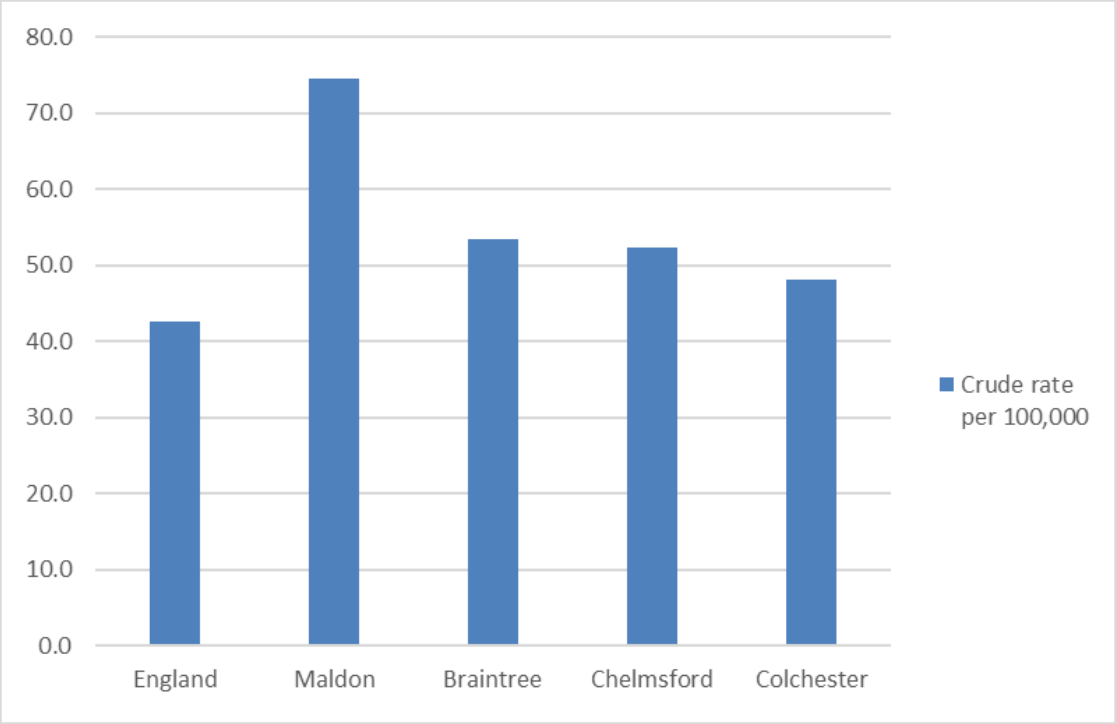
- Incidence of cardiovascular disease and cardiovascular mortality
- Type 2 diabetes
- Adverse birth outcomes
- All-cause mortality

Road traffic collisions

13.7.62 Rates of people killed and seriously injured (KSI) on roads in all four local authorities within which the proposed scheme is located, are worse than the average for England.

13.7.63 Up to date collision analysis, which is being undertaken to inform a safety assessment for the proposed scheme (required to fulfil requirements of the NNNPS), was not available at the time of the assessment reported in this PEIR. The population and human health assessment will draw on that analysis, when available, to inform the baseline understanding of road safety to be reported in the Environmental Statement. In the meantime, Department for Transport data on collisions mapped on the website crashmap.co.uk have been used to provide a preliminary understanding of the numbers of people killed or seriously injured on the A12 trunk road and its junctions between, and including, junctions 19 and 25 (see Plate 13.4).

Plate 13.4 Killed and seriously injured casualties on roads (2016-2018)



Source: Department for Transport/Public Health England

13.7.64 The data shows that between 2016 and 2020, 77 people were KSI on the A12. Of these, eight were killed, 12 were motorcyclists, three involved pedestrians (at interchange locations, all fatal), one involved a cyclist (also at an interchange) and four vehicle collisions resulting in serious injury involved child passengers.

13.7.65 The interpretation of collision data and safety is a complex area in relation to population health. For example, low levels of pedestrian and cycle collisions could actually indicate highly unsafe road conditions as people are discouraged from walking and cycling due to fear of accidents. This in turn can lead to a burden of ill-health in the population associated with physical inactivity. Furthermore, police statistics and hospital data on road injuries are often different, indicating underreporting of collisions to the police.

13.7.66 In addition to deaths and physical injuries (with associated lifelong implications of disability), the wider effects on society are also an issue for road collisions. A follow-up study of 1,148 people aged 19 to 69 years who attended Accident and Emergency following a road accident identified that 32% suffered notable psychiatric outcomes (post-traumatic stress disorder, phobic travel anxiety, general anxiety or depression) at one year following the accident (Mayou, 2001).

13.7.67 Reducing the rates of KSI in Essex is a local public health priority, with the Joint Strategic Needs Assessment identifying it as a potential area of future focus for the Essex Health & Wellbeing Board (Essex County Council, 2019b).

Future baseline

13.7.68 The future baseline will likely be characterised by continued population growth within and around the study area as more of the residential development allocations get built out. For example, a further 3,000 households are expected at North East Chelmsford, which is just outside the land use and access study area but may result in a larger population interacting with the land use and access study area.

13.7.69 The COVID-19 pandemic that has affected the UK in 2020/2021 may influence future trends. For example, there may be a long-term increase in people working from home. Some people may switch from the use of public transport to walking, cycling or using their own cars due to concern about communicable diseases. There may be a further increase in cycling levels, which have been increasing in England since 1993 (Cycling UK, 2019). In addition, people may have an increased preference for outdoor recreation where social distancing is easier than in indoor leisure and recreation venues. The level of occurrence of these types of behaviour change will depend on the trajectory of the pandemic and individual responses to their experience of 2020/2021 (e.g. heightened anxiety or concern) which at this time is uncertain.

Value and sensitivity of receptors

13.7.70 All land use and accessibility receptors within the baseline have been assigned a value based on criteria in DMRB LA 112 and using professional judgement. Table 13.9 summarises the value of receptors identified within the study area.

13.7.71 All human health receptors are valued high. Although it is known that some areas have higher prevalence of certain sensitive health conditions, it is not known exactly where those individuals are, and individuals with sensitive conditions will be located throughout the study area. Therefore, it is deemed logical that all communities should be regarded as having high sensitivity in terms of health.

Table 13.9 Value of receptors in the study area for population and health

Value and sensitivity	Description	Examples within the study area
Very high	Residential property and housing: • existing housing or land allocated for housing located in a local authority area where the number of households is expected to increase by more than 25% by 2041 (ONS data)	There are no local authorities in the study area where numbers of households are expected to increase by this level.
	Residential property and housing: • Residential settlements within the study area which exceed 5ha or 150 houses.	Chelmer Village and Springfield in Chelmsford; Boreham; Hatfield Peverel; Witham; Rivenhall End; Kelvedon; Feering; Marks Tey and Copford.

Value and sensitivity	Description	Examples within the study area
	Community land and assets providing essential services for the daily health and functioning of the community where: • there is limited potential for substitution • they are frequently used by the majority of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs	Schools (e.g. Boreham Primary School); GP surgeries (e.g. the Laurels Surgery, Boreham); care homes.
	Large employment sites and allocations within the study area which exceed 5ha.	Springfield Industrial Estate, Chelmsford; Eastways Industrial Estate, Witham; Coleman's Quarry, Witham.
	National trails and routes likely to be used regularly by high numbers for commuting and/or recreation (with limited potential for substitution).	NCN 16 (Little Braxted Lane, Witham); Regional cycle route 50 (high commuting numbers) (Terling Hall Road); shared-use footway/cycleway along A12.
	Grade separated crossing points of the A12 for WCH, which link communities and there are no alternatives without substantial detours.	Main Road, Chelmsford; B1018 Maldon Road, Witham; Station Road and Bury Lane; Hatfield Peverel; Henry Dixon Road; Rivenhall End; Maldon Road, Kelvedon; A120 slip roads, Marks Tey.
	At-grade crossing points with >16,000 vehicles per day; and/or routes with no accessibility provision.	Footpath 103 (Witham), footpath 30 (Kelvedon).
High	Residential property and housing: • Existing housing or land allocated for housing located in a local authority area where the number of households is expected to increase by 16-25% by 2041 (ONS data)	Based on mid-2018 to mid-2043 projections, households in Colchester, Maldon and Chelmsford are projected to increase 22.4%, 20.2% and 20.1% respectively (ONS data).
	• Small settlements, (>1-5ha (circa 30 to 150 houses))	Examples in study area to be identified through further EIA process.

Value and sensitivity	Description	Examples within the study area
	Community land and assets supporting the health and functioning of the community where: • alternatives are available only by travel to other settlements and areas • they are regularly used by a large portion of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs	Recreation grounds (e.g. Marks Tey Recreation Ground); village greens and local areas of recreational value; sports grounds (e.g. golf courses open to the public); convenience stores; post offices (e.g. Marks Tey Post Office and Store); train stations
	Agricultural land holdings: • Areas of land in which the enterprise is dependent on the spatial relationship of land to key agricultural infrastructure, and access is required on a frequent basis (e.g. weekly) For example, large arable farm holdings dependent on access to extensive land.	Examples throughout study area.
	Employment sites and allocations (circa 1 to 5ha).	Sites RIVE 362 and 363 under Braintree Draft Local Plan, Witham; Site RIVE 364 under Braintree Draft Local Plan, Kelvedon; Threshelfords Business Park, Feering; Prested Hall, Feering; unnamed business park located on Inworth Road south of the A12.
	Regional trails and routes (e.g. promoted circular walks) located close to communities likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use and have limited potential for substitution.	Regional cycle route 50; Blackwater Rail Trail; public footpath 25 (Kelvedon).
	At-grade crossings with 8,000 - 16,000 vehicles per day and/or routes with limited accessibility provision.	Waltham Road, Boreham; Inworth Road, Feering.
Medium	Residential property and housing:	Braintree local authority (13.4% increase in households projected mid-2018 to mid-2043) (ONS data).

Value and sensitivity	Description	Examples within the study area
	• Existing housing or land allocated for housing located in a local authority area where the number of households is expected to increase by between 6% and 15% by 2041 (ONS data) • Isolated houses and very small hamlets (<1ha and/or <30 houses) within study area	Examples throughout study area.
	Community land and assets supporting the health and functioning of the community where: • alternatives are available only by travel to adjacent communities or neighbourhoods • they are regularly used by the community	Public houses; neighbourhood playgrounds; local shops (where others exist in the settlement).
	Small employment sites and land allocated for employment (circa <1ha).	Examples throughout study area.
	Agricultural land holdings: • Areas of land in which the enterprise is partially dependent on the spatial relationship of land to key agricultural infrastructure, and access is required on a reasonably frequent basis (e.g. monthly) For example, small agricultural land holdings requiring access to limited areas of land and with potential for relocation.	To be identified through further EIA process.
	Public rights of way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys.	Several public rights of way and other routes throughout study area.
Low	Residential property and housing: • Proposed housing development on unallocated sites providing housing with planning permission, or in the planning process.	Examples throughout study area.

Value and sensitivity	Description	Examples within the study area
	Community land and assets where: • alternatives are available at a local level in the wider community • level of use is infrequent • land and assets are used by a minority in the community	Area of greenspace south of Gershwin Boulevard and Oliver's Drive, Witham.
	Agricultural land holdings: • Areas of land where the enterprise is not dependent on the spatial relationship of land to key agricultural infrastructure, and access is required on an infrequent basis (monthly or less frequent)	To be identified through further EIA process.
	Routes which have fallen into disuse through past severance and/or which are scarcely used because they do not offer a meaningful route for either utility or recreational purposes.	Footpath 21 (Boreham); footpaths 24 and 25 (Boreham); bridleways 23 and 45 (Boreham), footpath 15 (Feering).
Negligible	Community land and assets which are very infrequently used.	None identified.
	Agricultural land which is infrequently used on a non-commercial basis.	Examples in study area to be identified through further EIA process.

13.8 Potential impacts

Construction

Land use and accessibility

Residential property and housing

13.8.1 Construction of the proposed scheme would lead to permanent loss of land from residential premises, and although efforts will be made to limit the impacts on residential dwellings, demolition of a limited number of buildings within the footprint of the proposed scheme would be required.

13.8.2 Temporary disruption of access to residential dwellings from sections of the A12 undergoing online widening, or where improvements to existing junctions or the construction of new junctions is proposed, would also occur.

Community land and assets

13.8.3 Construction of the proposed scheme would cause temporary disruption of access to community facilities from sections of the A12 undergoing online widening, or where improvements to existing junctions or the construction of new junctions is proposed.

13.8.4 There is also potential for temporary or permanent land take from community facilities, for example where construction activities may require access to a car park for a construction compound, or to accommodate a construction activity. Construction activities could also cause disturbance as a result of construction noise and vibration, which could affect community activities which take place in certain venues, for example schools, churches and community meeting places.

Development land and business

13.8.5 There would be temporary and permanent loss of some areas of land allocated for employment and commercial premises to allow for the construction footprint of the proposed scheme, particularly within Witham and Feering.

13.8.6 Construction of the proposed scheme would cause temporary disruption of access to businesses from sections of the A12 undergoing online widening, or where improvements to existing junctions or the construction of new junctions is proposed.

13.8.7 There would also be potential disruption to businesses from construction noise and vibration.

Agricultural land holdings

13.8.8 There would be permanent and temporary loss of agricultural land from the construction footprint of the proposed scheme, including land required for borrow pits.

13.8.9 Temporary severance or access difficulties to some agricultural land holdings would also occur, particularly where new offline sections of road are proposed.

Walkers, cyclists and horse riders

13.8.10 The construction footprint of the proposed scheme, including associated haul routes, would require the diversion and temporary closure of PRoW throughout the study area, with associated impacts on local outdoor recreation and access. There would also be loss of amenity during construction from factors such as dust, noise and visual intrusion.

Public transport

13.8.11 During construction there is a likelihood of disruption to bus services due to traffic management and construction activities. Specifically, works to junction 19 could affect services on bus routes 40, 71, 71A, 71C, 71E, 71X, 73, and 73A. Works to junction 25 could affect services on routes 15, 70, 71, 71A, 71C, 71E, 71X, 82, 82A, 133, 901, 903, and 910. Some of these services are school buses, while another services Stansted Airport. Works in the vicinity of junction 21 are likely to have impacts on route 621.

13.8.12 The proposed replacement of the Bury Lane Overbridge and the Station Road Overbridge would temporarily sever access to Hatfield Peverel railway station for residents in Hatfield Peverel south of the A12.

Human health

Noise, air and other environmental pollutants

13.8.13 Potential impacts of construction noise and dust may cause public concern and annoyance. There is also a risk of sleep disturbance due to construction noise, particularly where night-time working is involved. The routing of construction vehicles and potential traffic congestion and emissions may also cause public concern, which could affect community wellbeing throughout the construction period.

Community severance and social networks

13.8.14 Medium or long-term disruption to access, or permanent loss of access along existing routes connecting settlements bisected by the existing A12 such as Hatfield Peverel and Rivenhall End, could increase perceptions of community severance in these communities. Similar impacts would be felt by smaller communities located south of the existing A12 such as Inworth, Wickham Bishops, Nounsley, Messing and Easthorpe if access routes into Chelmsford, Witham, Kelvedon and Marks Tey or Colchester are disrupted in the medium to long term, or are permanently lost.

Access to facilities, services and employment

13.8.15 Temporary or permanent land take from existing and proposed residential properties, commercial enterprises, agricultural land holdings or community assets, such as churches, where required to facilitate construction of new highway infrastructure, could compromise the ability of local planning authorities to meet predicted future housing needs, or reduce the availability of employment opportunities within certain sectors in the local area.

13.8.16 There is potential for social value initiatives, employment and skills training to be provided as part of the construction of the proposed scheme.

Active travel

13.8.17 Disruption in access along routes used by walkers and cyclists within and between settlements to access places of employment or study would reduce rates of active travel in affected communities. Those communities most likely to be affected would be as identified under ‘Community severance and social networks’ above.

Physical and visual access to greenspace and outdoor recreation

13.8.18 Medium or long-term disruption to access along routes connecting settlements located along the existing A12 to areas of open space, PRoW networks and lanes used by WCH for recreational purposes would have a negative effect on physical and visual access to greenspace and opportunities for outdoor recreation. Medium to long-term or permanent loss of areas of publicly accessible greenspace within settlements, and of garden space, trees and shrubs surrounding the existing highway infrastructure within these settlements, would also have a negative effect.

Road traffic collisions

13.8.19 Traffic management measures, diversions and presence of construction vehicles on the highway may increase risk, or the perception of risk, of collisions for vehicle drivers, pedestrians and cyclists.

Operation

Land use and accessibility

Residential property and housing

13.8.20 Since land and property loss would occur at the construction stage, this is not considered to be an operational effect even though it would be permanent.

13.8.21 Impacts on access to residential areas or individual properties would occur as a result of changes in local road alignments, de-trunking of the existing A12 and changing traffic patterns as a result of the new A12 road alignment.

Community land and assets

13.8.22 Potential impacts on community land and assets would be similar to impacts on residential property and housing and would arise from changes in accessibility related to local road alignments and traffic conditions.

Employment land and business

13.8.23 Potential impacts on employment land and businesses would be similar to impacts on residential property and housing, and would arise from changes in accessibility related to changes in local road alignments and traffic conditions.

13.8.24 For those businesses where direct access would be removed from the A12, in particular along sections of the existing A12 that would be de-trunked between junctions 22 and 23 and junctions 24 and 25, there is a risk that there could be a loss of trade.

Agricultural land holdings

13.8.25 There is potential for permanent severance of some agricultural land holdings which consist of land located to the north and south of the existing A12 or proposed bypass routes.

Walkers, cyclists and horse riders

13.8.26 Potential beneficial impacts on access for WCH would occur where the proposed scheme addresses issues of past severance, poor accessibility and inadequate cycleway and footway provision. Improvements in access would help more people access public transport hubs and bus stops. Improvements to footway and cycleway provision would improve amenity for active travellers, for example through increasing segregation from fast traffic and HGVs.

13.8.27 PRoW or other routes temporarily severed by the proposed scheme would be reinstated, with no new operational severance. Diversions and closures of existing PRoW would be required with new routes being provided to access existing or proposed new crossing points.

Public transport

13.8.28 The proposed scheme would bring opportunities to improve public transport provision by improving the accessibility of bus stops on side roads at the various junctions of the proposed scheme and to railway stations located within Hatfield Peverel and Marks Tey.

Human health

Noise, air and other environmental pollutants

13.8.29 The proposed new highway alignment and potentially redirected traffic flows may alter the exposure of people in local communities to traffic-related noise and air pollution. No change in exposure to other forms of pollutant are considered likely.

Community severance and social networks

13.8.30 The proposed scheme has the potential to reduce perceived community severance by drawing traffic away from settlements bisected by the existing A12 such as Rivenhall End, but also to increase community severance if traffic flows on residential roads within settlements rise as a result of changing alignments and junction arrangements in combination with induced demand.

Access to facilities, services and employment

13.8.31 Changing traffic patterns may alter the accessibility of facilities and services including schools and areas of urban greenspace, and could also affect the continued viability of hospitality and retail businesses located on the existing A12 that are dependent on high levels of passing trade, reducing local employment opportunities in certain sectors.

Active travel

13.8.32 Improvements in access to public transport and to walking and cycling provision would support increased rates of active travel within local communities. However, changing traffic patterns may also positively or negatively affect the amenity of active travel routes.

Physical and visual access to greenspace and outdoor recreation

13.8.33 The reconnection of previously severed PRoW would improve access to greenspace and outdoor recreation opportunities. However, changes in highway alignment and junction arrangements also could reduce visual access to greenspace from within settlements and from recreational routes used by WCH.

Road traffic collisions

13.8.34 Proposed improvements to WCH infrastructure may encourage more active travel. There is concern that the promotion of active travel modes would lead to greater increases in casualties among pedestrians and cyclists. However, evidence suggests that there is ‘safety in numbers' for walkers and cyclists. Motorists appear to adjust their behaviour in the presence of more people walking and cycling, which means the relationship between pedestrians or cyclists’ exposure and casualties is not linear (Jacobson, 2003). The improved standard of highway infrastructure should also improve safety.

13.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

13.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3 details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

13.9.2 Embedded mitigation relevant to this aspect includes the following:

- The design for all elements of the proposed scheme has limited land take from existing residential, commercial, community and agricultural assets, as far as practicable
- New and improved provision for WCH as shown on Figure 2.1 and described in Chapter 2: The scheme
- Provision of earth bunding at six locations and noise barriers at eight locations to mitigate adverse noise effects as described in Section 12.9 of Chapter 12: Noise and vibration
- Measures to reduce the visual impact of the proposed scheme as described in Section 8.9 of Chapter 8: Landscape and visual
- Re-provision of accesses to residential properties, commercial premises and agricultural land holdings as described in Section 2.4 of Chapter 2

13.9.3 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Standard mitigation

13.9.4 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect include the following:

- The construction activities would be planned to limit requirements for temporary PRoW, footway and cycleway closures or diversions. Temporary diversion routes would be well-signed and would be suitable for all potential users of the existing provision (for example, where closure of a bridleway is required, the diversion route provided would be suitable for WCH).
- Signage for temporary and permanent diversions of PRoW and other routes used by walkers and cyclists.
- Traffic management measures would be implemented to ensure safe access along roads within the site where necessary. The construction works would be phased such that disruption to access is minimised, with full road closures restricted to nights and weekends.

- Standard mitigation measures identified in Chapter 12: Noise and vibration, including preparation of an Environmental Management Plan (EMP) which would include the relevant construction noise criteria and any monitoring proposals for the construction period, and implementation of Best Practicable Means (BPM) in accordance with British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (British Standards Institution, 2014a).
- Standard mitigation measures identified in Chapter 6: Air quality, including use of best practice measures to control dust emissions during construction.
- Standard mitigation measures identified in Chapter 8: Landscape and visual, which would reduce the visual impact of construction activities required for the proposed scheme.
- All land acquired on a temporary basis would be fully reinstated.

13.9.5 Standard mitigation will be included in a first iteration of the EMP which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5).

13.9.6 The issue of public concern and mental health can be mitigated through the adoption of good practice engagement and consultation through the pre-application and construction stages. The results of this pre-application consultation will be carefully considered to identify the key areas of concern and how these concerns can be managed. This would help with protective factors for mental health such as giving communities enhanced control and facilitating participation.

Additional mitigation

13.9.7 Additional mitigation relevant to this aspect during the construction and operational phase of the proposed scheme are set out below.

Construction

- Additional mitigation identified in Chapter 12: Noise and vibration, and Chapter 6: Air quality, including the use of Design for Manufacture construction solutions.
- Liaison with Chipping Hill Primary School regarding measures to minimise noise disruption associated with the adjacent construction compound and measures to minimise road traffic collision risks associated with worker vehicles accessing the construction compound from Hatfield Road or residential areas to the north. These would likely include restrictions on noisy activities at key times, and restrictions on access to and from the compound at the beginning and end of the school day.
- Siting of construction laydown area which currently conflicts with Blackwater Lane and footpath 101 (Witham) to be amended to ensure access along these routes can be maintained during construction.

- Liaison with owners of Prested Hall, Feering, regarding the alignment and landscaping of the proposed cut off ditch required within these premises, and also the timing of construction works which should avoid the most sensitive times of year (i.e. peak wedding season).
- Limit land take from Coleman's Reservoir by reducing the construction working area such that the reservoir is not directly impacted on.
- Realign the provisional Order Limits to avoid land take from the north-western corner of The Matchyns, Rivenhall End.

Operation

- Re-provisioning of access to commercial premises located immediately south of the eastern dumbbell of junction 19 including Boss Hoggs, Sani's Motors, and Boreham House from the B1137 Main Road via the proposed attenuation pond access track.
- Re-provisioning of access to D's Café Diner immediately south of junction 20b and realignment of embankments to limit land take requirements from the parking area.
- Ensuring the design accommodates access requirements from the B1024 London Road as required by planning application 17/01979/OUT (submitted, Braintree District Council).
- Re-provisioning of access to General's Farm, Boreham, from the B1137 Main Road via the proposed attenuation pond access track.
- Culverting proposed cut-off drain which conflicts with footpath 34 (Hatfield Peverel).
- Realignment of footpath 15 (Feering) and footpath 18 (Feering) along the proposed Prested Hall/Threshelfords access road.
- Realignment of footpath 26 (Kelvedon) to join footpath 2 (Great Braxted) should the planned flood alleviation works which intersect the route be expected to frustrate or prevent access on a regular basis.
- Signage at appropriate locations on the new trunk road junctions directing travellers to hospitality and petrol stations on the de-trunked A12.

Enhancement

13.9.8 The proposed noise barriers in Hatfield Peverel (south side of A12) and Witham (Pantile Close, near Maldon Road) are considered enhancement as they reduce noise levels at locations where no significant adverse noise effect is assessed (see Section 12.9 of Chapter 12: Noise and vibration, for further detail).

13.9.9 Further opportunities for enhancement will be explored, such as the potential to connect with wider environmental initiatives, for example the Essex Green Infrastructure Strategy (Essex County Council, 2020a).

13.9.10 Potential for social value initiatives during construction will be explored between the Contractor and Essex County Council. Appropriately targeted initiatives may help to address health inequalities by offering opportunities to vulnerable or disadvantaged groups.

13.10 Assessment of likely significant effects

Construction

Land use and accessibility

Residential property and housing

13.10.1 The preliminary assessment has identified construction impacts on a total of 471 residential properties. In the case of 460 of these properties, the effects would be temporary and short-term. They relate to short-term occupation of parts of the residential drives or gardens to facilitate construction, or areas where access to residential properties is likely to be temporarily disrupted due to construction activities.

13.10.2 The community most affected in terms of construction impacts on residential land use is Hatfield Peverel. This includes impacts on residential areas north of the A12, where access to 415 properties (including 245 homes currently under construction) would be temporarily impacted by the Bury Lane Overbridge and Station Road Overbridge replacements.

13.10.3 Permanent land use impacts have been identified on 11 residential properties (see Figure 13.3). Of these, the most notable impact would be the demolition of two residential properties near Rivenhall End to accommodate the footprint of the proposed scheme. As a consequence, the viability of residential land use in this location would be permanently lost. The potential effects of this in terms of health and wellbeing of people in the affected households are discussed in the 'human health' assessment below.

13.10.4 For seven of the properties that would experience permanent impacts, two would experience negligible impacts as only a slight alteration to a boundary feature is anticipated which would not be noticeable to the context of residential land use. For the remaining properties permanently affected, the impacts would relate to a reduction of garden area or encroachment on drives or boundaries, which would be noticeable but unlikely to affect the overall integrity of residential use of the properties.

13.10.5 Table 13.10 identifies residential property and housing affected on a community by community basis and provides a description of the impacts and assigned magnitude of impact. Note that only impacts of minor magnitude and above have been reported in this PEIR, to keep the table more concise.

13.10.6 In terms of overall significance of effect on residential property and housing as a resource, the proposed scheme would have an impact on 5% of the residential properties within the study area (471 of the 9,509 dwellings within 500m). However, only 0.02% of the existing residential land use would be lost to the proposed scheme (i.e. two houses), which is assessed as **slight adverse (not significant)** effect in terms of land use change.

13.10.7 It is noted that the permanent loss of two houses at Rivenhall End would have large significance for the individuals concerned, while the permanent loss of a sizeable part of a garden at Chase Hall would compromise the amenity of the property. The assessment has considered the issue of significance in relation to overall effects on residential property and housing as a resource for the population in the study area, rather than effects on individuals. The scale of impacts is not considered sufficient to require mitigation over and above the compensation that would be provided to individuals who would experience loss of land or property due to the proposed scheme.

Table 13.10 Construction impacts on existing residential land and housing

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
Hatfield Peverel				
Bury Lane north of the A12 (including new housing developments)	High	Likely temporary loss of access for residential properties on the north side of the A12 during Bury Lane Overbridge Replacement activities. This would have an impact on 12 existing residential properties off Bury Lane, and two sites with planning permission for 50 dwellings each (planning references: 17/00973/FUL and 19/01803/FUL), one of which is currently under construction. Temporary reduction of access to residential properties is considered likely during the bridge replacement itself, as well as occasional, intermittent disruption to access due to construction activities at this location. Traffic would need to divert through a new route to Station Road associated with the planning applications. Long-term residential land use would remain viable.	112	Minor adverse
Bury Lane south of the A12	Very high	Likely short-term occupation of part of the drive and garden associated with a single residential property immediately south of Bury Lane Overbridge to enable construction activities associated with widening of the A12 in this location. This may compromise the use of elements of this residential property in the short term, such as access to outbuildings, and approximately 50% of the garden for the duration of works in this location. Full land-use would be anticipated to be restored on completion of the works.	1	Minor adverse

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
Station Road	Very high	Likely temporary loss of access for residential properties on the north side of the A12 during Station Road Overbridge Replacement activities. This would have an impact on the entire existing residential area (158 homes) in Hatfield Peverel north of the A12, and a further 145 new homes currently under construction at the former Arla Dairy site (planning reference: 19/01786/VAR). While alternative access via Bury Road and the new housing sites off Bury Lane would be feasible for motor vehicles, access on foot and by bicycle would be considerably longer (>500m). Temporary prevention of access to residential properties is considered likely during the bridge replacement itself, as well as occasional, intermittent disruption to access due to construction activities at this location, however, long-term residential land use would remain viable.	303	Minor adverse
Gleneagles Way, The Street	Very high	Permanent land take from the edge of one property's garden (<7.5% total garden area) to accommodate realignment of the B1137 and shared-use footway/cycleway associated with the new J21. This permanent impact would have a marginal impact on the residential use of this land.	1	Minor adverse
The Street	Very high	The provisional Order Limits appear to impact on one residential property and occupy the majority of its garden. Discussions with the engineering designers have not indicated that this land is required for any permanent proposals and that no direct impact on the house is anticipated. It is not thought that this land would be required during construction. For this preliminary assessment it is assumed that the property would not be permanently impacted on, but that some impact on the garden during construction may occur as a worst case (for example to allow access to the highway boundary). This assessment will be clarified for the Environmental Statement.	1	Minor adverse

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
The Street	Very high	Potential direct impact on boundary features of one residential property to accommodate realignment of the B1137 associated with the new J21. This permanent impact would have a marginal impact on the residential use of this land.	1	Minor adverse
Witham				
Maldon Road	Very high	Permanent land take from parts (<20%) of gardens to accommodate embankments associated with widening of the A12 at this location. This may result in loss of elements of residential use of gardens but overall function of garden land use would not be compromised.	3	Minor adverse
Maldon Road	Very high	Likely short-term occupation of parts (<50%) of residential drives and gardens to accommodate construction haul routes and access for construction activities associated with widening the A12 at this location. This may compromise the use of elements of this residential property in the short term, such as access to outbuildings and up to approximately 50% of the gardens for the duration of works in this location. The majority of garden land use is anticipated to be reinstated post-works (note three of these properties are those affected by permanent land take impacts identified above).	5	Minor adverse
Rivenhall End				
London Road	Medium[1]	Demolition of residential properties (houses) required to accommodate the footprint of the proposed scheme. This would result in a permanent loss of this residential land use.	2	Major adverse

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
Kelvedon and Feering				
New Lane	Medium[1]	Potential permanent direct impact on boundary features of residential properties due to construction of a new roundabout with New Lane and the B1024 London Road. Impact is likely to involve marginal encroachment to the edge of front gardens/drives. This permanent impact would have a marginal impact on the residential use of this land.	2	Minor adverse
Marks Tey				
Chase Hall, London Road	Medium[1]	Permanent land take from a portion of the garden (<50% garden area) to accommodate the tie in from the new offline A12 alignment with J25. This would result in permanent loss of garden elements, compromising the quality of the residential land use for this individual property.	1	Moderate adverse

Notes:

Impacts on 471 residential properties were identified during the preliminary assessment. Of these impacts, 39 were assessed as negligible and have been excluded from this table.

[1] Medium sensitivity assigned on basis that this is an isolated and/or relatively small area of residential land use.

[2] This is an approximate number based on aerial imagery and mapping.

13.10.8 Table 13.11 identifies land that is allocated for residential development and/or is currently subject to a submitted or approved planning application for residential development and would be subject to temporary or permanent land take and/or changes in access during construction of the proposed scheme. As set out in Table 13.11 the magnitude of impact on land allocations and planning applications associated with construction impacts is assessed as either minor adverse or negligible.

13.10.9 Overall, the significance of effect on the future availability of housing as a resource that could be affected by construction activities associated with the proposed scheme is assessed as **slight adverse (not significant).**

Community land and assets

13.10.10 0 sets out community assets which would be affected by land take or changes in amenity or access during construction of the proposed scheme. In most cases the impacts would be limited to a degree of temporary disruption to access, and also in some cases a very small degree of permanent land take which would not compromise the continued use of the identified sites either in the short term while construction activities are taking place or once the proposed scheme is operational.

13.10.11 A small area of open space located south of Oliver's Drive and east of Gershwin Boulevard within the Maltings area of Witham would be occupied during construction in the short to medium term, however, there are numerous other pockets of open space available to residents within this housing development which would remain readily accessible during this time.

13.10.12 Taking all identified impacts as described in 0 into account, the significance of effect on community land and assets is assessed as **slight adverse**.

Table 13.11 Construction impacts on residential allocations and planning applications

Application (status and local planning authority where relevant)	Sensitivity /value	Allocation (where relevant)	Description of impact	Magnitude of impact
Chelmsford				
09/01314/EIA (approved, Chelmsford City Council), located east of Chelmsford and north of the existing A12 3,600 dwellings, business park, retail, hotel, leisure, education and community facilities. Radial distributor road and public transport provisions.	Very high	N/A	A very small degree of permanent land take would be required to accommodate the new Payne's Lane footbridge, and an additional small degree of temporary land take to accommodate a construction compound and utilities diversions within an area identified for commercial use (Beaulieu Exchange) and for housing (Beaulieu Parklands). This development would be rephased to accommodate construction of the proposed scheme, however the proposed scheme would not adversely affect the viability of this development**.**	Minor adverse
Hatfield Peverel				
19/01803/FUL (approved, Braintree District Council). Bury Farm, Bury Lane Hatfield Peverel, Essex. 51 dwellings	Very high	Policy LPP 31 Comprehensive Redevelopment Area – Land between A12 and GEML, Hatfield Peverel. Up to 285 residential dwellings across three sites.[1] (Braintree Publication Draft Local Plan, 2017)	None – there would be no direct impacts on this site	No change

Application (status and local planning authority where relevant)	Sensitivity /value	Allocation (where relevant)	Description of impact	Magnitude of impact
Witham				
19/01896/OUT (submitted), Braintree District Council). Land North of Woodend Farm, Hatfield Road, Witham, Essex. 400 dwellings, care home and day nursery.	Very high	Policy LPP 23 Strategic Growth Location – Wood End Farm, Witham. Up to 450 homes and early years and childcare nursery. Allocation sites HATF 315. (Braintree Publication Draft Local Plan, 2017)	Small degree of permanent land take required to enable construction of the new J22, and moderate degree of short to medium-term land take to facilitate construction. The application makes provision for the land required within the development application site which also falls within the provisional Order Limits to be landscaped, with the landscaping maintained by the development except on land required by Highways England.	Negligible adverse
Feering				
19/01222/REM (submitted, Braintree District C) Bury Farm, Bury Lane, Hatfield Peverel, Essex. 165 dwellings	Very high	Policy LPP 22 Strategic Growth Location – Land at Feering. Allocation sites FEER 232 and FEER 233. (Braintree Publication Draft Local Plan, 2017)	19/01222/REM applies to a proportion of the FEER 233 allocation site. The proposed scheme includes provision for access to both FEER 232 and FEER 233 from the de-trunked A12, including shared-use footway/cycleway along the proposed access roads. A small degree of permanent land take would be required within FEER 233 (but not within 19/01222/REM), predominantly along the south-eastern boundary of the site but with a larger section south of the existing access road from Prested Hall required to accommodate environmental mitigation landscape planting. There would be temporary disruption to access along the access track between Prested Hall and Threshelfords Business Park/the site of 19/01222/REM.	Minor adverse

Application (status and local planning authority where relevant)	Sensitivity /value	Allocation (where relevant)	Description of impact	Magnitude of impact
			The permanent land take required is not anticipated to compromise the viability of the site for the purposes that it is allocated, and it may be possible to incorporate the attenuation pond and surrounding landscaping into the development masterplan as a recreational feature.	
Kelvedon				
17/00679/OUT (submitted, Braintree District Council). Land North East Of Inworth Road Feering. 200 dwellings, school health centre, employment area and local retail area	Low	N/A	Limited information is currently available regarding the construction phasing for this development and for the proposed scheme. Therefore, as a worst-case assumption this assessment presumes that temporary land take would be required from the south-eastern part of the site intended for use as employment land, and that this would delay but not prevent this element of the development being built out.	Negligible

[1] The remainder of the allocated site was developed under planning application 19/00494/REM which is currently under construction.

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Table 13.12 Construction impacts on community land and assets

Site or asset	Sensitivity /value	Description of impact	Magnitude of impact
Hatfield Peverel			
Hatfield Peverel Rail Station, Station Road, Hatfield Peverel	High	Short-term disruption to access during construction while Station Road overbridge is demolished and replaced – assessed in Table 13.15. No direct impacts on the station facilities are anticipated.	(see Table 13.15)
Witham			
Chipping Hill Primary School	High	The construction compound located adjacent to the school site has potential to generate noise and risk of road traffic collisions as a result of construction worker vehicles and plant accessing the proposed compound site, however with the additional mitigation measures identified in Section 13.9 in place the magnitude of impact is assessed as minor adverse.	Minor adverse
King's Centre, west of Witham and north of the A12 (church)	High	Short-term disruption to access while widening works to Hatfield Road are completed.	Negligible adverse
Church of Jesus Christ Latter Day Saints, Pantile Close, Witham	High	Short-term occupation of a proportion of the car parking area to facilitate construction of a retaining wall.	Negligible adverse
Area of open space on the southern border of the residential area south of Maltings Lane, Witham	Low	Short to medium-term land take to accommodate a construction compound and haul route. Land occupied on a temporary basis would be fully reinstated on completion of works.	Moderate adverse
Woodland areas to the north of the A12 near Brain Bridge, Witham accessed via footpath 101 (Witham)	Medium	A small degree of short-term land take and disruption to access to enable utilities diversions. Land occupied on a temporary basis would be fully reinstated on completion of works.	Minor adverse

Site or asset	Sensitivity /value	Description of impact	Magnitude of impact
Whetmead Nature Reserve, off Blackwater Lane, Witham	Medium	Very small degree of permanent land take along the north-western boundary of the site to facilitate road widening works. Additional short to medium-term land requirement to accommodate site compounds and a haul route. Land temporarily occupied would be fully reinstated on completion of works. Noise and views of construction works would reduce the amenity of this recreational area for users.	Minor adverse
Kelvedon			
Essex County Fire and Rescue Service Headquarters, Kelvedon Park (east of Rivenhall End and south of the A12)	High	Small degree of short to medium-term land take to facilitate construction which would not interfere with the functioning of this community service. Access to the facility would be maintained throughout construction, however small-scale diversions may be required. Land occupied on a temporary basis would be fully reinstated on completion of works. Direct access to the A12 would be permanently removed.	Negligible adverse
Marks Tey			
Marks Tey Parish Hall, Marks Tey Playground and Marks Tey Skatepark all located off the Old London Road south-west of J25	High	These facilities are accessed from the Old London Road at Marks Tey and temporary disruption to access during construction is likely. Construction works would be visible and audible to users of the playground and skatepark. Even considering the context of these facilities, which are located adjacent to the existing J25, users would experience a noticeable reduction in amenity during construction.	Minor adverse
Marks Tey Railway Station, Station Road, Marks Tey	High	Short-term disruption to access onto the A12 northbound and southbound during construction of the new J25. Access from the north via Marks Tey bridge would be unimpeded.	Minor adverse

Site or asset	Sensitivity /value	Description of impact	Magnitude of impact
Queensbury Avenue Playground	High	Road widening to the north, and construction of the attenuation pond and associated access to the west of this facility are likely to be audible to users, but existing retained vegetation would screen views of the construction activities.	Negligible adverse

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Development land and business

13.10.13 Table 13.13 identifies commercial enterprises which would be affected by land take or changes in amenity or access during construction of the proposed scheme to an extent that the viability of the current land use may be affected either on a temporary or permanent basis. The proposed scheme would necessitate demolition of one premises (Barconn Limited, located off the B1023 Inworth Road at Feering) In addition, three commercial enterprises would experience a level of temporary land take or disruption to access during construction so that the continued viability of these sites is compromised.

13.10.14 In addition to those identified in Table 13.13 and discussed above, a further 19 commercial enterprises have been identified as experiencing a lesser degree of temporary or permanent land take and/or disruption to access during construction (see Figure 13.3) which, while potentially undesirable, is not anticipated to compromise the continued viability of the site for the current land use (i.e. minor adverse or negligible magnitude of impact assessed). Of these 19 sites, of particular note are:

- The Kingswood Gateway area of Witham (including Mayfield Nursery, Josephs Barn, Telchristie Cars, Balloons and Laughter, and The Silk Flower Shop) is currently subject to a planning application for mixed use and commercial development (19/01896/OUT, Braintree District Council) which is anticipated to be built out prior to commencement of construction of the proposed scheme, and therefore the proposed scheme design has not allowed for access to these sites.

- The offline section of the proposed scheme at Rivenhall End bisects Coleman's Farm Quarry (off Braxted Lane south the existing A12 at Rivenhall End), and in respect of this potential impact, the proprietor of the quarry is applying for planning approval to increase the area of mineral extraction (to reduce the risk of mineral sterilisation by the road development), amend the phasing of the excavation, and amend the quarry restoration plan, to more easily accommodate the proposed scheme.

13.10.15 Table 13.14 identifies land parcels affected by the proposed scheme that are allocated for employment purposes within a local development plan and/or that are currently subject to a planning application for commercial use which is of sufficient scale that it is considered likely to provide new employment opportunities for more than 10 people. While there are a number of developments which may require small-scale alterations to the proposed layout or phasing of development to accommodate the proposed scheme, or where construction works may temporarily impact on access, it is not anticipated that the proposed scheme would affect these proposals to an extent that the planned land use is compromised.

13.10.16 Taking into account the anticipated impacts on existing commercial enterprises and land allocations and planning applications that would support employment in the future, as set out in Table 13.13 and Table 13.14 and described above, the overall significance of effect on development land and business is assessed as **slight adverse** as only five existing or proposed commercial enterprises within the study area would be compromised by the proposed scheme to the

extent that their continued viability is at risk. Similar to the assessment of impacts on residential housing, this assessment has considered the issue of significance on businesses in relation to overall effects on land which currently, or has potential to, support employment across various sectors within the study area, rather than effects on individual businesses. The scale of impacts is not considered sufficient to require mitigation over and above the compensation that would be provided to individual businesses who would experience loss of land or property due to the proposed scheme.

Agricultural land holdings

13.10.17 Based on current understanding of land ownership and tenancy arrangements across the study area, there are currently fourteen agricultural land holdings across Chelmsford, Witham, Rivenhall End, Kelvedon, Feering and Marks Tey which have been identified as being affected by the proposed scheme in terms of temporary or permanent land take and/or changes in access. Each of these agricultural land holdings is fully or predominantly arable, although at least two also host farm diversification businesses. In addition, there are a further:

- five tenanted plots of land used for arable cropping for which tenant details have not yet been identified
- seven plots of land of varied use (grazing, arable, livestock) where the land ownership/tenancy is unknown
- two plots of land where the current land use is uncertain

13.10.18 Agricultural land holdings likely to experience the greatest magnitude of impact resulting from construction-related activities are those which:

- are located along the offline sections of the proposed scheme at Rivenhall End and between Feering and Marks Tey, such as Coleman's Farm and Wishing Well Farm
- straddle the existing A12, such as Lord Rayleigh Farms, Coleman's Farm and Highfield Farm
- are located adjacent to the proposed junction 21 or 22 or where large borrow pits or attenuation ponds are proposed, such as Coleman's Farm, Highfields Farm, Woodend Farm and Dengie Farm

13.10.19 Further information regarding current ownership and usage of agricultural land within the provisional Order Limits is required to assess the sensitivity of the identified agricultural land holdings, and to understand the impacts of the proposed scheme on the continued viability of the existing land uses. The additional information will be sought through consultation with the identified landowners and other sources over the coming months. This information will inform the assessment of the impacts on agricultural land holdings which will be presented within the Environmental Statement for the proposed scheme.

Table 13.13 Construction impacts on commercial enterprises (where magnitude of effect moderate or major adverse)

Site or asset	Sensitivity/value	Description of impact	Magnitude of impact
Chelmsford			
Boss Hoggs, immediately south of J19	Medium	Direct access from J19 would be lost permanently, with short to medium-term disruption to access to the site during construction. A moderate proportion of the parking area would be acquired on a temporary basis to accommodate a haul route, with a very small proportion acquired on a permanent basis to enable construction of the new attenuation pond access.	Moderate adverse
Hatfield Peverel			
D's Café Diner, The Street	Medium	The embankments of the widened J21 off-slip encroach upon approximately 20-30% of the parking area.	Moderate adverse
Witham			
Coleman's Cottage Fishery, off Little Braxted Lane south of Witham	High	Short to medium-term land take where required to accommodate construction works would preventing access to the northern side of the lake. Noise from construction works would reduce the amenity of the site. There would be temporary disruption to access during construction as a result of the demolition of Coleman's Bridge. Access from Witham would be re-provided through the new J22 via Little Braxted Lane Overbridge.	Moderate adverse

Site or asset	Sensitivity/value	Description of impact	Magnitude of impact
Feering			
Barconn Limited, off the B1023 Inworth Road at Feering	Medium	This site falls within the footprint of the highway widening proposals at this location and would be permanently acquired.	Major adverse
Prested Hall, Feering	High	The Proposed Scheme would sever the existing access to Prested Hall, with access onto the de-trunked A12 provided via the new Prested Hall/Threshelfords overbridge. Temporary disruption to access likely during construction, and temporary land take required to facilitate construction of a new cut-off ditch. Construction works to the new trunk road and access would be visible and audible from Prested Hall, which given the nature of the business (wedding venue, amongst other usages), would be sensitive to construction noise.	Moderate adverse

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Table 13.14 Construction impacts on employment allocations and planning applications

Application (where relevant)	Sensitivity	Allocation (where relevant)	Description of impact	Magnitude of impact
Witham				
20/01754/FUL (approved, Braintree District Council). Junction of Wheaton Road and Freebournes Road, Witham. Two warehouse units (B2, B8 uses).	High	N/A	Very small degree of short to medium-term land take along the western and northern boundaries of the site, within areas allocated for landscaping and/or car parking.	Minor adverse
ESS/11/20/BTE (submitted, Essex County Council). Located off Braxted Lane, south of the existing A12 at Rivenhall End. Erection and use of a ready-mix concrete plant.	Very high	N/A	ESS/11/20/BTE, which has not yet been approved, relates to an application for the erection and use of a ready mixed concrete plant with ancillary facilities and would not be affected by the proposed scheme. There may be some short-term disruption to access along Braxted Lane while it is tied-in to the new J22 arrangement and while the realigned section of Braxted Road north of Coleman's Reservoir is tied-in to the existing route, however this is not considered likely to affect the viability of these applications.	Negligible

Application (where relevant)	Sensitivity	Allocation (where relevant)	Description of impact	Magnitude of impact
20/00128/OUT (submitted, Braintree District Council). North of Colchester Road, Witham. B1c, B2 and B8 uses with service yards and HGV parking.	High	Policy LPP2 Extension to Eastways Industrial Estate Allocation site: RIVE 362 Ch. 23300-23550 (Braintree Publication Draft Local Plan – Section 2, 2017)	A very small degree of land take on the south-eastern boundary of the site would be acquired permanently to accommodate the new J22, with an additional small area of land required on a temporary basis to facilitate construction. The proposed scheme would not impede access to the site, which would be achieved through an extension to Eastways. A number of indicative site plans have been submitted in support of the application, and depending on the option taken forward, very minor alterations may be required to accommodate the proposed scheme should the construction period for this development precede that of the proposed scheme. Depending on the final construction phasing of the development and the proposed scheme it may be possible to avoid changes to the current site layout proposals.	Negligible
21/00031/OUT (submitted, Braintree District Council). Land at Burghey Brook Farm, London Road, Rivenhall End. B2 and B8 uses with service yards and HGV parking.	High	Policy LPP2 Extension to Eastways Industrial Estate Allocation site: RIVE 363 Ch. 23300-23550	A very small degree of land take on the south-eastern boundary of the site where landscaping is proposed would be acquired permanently to accommodate the new J22, with an additional small area of land required on a temporary basis to facilitate construction.	Negligible

Application (where relevant)	Sensitivity	Allocation (where relevant)	Description of impact	Magnitude of impact
Kelvedon				
N/A	High	Policy LPP4 Kelvedon Park Allocation site: RIVE 364 Ch. 25025-25325 (Braintree Publication Draft Local Plan, 2017)	Small degree of short-term land take from the north-western boundary to facilitate construction of new access onto the B1024 London Road and new footbridge. Very small degree of permanent land take from the north-western corner of the site for a new attenuation pond access track.	Negligible
Marks Tey				
200388 (submitted, Colchester District Council). New/replacement buildings for employment purposes (B1, B2 and B8).	Low	N/A	Potential for short-term disruption to access while de-trunking works are undertaken if the development is built out prior to construction of the proposed scheme.	Negligible

[1]Applications for mixed use sites 09/01314/EIA and 17/00679/OUT have been considered within Table 13.11.

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Walkers, cyclists and horse riders

13.10.20 Table 13.15 sets out effects on those routes used by WCH which are considered most sensitive to disruption or loss of access during construction as a result of their frequent use for commuting or vulnerable travellers. For example, groups such as the elderly, school children and people with disabilities, could be disproportionately affected by small changes in the baseline due to potentially different needs.

13.10.21 In addition to the routes identified in Table 13.15, WCH using many of the PRoW, lanes and minor roads which intersect the provisional Order Limits would experience temporary disruption to access and reduction in amenity during construction associated with noise and views of the construction works. Some routes which are outside the provisional Order Limits may also experience a reduction in amenity for a proportion of their length. The number of affected routes in the vicinity of each affected settlement is provided in Table 13.16, with routes affected by temporary disruption to access shown on Figure 13.3. The magnitude of impact for routes identified in Table 13.16 would be either minor adverse or negligible.

13.10.22 In summary, the significance of effect on routes used by WCH during construction is assessed as **slight adverse**.

Public transport

13.10.23 There would be short to medium-term disruption to access to the following bus stops during the construction period for the proposed scheme. No significant alteration to the permanent location of these stops would be required, however stops may be relocated or closed in the short term.

- Boreham House, Main Road, Chelmsford
- Eight stops on The Street, Hatfield Peverel
- Two stops on the B1389 Hatfield Road, Witham
- Two stops on the B1023 Inworth Road, Kelvedon
- One stop on the existing A12 at Kelvedon Park (permanently relocated onto the proposed new access road for Kelvedon Park)
- One stop on the B1024 London Road southbound off-slip of the existing junction 24
- Seven stops on the de-trunked A12 London Road between Feering and Marks Tey
- Two stops on the A12 London Road southbound on-slip at junction 25
- Two stops on Coggeshall Road, Marks Tey
- Two stops on the B1408 London Road at Marks Tey

13.10.24 It is assumed that the following bus stops would be permanently relocated to an appropriate position on Little Braxted Road, Witham, and the new Prested Hall/Threshelfords access road respectively:

- One stop on Little Braxted Road, Witham
- One stop on the B1024 London Road northbound on-slip to the existing junction 24

13.10.25 It is likely that temporary traffic management measures implemented during construction of the proposed scheme would affect the timetabling of routes which make use of affected roads; however, this would be a commercial matter dictated by bus operator scheduling.

13.10.26 Impacts on walking and cycling access to rail stations are described in Table 13.15. A temporary rail possession would be required to install the new footbridge at Payne's Lane (FB01); however, this would take place overnight and is not anticipated to affect rail timetabling.

13.10.27 The significance of effect on public transport during construction is assessed as **slight adverse**.

Table 13.15 Construction impacts on PRoW and other routes used by walkers, cyclists and horse riders

Route	Value	Description of impact	Magnitude of impact
Chelmsford			
Shared-use footway/cycleway through junction 19	High	Short-term disruption to access for up to ten months while widening works to J19 are completed.	Minor adverse
Hatfield Peverel			
Bury Lane	High	Short-term disruption to access while the existing overbridge is demolished and replaced, likely including a weekend closure. The bridge replacements would be phased so that either Station Road bridge or Bury Lane bridge is open at any one time. It is anticipated that the development currently underway on the former Arla site would be completed prior to construction of the proposed scheme and facilitate access between the two routes to the north of the A12. However, there would be a significant diversion (>500m) required for pedestrians and cyclists during the closure period.	Moderate adverse – while diversion of >500m is required, the diversion would only be required on a temporary basis.
Station Road	Very high	As per Bury Lane. In addition, provision has been included for a potential temporary pedestrian access route between the existing J20b and Hatfield Peverel rail station if required, which would run adjacent to the railway line north of the existing A12.	Moderate adverse – while diversion of >500m is required, the diversion would only be required on a temporary basis.

Route	Value	Description of impact	Magnitude of impact
B1137 The Street – Wellington Road Bridge	Very high	Temporary disruption to access while the existing Wellington Road Bridge is demolished and replaced with a footbridge and the retained section of this route is tied in to the new J21 arrangement. There are no alternative access points to the shared-use footway/cycleway along the northbound carriageway of the A12 between Hatfield Peverel and Witham within Hatfield Peverel.	Moderate adverse – this route would be closed on a temporary basis only.
Hatfield Road (B1389)	High	The new J21 would be constructed prior to demolition of Woodend Bridge, meaning access between Hatfield Peverel and Witham would be maintained throughout construction. There would be temporary disruption to access along the existing northbound off-slip and southbound on-slip while they are tied-in to the offline sections of the new J21 arrangement under weekend closures. Highly localised diversions would be required during construction of the new shared-use footway/cycleway on the retained section of the route. During the closure period, a diversion of >500m would be required in order to access the shared-use footway/cycleway along the existing A12.	Minor adverse – this route would be closed on a temporary basis only.
Little Braxted Lane (NCN Route 16)	Very high	There would be no significant disruption to access as the new footbridge suitable for use by walkers and cyclists (FB04) would be constructed in advance of demolition of Coleman's Bridge. Depending on detailed construction phasing, cyclists may be required to use the highway on Freebournes Road and Eastways while the existing footway is upgraded to a shared-use footway/cycleway.	Minor adverse

Route	Value	Description of impact	Magnitude of impact
Shared-use footway/cycleway between Hatfield Peverel (junction 20b) and Witham (junction 21)	High	Short-term disruption to access while the new J21 arrangement is tied-in to the B1137 and B1389 (approximately one month for each route, including two weekend closures).	Minor adverse
Witham			
B1018 Langford Road/Maldon Road	High	Likely worst-case scenario is that a weekend closure of the B1018 would be required to enable Oliver's Bridge to be demolished and reconstructed. The nearest alternative access across the A12 between Maldon and Witham for walkers and cyclists would be via the Blackwater Rail Trail at Benton Bridge, incurring a substantial (>500m) diversion, however given the short duration and weekend timing of the closure it is not anticipated that this diversion would significantly inconvenience users.	Minor adverse
Rivenhall End			
Oak Road	High	Short-term disruption to access while the new Braxted Road alignment is tied-in to the de-trunked A12 and a new footway connecting the new Braxted Road junction to J23. Alternative access onto the shared-use footway/cycleway along the northbound carriageway of the de-trunked A12 and to Rivenhall End south of the de-trunked A12, would be available via Henry Dixon Road.	Minor adverse
Henry Dixon Road	High	Short-term disruption while the realigned Braxted Road is tied-in to the far southern extents of this route. It is anticipated that access along this route and onto Oak Road for walkers and cyclists would be maintained while these works are undertaken.	Minor adverse

Route	Value	Description of impact	Magnitude of impact
Feering			
Shared-use footway/cycleway (northbound carriageway) and footway (southbound carriageway) between Feering and Marks Tey	High	Short to medium-term disruption to access while the new Prested Hall/Threshelfords overbridge and local road junction are tied-in to the existing A12, and while the new link road between Feering and Marks Tey is constructed.	Minor adverse
Marks Tey and Copford			
A120/Station Road	High	Short-term disruption in access while the new Marks Tey junction is constructed. It is anticipated that diversions would be put in place to ensure the route remains open throughout construction.	Minor adverse
A12 and A120 through J25 Marks Tey interchange	High	Medium-term disruption to access to footways along the A120 through J25. It is anticipated that small scale diversions would avoid the need for closures. Construction phasing would ensure the new Marks Tey footbridge is installed prior to demolition of the old structure such that access between the eastern and western areas of Marks Tey is maintained.	Moderate adverse

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Table 13.16 Less-affected routes used by walkers, cyclists and horse riders

Settlement	Temporary to medium-term disruption to access and reduction in amenity	Temporary to medium-term reduction in amenity only
Chelmsford	3	Up to 4
Boreham	11	Up to 3
Hatfield Peverel	10	Up to 12
Witham	11	Up to 11
Rivenhall End	8	Up to 7
Kelvedon	16	Up to 6
Feering	4	Up to 7
Marks Tey	17	Up to 20

Human health

Noise, air and other environmental pollutants

13.10.28 Construction of the proposed scheme would lead to noise and dust emissions, although these would be reduced through the use of best practicable means (noise) and best practice measures (dust) as identified in Section 13.9. The construction and excavation of borrow pits is likely to generate the greatest amount of dust emissions. The borrow pit sites are located either away from, or on the outskirts of settlements, meaning that those experiencing impacts would be limited to a relatively low number of individuals living in isolated residential dwellings. People using PRoW, lanes or roads passing close to the area would experience only a transient nuisance effect at worst. Even where it is necessary for works to take place within very close proximity to residential areas, such as where online widening of the existing A12 is proposed in Hatfield Peverel and in south-west Witham, the impact from dust emissions would be temporary nuisance effects, which could cause public concern but with no likely risk to health of the nearby communities.

13.10.29 There would likely be a degree of annoyance or disturbance associated with construction noise as the proposed scheme is very close to residential dwellings and community assets in Hatfield Peverel, south-east Witham and Marks Tey in particular, as well as to several isolated residential properties outside the main settlements. The construction programming would limit night working as far as practicable, but it would still be required in some areas on a temporary to short-term basis to ensure that connectivity along existing roads is maintained during construction or for safety reasons. For example, the demolition of road bridges within Hatfield Peverel and for communities in Witham near the Maldon Road bridge, and at junctions 21 and 25. Construction noise, and in particular night working, can lead to sleep disturbance and annoyance, to which some groups in the population are more susceptible than others (for example shift workers and children). However, given the impermanent nature of the construction works, and with mitigation in place, no measurable impact on the health status of the affected communities is likely.

13.10.30 In terms of effects on air pollutant levels (NO_2 and PM_{10}) during construction, air quality changes associated with increases in traffic on the A12 during the worst-case scenario in 2025 have been modelled (See Chapter 6: Air quality) and results show that changes in both NO_2 and PM_{10} levels would largely be imperceptible except for a limited number of existing or proposed residential properties which are located very close to the existing A12. Given the low number of residential dwellings affected and impermanent nature of these effects, no measurable population health impact is likely.

13.10.31 Overall, the effect on population health during construction is assessed as **neutral** during construction.

Community severance and social networks

13.10.32 It is anticipated that construction traffic and vehicles carrying construction workers accessing site would predominantly be routed along the A12, travelling eastwards from the M25 and A138 and westwards from A14 and A133. Baseline traffic flows along the A12, A138 and A133 in the human health study area at peak construction (2025) would range between 25,000 and 65,000 AADT, and the 1-2% increase in AADT flows generated by construction of the proposed scheme would not have a noticeable impact on community severance.

13.10.33 A small proportion of construction worker vehicles would access the site via the following two routes:

- B1019 Maldon Road via existing junction 20b, passing through the settlement of Hatfield Peverel and past isolated residential dwellings
- B1018 Cressing Lane from the direction of Braintree, passing through the settlement of Witham

13.10.34 The B1019 Maldon Road and B1018 Cressing Lane are also already reasonably heavily trafficked routes (baseline traffic flows at peak construction year >8,000 AADT) and the relative change in traffic flows would be less than 5% during the peak construction year (2025) with no increase in HGV flows. Therefore, no noticeable impact on community severance at Hatfield Peverel and Witham is predicted.

13.10.35 Access along key routes connecting communities bisected by the existing A12 such as Hatfield Peverel, Rivenhall End and Marks Tey would be maintained as far as practicable during construction, with only very short-term (weekend) closures anticipated for Station Road and Bury Road (Hatfield Peverel) (see Section 13.9 and Table 13.15).

13.10.36 In summary, effects on community severance and social networks are assessed as **neutral** during construction.

Road traffic collisions

13.10.37 As described under ‘Community severance and social networks’ above, changes in traffic flows within the study area associated with construction vehicles travelling to and from site would be relatively minor and HGVs would not use the minor roads which are used by walkers and cyclists (B1019 Maldon Road and B1018 Cressing Road).

13.10.38 Specific segregated provision for WCH (where appropriate) would be provided on routes where temporary traffic management measures are in place or for diversion routes, and both temporary and permanent diversion routes would be well signed.

13.10.39 The results of collision and safety analyses, which are being undertaken to support the DCO application, are required to validate this assessment and will be referred to in the forthcoming Environmental Statement.

Access to facilities, services and employment

13.10.40 Construction of the proposed scheme would result in the direct loss of two residential properties near Rivenhall End and significantly compromise the quality of residential land use for one further property in Marks Tey (see Table 13.10). Impacts on future planned housing developments would be limited to the potential loss of two dwellings (see Table 13.11). Moving house is widely acknowledged to be a stressful life event, and there is evidence to suggest that moves which are not made out of choice are linked to development of negative mental health (depression and anxiety) and physical health (blood pressure) outcomes in affected adults (Vasquez-Vera et al. 2017, Hoke and Boen, 2021) and children. However, this limited number of losses would not affect the current or future availability of good quality housing resource supporting physical and mental health outcomes within Braintree district and Colchester borough.

13.10.41 Similarly, while the proposed scheme would compromise the continued viability of four existing commercial enterprises and cause the loss of one (see Table 13.13), these impacts are not likely to reduce the current or future availability of employment opportunities within the study area. This conclusion will be reviewed in the Environmental Statement once a full assessment of the effects on agricultural land holdings has been undertaken. No direct loss of community facilities, excepting areas used for recreation which are discussed in the following 'Physical and visual access to greenspace and outdoor recreation' sub-section, are anticipated as a result of construction activities.

13.10.42 Traffic management measures and diversions would ensure access to facilities, services and places of employment and study are accessible by motorised vehicles throughout construction, with the potential exception of some weekend road closures where the demolition and replacement of online structures is required. Impacts on access to facilities, services and employment as a result of changes in active travel opportunities, are discussed below.

13.10.43 Overall, the effect on access to facilities, services and employment resulting from construction activities is assessed as **neutral**.

Active travel

13.10.44 There would be temporary disruption to access along some of the key active travel routes identified within the study area during construction, as described in Table 13.15. This includes:

- The shared-use footway/cycleway through junction 19
- Bury Lane, Station Road and the B1139 Hatfield Road in Hatfield Peverel

- The shared-use footway/cycleway between Hatfield Peverel (junction 20b) and Witham (junction 21)
- Little Braxted Lane (NCN Route 16) in Witham
- The shared-use footway/cycleway (northbound carriageway) and footway (southbound carriageway) between Feering and Marks Tey
- Station Road and Coggeshall Road, Marks Tey (approximately two months) and the shared-use footway/cycleway through junction 25

13.10.45 The construction phasing for the proposed scheme would seek to limit the level of disruption experienced along these routes as set out in Section 13.9, with localised diversions made available where practicable. As such, while construction of the proposed scheme may dissuade a very limited proportion of walkers and cyclists from undertaking active travel journeys for a matter of months, it is anticipated that this short-term impact on some individuals would not affect the positive contributions to physical and mental health afforded by active travel journeys undertaken by groups in the area over the long-term. A **neutral** effect is assessed during construction.

Physical and visual access to greenspace and outdoor recreation

13.10.46 Physical access between communities and greenspace would be affected where online widening or junction reconfigurations disrupt or reduce access to routes used by WCH. Key communities and routes affected by changes in access are set out below.

- Residents of Hatfield Peverel would be relatively unaffected in terms of changes in access to greenspace as those located in residential areas north of the existing A12 are likely to use the PRoW network north of the A12 for outdoor recreation, with those located south of the A12 heading south.
- PRoW network to the south-east of junction 19 for residents of the Springfield area of Chelmsford. Residents of Chelmer Village would be more likely to use the Centenary Way (Footpath 17 (Springfield)) crossing or NCN Route 1 crossing south of junction 19.
- PRoW network south of Witham and Whetmead Nature Reserve for residents of the housing developments adjacent to Maltings Lane and Maldon Road, Witham, while works affecting Maldon Road, Blackwater Lane/Footpath 101 (Witham) and Hatfield Road (B1389) are underway. Residents of the housing developments north of Newfoundland Road, Witham, are more likely to access greenspaces to the north of Witham.
- PRoW network south of Kelvedon and Feering while works affecting Maldon Road, Ewell Hall Chase and Inworth Road (B1023) are underway and the new Threshelfords/Prested Hall overbridge is constructed.
- PRoW network south-east of Marks Tey and south of Copford for residents of the housing development adjacent to the A120 while works to junction 25 are underway.

13.10.47 There would be also be short to medium-term loss of access to a small area of greenspace located off Oliver's Drive, Witham. However, there is good availability of alternative facilities within close proximity to the affected site (see 0).

13.10.48 Temporary land take from the gardens of 17 residential properties in Hatfield Peverel, Witham and Rivenhall End would be required, and permanent land take from the gardens of one property in Hatfield Peverel and one property in Marks Tey (see Table 13.10 for further details). Green areas within the curtilage of residential properties affected would be fully reinstated where temporary land take is proposed. Given the short duration of the temporary effects, and very limited number of properties experiencing a permanent reduction in garden size (two), it is not anticipated that changes in access in private greenspace would contribute to a measurable population-level impact on physical or mental health.

13.10.49 Online widening, improvement works to junction 25 and construction laydown areas and borrow pits, would likely result in tree and scrub removal. This would potentially affect visual access to urban greenspace[21] for people in these settlements. People living in residential properties located directly adjacent to the A12 within Hatfield Peverel, Witham and Rivenhall End, at the far eastern extents of Hatfield Peverel, eastern and western extents of Witham and on the western side of Rivenhall End would likely be most affected by these changes. Some of the trees and vegetation would be replaced in the medium to long term through the planting proposals. This matter will be assessed in further detail in the Environmental Statement, informed by the detailed landscape and visual impact assessment as described in Section 8.4 of Chapter 8: Landscape and visual.

Operation

Land use and accessibility

Residential property and housing

13.10.50 There would be a permanent alteration in vehicular access arrangements for 15 residential properties located in Hatfield Peverel, Rivenhall End and Marks Tey as described in Table 13.17. However, in all cases the nature of the changes would not be sufficient to compromise the continued viability of existing residential land uses. The significance of effect on existing residential property and housing during operation is assessed as **slight adverse**.

13.10.51 The new Payne's Lane footbridge would have a beneficial impact for future residents of the Beaulieu Park development in Chelmsford (09/01314/EIA) by facilitating better access for walkers and cyclists into Boreham and the wider PRoW network to the north and south of Boreham.

[21] For the purposes of considering impacts on mental health, tree canopy is considered to be greenspace

13.10.52 The exact nature of the ecological mitigation area included in the proposed scheme within the boundary of planning application reference 202408 in Copford is currently uncertain (see Table 13.18), however it is not anticipated that the proposals would adversely affect this development beyond the required land take which is assessed as a construction-related impact in Table 13.11. No impact on the five further allocations or planning applications for residential uses located within or adjacent to the provisional Order Limits are anticipated. The significance of effect on the future availability of housing as a resource is assessed as **neutral**.

Table 13.17 Operational impacts on existing residential land and housing

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
Hatfield Peverel				
The Vineyards, located off the B1137	Medium[1]	Permanent loss of direct vehicular access into south side of Hatfield Peverel due to removal of Wellington Road Bridge. Access would still be available on foot or by bicycle. This would not compromise viability of residential land use in that location.	4	Negligible adverse
Rivenhall End				
Braxted Road, south of the A12	Medium[1]	A permanent alteration of the access arrangement for these residential properties via a new junction with the new Braxted Road alignment. Viability of existing residential land use is not expected to be compromised.	3 (+ mobile homes/caravans)	Negligible adverse

Location	Sensitivity	Description of impact	Number of dwellings affected[2]	Magnitude of impact
Marks Tey				
Easthorpe Green	Medium[1]	Permanent alteration to access from these properties due to new layout of Easthorpe Green, such that there is no longer direct access to the A12. This is not expected to compromise residential land use.	5	Negligible adverse
Hall Chase, London Road	Medium[1]	Permanent alteration to access from these properties due to new alignment of Hall Chase for new layout of junction 25, such that there is no longer direct access to the A12. This is not expected to compromise residential land use.	3	Negligible adverse

[1]Medium sensitivity assigned on basis that this is an isolated and/or relatively small area of residential land use.

[2]This is approximate number based on aerial imagery and mapping.

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Table 13.18 Operational impacts on residential allocations and planning applications

Application (status and local planning authority) (where relevant)	Allocation (where relevant)	Sensitivity /value	Description of impact	Magnitude of impact
Chelmsford				
09/01314/EIA (approved, Chelmsford City Council). Greater Beaulieu Park, White Hart Lane, Springfield, Chelmsford. 3,600 dwellings, business park, retail hotel, leisure, education and community facilities. Radial distributor road and public transport provisions.	N/A	Very high	The new Payne's Lane footbridge and associated walking/cycling provision linking to the B1137 Main Road would benefit this development by improving access for pedestrians and cyclists to facilities in Boreham and to the PRoW network to the south of Boreham.	Negligible beneficial
19/01222/REM (submitted, Braintree District Council). Bury Farm, Bury Lane, Hatfield Peverel, Essex 165 dwellings	Policy LPP 22 Strategic Growth Location – Land at Feering. Allocation sites FEER 232 and FEER 233. (Braintree Publication Draft Local Plan, 2017)	Very high	Access to the PRoW network south of the new trunk road would be provided via the new Prested Hall/Threshelfords overbridge with shared-use footway/cycleway.	Minor beneficial

Application (status and local planning authority) (where relevant)	Allocation (where relevant)	Sensitivity /value	Description of impact	Magnitude of impact
202408 (submitted, Colchester Borough Council). Land north of Foundry Lane, Copford. Four dwellings	N/A	Low	The impact of permanent land take has been assessed as a construction effect. The adjacent ecological mitigation area included in the proposed scheme would not reduce the amenity of this site for those elements of the development which could be built out.	No change

Note:

- The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.
- There would be no discernible impacts on planning applications with references 19/01803/FUL, 18/01089/FUL, 19/01896/OUT and 17/00679/OUT and their respective allocations (see Table 13.11) or on Braintree Publication Draft Local Plan (2017) Policy LPP 22 Strategic Growth Location – Land at Feering (Allocation sites FEER 232 and FEER 233) (see Table 13.11), resulting from the operation of the proposed scheme.

Community land and assets

13.10.53 There would be minor changes in the WCH access arrangements to Essex County Fire and Rescue Service Headquarters, Kelvedon Park east of Rivenhall End, and to Marks Tey Parish Hall, Mark Tey Playground and Marks Tey Skatepark as set out in Table 13.19. It is not anticipated that the revised access arrangements for Kelvedon Park for vehicular traffic, which would no longer have direct access from the new trunk road, would adversely affect the operation of this facility. However further consultation with Essex Fire and Rescue Services will be undertaken to confirm this understanding.

13.10.54 Direct access between Coggeshall Road and Old London Road (Marks Tey) would be removed. The reconfigured Marks Tey junction would include provision for walkers and cyclists. However, under the baseline situation residents of Coggeshall travelling to Marks Tey playground and skatepark can do so without making any road crossings, whereas under the revised junction 25 and Coggeshall junction arrangements they would need to navigate a signalised junction crossing or take an alternative route involving a grade separated rail crossing and road with no footways. This would reduce the accessibility of this community resource for children but is not likely to notably affect adults.

13.10.55 Overall, the significance of effect on community lands and assets is assessed as **slight adverse to neutral**.

Table 13.19 Operational impacts on community land and assets

Site or asset	Sensitivity	Description of impact	Magnitude of impact
Kelvedon			
Essex County Fire and Rescue Service Headquarters, Kelvedon Park, (east of Rivenhall End and south of the A12)	High	Direct access onto the de-trunked A12 would be provided via a new access route which crosses Cranes Bridge before joining the de-trunked A12 near Crabbs Lane. The new access route would have a shared-use footway/cycleway, linking into the shared-use footway/cycleway along the new local access road between Rivenhall End and Kelvedon. There would be no direct vehicular access between Kelvedon Park and the new trunk road.	Negligible adverse
Marks Tey			
Marks Tey Parish Hall, Mark Tey Playground and Marks Tey Skatepark (all located off the Old London Road south-west of J25	High	Walkers and cyclists accessing these facilities from the residential areas of Marks Tey on Coggeshall Road would now be required to navigate the reconfigured Marks Tey junction rather than accessing London Road directly from Coggeshall Road. The reconfigured Marks Tey junction would have signalised crossings to accommodate walkers and cyclists.	Negligible adverse

Note:

- There would be no impact on Hatfield Peverel Railway Station, recreational facilities within Witham (as identified in 0) or Marks Tey Railway Station resulting from operation of the proposed scheme.
- The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement.

Development land and business

13.10.56 Coleman's Cottage Fishery in Witham, and Prested Hall near Feering would experience noticeable adverse effects associated with operation of the proposed scheme (see Table 13.20), however in neither case is the effect considered likely to be sufficient to compromise the continued viability of the current land uses. No further noticeable impacts on commercial enterprises are anticipated.

13.10.57 It is acknowledged that there are commercial premises lining the existing A12 in Rivenhall End, Witham and Marks Tey that benefit from their current position with direct physical access or visual access from a trunk road. These are primarily hospitality businesses and/or businesses catering specifically for travellers, including:

- Rivenhall Hotel, BP petrol station and Starbucks at Rivenhall End
- Esso petrol station, Burger King and Travelodge in Feering
- Shell petrol station at Potts Green, Marks Tey

13.10.58 While the existing direct access to these premises would be lost, no future direct accesses onto the new trunk road would be permitted and therefore these facilities would not be replaced by more convenient alternatives and signage would be provided at new and existing junctions between Chelmsford and Colchester pointing travellers to these facilities. On this basis, the magnitude of effect on these commercial enterprises is assessed as negligible adverse.

13.10.59 No noticeable impacts on land allocated for employment purposes or land currently subject to planning applications supporting employment have been identified.

13.10.60 Overall, the significance of effect on development land and business is assessed as **slight adverse to neutral**.

Table 13.20 Operational impacts on commercial enterprises

Site or asset	Sensitivity	Description of impact	Magnitude of impact
Witham			
Coleman's Cottage Fishery, off Little Braxted Lane south of Witham	High	It is anticipated that the northernmost fishing lake could be reinstated to its former use, and it is acknowledged that this would likely take a period of time. Access from the northern side of the lake would be permanently lost.	Negligible adverse
Feering			
Threshelfords Business Park, Inworth Road, Feering	Medium	Access to areas south of the new trunk road would be reinstated via the new Threshelfords/Prested Hall overbridge.	No change

Site or asset	Sensitivity	Description of impact	Magnitude of impact
Prested Hall, Feering,	High	Access to Prested Hall would be reinstated via the new Threshelfords/Prested Hall overbridge and access road to Prested Hall. The new highway infrastructure to the north-west of Prested Hall is identified as having a likely significant effect on visual amenity (see Chapter 8: Landscape and visual). However, the areas principally used by elements of the business most sensitive to changes in tranquillity and visual amenity are located to the south and east of the site and appear well shielded by existing vegetation.	Minor adverse

Note: The magnitude of impact assessed in this table represents the realistic likely worst case impact. As the design of the proposed scheme progresses, amendments may reduce the severity of impacts on certain receptors, and where this is the case it will be reported in the Environmental Statement

Agricultural land holdings

13.10.61 It is anticipated that the number of affected agricultural land holdings would be reduced during the operational phase of the proposed scheme relative to the construction phase, with lands acquired on a temporary basis to accommodate borrow pits, soil storage areas and haul routes reinstated and returned to the current landowners. A new access road at Easthorpe Green would maintain access between Easthorpe Green Farm and Wishingwell Farm and the de-trunked A12, and all other existing access routes located along online sections of the proposed scheme would be maintained.

13.10.62 As discussed in the construction effects section, further information is required to support the assessment of impacts on agricultural land holdings, and this information will be sought from landowners and tenants over the coming months. A detailed assessment of effects on agricultural land holdings will be provided in the Environmental Statement.

Walkers, cyclists and horse riders

13.10.63 Once the proposed scheme becomes operational, WCH would be prohibited from using the A12 between junction 21 and junction 25 by a Traffic Regulation Order (TRO) under the Road Traffic Regulation Act 1984. Figure 13.3 shows where and how routes used by WCH would be altered as a result of the proposed scheme.

13.10.64 In terms of east-west access between the settlements which lie between Chelmsford and Colchester:

- Access between Chelmsford and Hatfield Peverel would be via the B1137 Main Road as per the current situation (magnitude of impact assessed as no change).

- A shared-use footway/cycleway would be provided through the new junction 21 west of Witham connecting to the B1137 The Street in Hatfield Peverel and the B1389 Hatfield Road in Witham (minor beneficial magnitude of impact).
- A shared-use footway/cycleway through the new junction 22 located east of Witham would link the B1389 Colchester Road east-west onto the de-trunked A12 London Road through Rivenhall End via the existing WCH provision, and along the new link road between Rivenhall End and Witham with a shared-use footway/cycleway before joining the B1024 Old London Road on the eastern extents of Witham (minor beneficial magnitude of impact).
- A shared-use footway/cycleway would be provided through the new local road junction connecting the new Prested Hall/Threshelfords overbridge to the de-trunked A12 London Road on the eastern extents of Feering, providing access onto the existing WCH provision on the de-trunked A12 London Road between Feering and Marks Tey (minor beneficial magnitude of impact).
- Access through junction 25 at Marks Tey would be via the existing shared-use footway/cycleway on the Old London Road as it is currently and then through Marks Tey Roundabout and over the A12 via a replacement walking/cycling bridge which would connect Station Road, Marks Tey, to the local access road for Hall Chase (minor beneficial magnitude of impact).

13.10.65 Access along roads and lanes used by WCH that bisect the existing A12, or that would be bisected by the offline sections of the proposed scheme at Rivenhall End and between Feering and Marks Tey, would generally be maintained, in some cases with minimal diversions or realignments required. Specific provision for WCH would generally be reinstated in line with existing provision within the footprint of the proposed scheme, except for the Bury Lane and Station Road overbridges (Hatfield Peverel) and Little Braxted Road overbridge (Witham) which would be upgraded to shared-use footway/cycleway. Where existing WCH provision is upgraded, it would be fully Equality Act 2010 compliant, as would all new WCH provision.

13.10.66 The only routes where substantial permanent diversions would be required are as follows:

- With Woodend Bridge demolished, walkers and cyclists travelling north-south from the Latneys Boarding Kennels and Cattery area and footpath 29 (Hatfield Peverel) at the western extents of Witham would be routed via the shared-use footway/cycleway through the new junction 21, resulting in a diversion of more than 500m (major adverse magnitude of impact).
- Under a worst case scenario footpath 26 (Kelvedon) would be diverted west of its current location to join footpath 2 (Great Braxted) in order to accommodate a flood alleviation area. Whilst this would require a diversion of around 400m, the magnitude of impact is assessed as minor adverse as it is anticipated that this route is used for recreational purposes, and users are not very sensitive to the additional journey length incurred.

- Footpath 15 (Feering) and footpath 18 (Feering) would be permanently closed at the boundary with the new trunk road. However, access between the Prested Hall area and the de-trunked A12 London Road and Inworth Road would be reinstated via a shared-use footway/cycleway through the new Threshelfords/Prested Hall overbridge. While this would require a diversion of more than 500m for footpath 15 (Feering) and around 200m for footpath 18 (Feering), it would provide new access onto the existing shared-use footway/cycleway on the northbound carriageway of the de-trunked A12 London Road from footpath 15 (Feering). Therefore overall a negligible beneficial magnitude of impact is assessed for footpath 15 (Feering) and a minor adverse magnitude of impact for footpath 18 (Feering).

- A shared use walking/cycling path and footbridge suitable for use by walkers and cyclists would carry NCN Route 16 from Little Braxted Lane at the junction with bridleway 29 (Rivenhall) over the realigned A12 and onto a shared use footway/cycleway on the de-trunked A12 and junction between Eastways and Colchester Road. The new route would increase journey lengths by around 200m, however, it would also remove the need for users of this route to negotiate a major highway junction, and therefore the magnitude of impact is assessed as negligible adverse. This provision will also facilitate more convenient access from bridleway 29 (Rivenhall) and footpath 63 (Rivenhall) north into Witham.

13.10.67 The proposed scheme would reconnect routes historically severed by the existing A12 in several locations:

- A footbridge suitable for use by WCH would reconnect bridleway 23 (Boreham) and bridleway 45 (Boreham) immediately north of Payne's Lane in Boreham (major beneficial magnitude of impact).

- A footbridge suitable for use by walkers and cyclists would reconnect footpath 95 (Witham) which is severed by the existing A12 (major beneficial magnitude of impact). This would improve access from the residential areas of Witham surrounding Maltings Lane to outdoor recreational opportunities in areas of open countryside south of the A12.

- Toucan crossings (crossings that allow both walkers and cyclists to cross) would be provided on the de-trunked A12 in Rivenhall End to facilitate safe access to the existing bus stops which are currently decommissioned due to safety concerns.

13.10.68 In total, the proposed scheme is assessed as having a beneficial (minor magnitude or greater) impact on 14 routes, which includes the existing section for footway and shared-use footway/cycleway along the existing A12 which provide east-west access between settlements located between Chelmsford and Colchester. There would be an adverse (minor magnitude or greater) impact on five routes. Those routes for which the impact is considered moderate magnitude or greater are discussed in detail above. Impacts on a further 91 routes have been assessed as having negligible or no change magnitude of impact. Further detail regarding impacts on these routes, as well as those routes for which a minor adverse or minor beneficial impact is assessed, will be provided in the Environmental Statement. The overall significance of effect on WCH is assessed as **neutral to slight beneficial**.

Public transport

13.10.69 The new bypass at Rivenhall End would significantly reduce traffic flows along the de-trunked A12, with AADT24 values reducing from around 30,000-40,000 in 2017 in the absence of the proposed scheme (Do-Minimum scenario), to around 6,000 AADT with the proposed scheme in place (Do-Something scenario). Together with the installation of toucan crossings (crossings that allow both walkers and cyclists to cross) on the de-trunked A12 London Road and installation of shared-use footway/cycleways where the new local road junction is proposed on the western side of the settlement, there would be a moderate beneficial impact on access to the existing bus stops located on the A12 within Rivenhall End.

13.10.70 A similar substantial reduction in traffic flows would also be seen on the de-trunked A12 London Road between Feering and Marks Tey, and the bus stop located on the existing A12 at the Kelvedon Park access would now be located on a local access road with shared-use walking/cycling provision rather than directly adjacent to the trunk road, improving the amenity of these stops and their access routes (minor beneficial magnitude of impact). Altogether, the significance of effect on access to public transport is assessed as **slight beneficial**.

Human health

Noise, air and other environmental pollutants

13.10.71 Table 13.21 sets out key changes in air and noise pollution levels on a community-by-community basis, and identifies where changes are anticipated within areas considered particularly vulnerable or sensitive to change such as AQMAs and NIAs, and at locations of particular importance for children and the elderly. Further detail regarding the results of air quality and noise modelling undertaken for the proposed scheme and changes identified for individual residential properties and other receptors are shown on Figures 6.10 and 12.5.

13.10.72 As identified in Table 13.21 and shown on Figures 6.10 and 12.5, those settlements likely to benefit most from the proposed scheme in terms of air and noise pollutant levels would be Rivenhall End, and also those residential areas south of Hatfield Peverel, Feering and west of Marks Tey where a large number of residential receptors would experience significant beneficial noise effects.

13.10.73 Based on the air quality assessment of worst-case receptor locations, the number of residential properties and other residential receptors (e.g. sites of planned future residential development) anticipated to experience a small-magnitude increase in NO_2 concentrations, is approximately seven times greater than those expected to experience a decrease. As shown on Figure 6.10, increases in NO_2 concentrations were seen at the majority of modelled worst-case sample receptors within Boreham, Hatfield Peverel, south-west and central Witham, Little Braxted, Tiptree, Inworth, Marks Tey, Eight Ash Green, Fordham Heath and within the Stanway and Mile End areas of Colchester (including one worsening of an existing air quality objective (AQO) for NO_2, and one increase within the Lucy Lane AQMA, which is below the AQO).

13.10.74 Other areas showing increased NO_2 concentrations at modelled sample receptors include the Boreham and The Leighs ward in Boreham, Witham South ward in south-west Witham and Wickham Bishops and Woodham and Tiptree wards which includes Inworth and Little Braxted, and the Stanway and Lexden and Braiswick ward in North Colchester (see Figure 6.10). All have relatively high proportions of residents belonging to age groups with increased susceptibility or vulnerability to air pollution (under 16s and over 65s) except for Stanway ward which has high rate of deaths from respiratory diseases relative to the England average (see Figure 13.2).

13.10.75 The number of residential properties experiencing a significant beneficial effect on noise pollution as a result of the proposed scheme is a third higher than those experiencing a significant adverse effect (see Figure 12.5). However, again, people aged over 65 are more susceptible to adverse health effects associated with noise pollution, and currently traffic modelling results indicate that a cluster of residential properties within the Wickham Bishops and Woodham ward would experience significant adverse noise effects (see Table 13.21 and Figure 12.5). Although the Wickham Bishops and Woodham ward has an above-average population of older residents who on average may be more susceptible to adverse health outcomes associated with noise, against other indicators this is a relatively healthy and likely resilient population (for example, average life expectancy and low levels of income deprivation).

13.10.76 Overall, the assessment of effects against noise and air pollution on population health is assessed as **uncertain** and further work will be undertaken to clarify the effects to be reported in the Environmental Statement. While significant beneficial noise effects would outweigh significant negative health effects, and changes in air pollutant levels would generally only be of small magnitude and would not lead to new AQO exceedances, many of the areas where significant adverse noise and increased air pollutant levels are anticipated, are characterised by relatively high proportions of residents more likely to be susceptible to adverse health outcomes.

Table 13.21 Changes in air and noise pollution levels within most affected settlements

Settlement	Changes in air and noise pollutant levels
Chelmsford	Changes in NO_2 and PM_{10} levels at worst-case modelled receptors (all residential) would largely be small, with the exception of one modelled receptor in the Cornelius Vale residential development in Chelmsford. Changes in noise levels would be of negligible magnitude increase or decrease, except for very small areas immediately adjacent to junction 19.
Boreham	Small and medium-level increases in NO_2 are seen at the modelled worst-case receptors. Changes in noise levels would generally be of negligible or minor magnitude. Changes in PM_{10} levels at worst-case modelled receptors (all residential) would be imperceptible.

Settlement	Changes in air and noise pollutant levels
Hatfield Peverel	Small and medium-level increases in NO_2 are seen at the modelled worst-case receptors to the north and south of the A12. Installation of noise barriers along the southern boundary of the A12 would result in significant beneficial noise effects for 40 residential properties and a few other receptors on the south side of the A12, while significant adverse noise effects are predicted on a cluster of properties located on the eastern end of The Street. Outside these specific areas there would generally be a minor or negligible magnitude increase in noise levels. Changes in PM_{10} levels at worst-case modelled receptors (all residential) would be imperceptible.
Witham	Small and medium-level increases in NO_2 concentrations are seen for modelled worst-case residential receptors in the residential area around Gershwin Boulevard and also in the Avenue Road area. No significant noise effects are identified for residential properties and other receptors within the main residential areas where generally a negligible or small magnitude increase in noise levels would be seen. There would be significant adverse noise effects at outlying residential properties including a farmhouse (Dengie's Farm) and five other properties on Maldon Road south of Witham.
Rivenhall End	Large magnitude reductions in NO_2 concentrations seen for modelled residential properties in Rivenhall End (with one exception) and also isolated residential properties between Witham and Rivenhall End. A significant beneficial noise effect has been identified for 40 residential properties within Rivenhall End, although four properties would experience a significant negative effect. In general, there would be moderate to large magnitude decreases in noise for the area north of the A12, and the reverse for the area to the south.
Kelvedon	Modelled air quality receptors located close to the A12 largely showed imperceptible or small-magnitude changes in NO_2 concentrations, and imperceptible magnitude changes in PM_{10} concentrations. No significant noise effects have been identified in Kelvedon, with negligible to small magnitude increase in noise levels expected on the southern boundary of the settlement. Eight isolated dwellings outside the main settlement would experience significant adverse noise effects.
Feering	Modelled air quality receptors along Inworth Road generally showed small increases in NO_2 concentrations, but those adjacent to the existing junction 24 showed either medium increases or decreases in PM_{10} concentrations and large increases or decreases in NO_2 concentrations depending on location. Significant beneficial noise effects were identified for a substantial number (around 80) residential properties in Feering and also a cluster of residential properties located between Feering and Easthorpe Lane, but around 20 properties between Feering and Inworth would experience significant adverse noise effects.
Easthorpe Green and isolated residential receptors between junction 24 and 25	Modelled air quality receptors along the A12 between Feering and Marks Tey generally show medium decreases in PM_{10} concentrations and large decreases in NO_2 concentrations, with two exceptions (imperceptible or small increases). Four residential properties between Easthorpe Lane and Marks Tey south of the new trunk road would experience significant adverse noise effects, whereas areas to the north would benefit.

Settlement	Changes in air and noise pollutant levels
Marks Tey	Modelled worst-case receptors east of junction 25 generally showed small increases in NO_2, whereas to the west medium increases and decreases are seen depending on location (changes in PM_{10} were imperceptible). South of the A12 London Road there were significant decreases in NO_2 but medium increases in PM_{10}. Significant beneficial noise effects were identified for a large number of properties in the residential area west of junction 25 and a cluster of residential properties on the de-trunked A12 London Road, with significant adverse effects for one residential property on Halls Chase. Changes in noise levels would generally be either negligible increase or negligible decrease.
Colchester	Imperceptible to small increases in NO_2 concentrations are seen for modelled worst-case receptors in Eight Ash Green, with small increases seen between junctions 26 and 27 including one residential receptor within the Lucy Lane AQMA and Cygnet Hospital on Boxted Road (a specialist facility for adult men with learning disabilities, autism and mental health needs). A worsening of an existing AQO exceedance is anticipated for one residential property in the Mellor Chase/Filstore Drive area. No significant noise effects predicted.

N.B. descriptions of changes in air quality pollutant levels are based on DMRB LA 105 Air Quality magnitude of change classifications (small > -0.4µg/m^3, medium >2 µg/m^3, large >4 µg/m^3). See Chapter 12: Noise and vibration, for description of how significant noise effects have been identified. Descriptions of changes in magnitude in noise are based on DMRB LA 111 classifications (negligible <1 dB, minor 1-3 dB, moderate 3-5 dB, major >5dB).

Community severance and social networks

13.10.77 As described against operational effects on public transport above, once the proposed scheme is operational there would be a very substantial reduction in traffic flows along the de-trunked A12 at Rivenhall End, with AADT24 values reducing from around 30,000-40,000 in 2017 in the absence of Do-Minimum scenario to around 6,000 AADT with the Do-Something scenario. Together with the installation of toucan crossings (crossings that allow both walkers and cyclists to cross) on the de-trunked A12 London Road and installation of shared-use footway/cycleways where the new local road junction is proposed on the western side of the settlement, there would be a notable reduction in perceived and physical severance for this community.

13.10.78 A similar substantial reduction in traffic flows would be seen on the de-trunked A12 London Road between Feering and Marks Tey. While this route does not directly sever an existing settlement, the resulting improvement to the amenity of this route would likely encourage walking and cycling journeys between the two settlements, reducing severance.

13.10.79 Very limited changes in traffic flows along the A12 through Hatfield Peverel, south of Witham, or Marks Tey are predicted. There would be a slight reduction in flows along the B1024 through Kelvedon and Feering.

13.10.80 One area of increase has been noted on the B1023 Inworth Road between Tiptree and Kelvedon where modelling indicates traffic flows would increase by more than 50%. While baseline traffic flows on this route are already relatively

high at around 10,000 AADT, this notable increase in flows could further increase severance (actual and perceived) within the village of Inworth, which may reduce social interaction within the neighbourhood. The Environmental Statement will consider whether additional traffic control measures can be implemented to reduce the severity of the impact on residents of Inworth. On balance, given the strong beneficial effects identified in other locations within the study area, the overall effect of the proposed scheme on community severance is assessed as **positive**.

Road traffic collisions

13.10.81 The provision of improved infrastructure for WCH, together with improved standards of highway layouts, is expected to reduce the risk of road traffic collisions with a consequent benefit in reducing rates of KSI. However, the results of collision and safety analyses, which are being undertaken to support the DCO application, are required to validate this assessment and will be referred to in the forthcoming Environmental Statement.

Access to facilities, services and employment

13.10.82 The operational phase of the proposed scheme is not anticipated to compromise any existing or future planned residential properties or community assets. Impacts would be limited to small changes in access for WCH or motorised vehicles that have been assessed as having negligible magnitude impacts which would not reduce the availability or amenity of these facilities (see Table 13.17, Table 13.18 and Table 13.19). The improvements to accessibility of bus stops in Rivenhall End and at Kelvedon Park as discussed in the following 'Active travel' subsection may also help improve access to facilities and employment, particularly for residents of Rivenhall End given the limited number of facilities, such as shops and the absence of medical facilities, within the settlement itself.

13.10.83 Where adverse effects on existing or proposed commercial enterprises have been identified (see Table 13.20), the degree of impact is not anticipated to be sufficient to compromise the continued viability of the current land uses. There is potential, although considered unlikely, that the proposed scheme would affect the functioning of the individual small businesses which occupy these premises, leading to changes in employment on an individual level. However, given the very small number of commercial enterprises affected, the limited number of employment opportunities afforded by the occupying businesses, and the continued presence of similar alternative businesses within the local area, no noticeable change in the availability, nature or quality of employment opportunities across the study area is anticipated.

13.10.84 At this stage, the effect on facilities, services and employment arising from operation of the proposed scheme is assessed as **neutral**.

Active travel

13.10.85 Elements of the provision for walkers and cyclists included within the proposed scheme which would particularly support active travel journeys, include:

- The new footbridge suitable for use by walkers and cyclists at Payne's Lane which would remove the need for people travelling between Boreham, the proposed Beaulieu Park development and the Springfield area of Chelmsford to navigate a major road junction as part of that journey (although shared-use footway/cycleways through junction 19 would remain available for users who wish to take the most direct route).

- The new footbridge suitable for use by WCH, linking Little Braxted Road to Colchester Road in Witham, which would remove the need for walkers and cyclists making active travel journeys to navigate a major highway junction with only a small (circa 200m) increase in journey length.

- Reduced traffic flows along the de-trunked A12 London Road between Feering and Marks Tey would improve the perception of safety and amenity of the existing shared-use footway/cycleway on the northbound carriageway and footway on the southbound carriageway, further encouraging the use of active travel modes for journeys between these two settlements. The shared-use footway/cycleway routed along the new link road between Rivenhall End and Kelvedon would provide similar benefit by moving active travel routes off the trunk road.

- Small-scale measures across the proposed scheme, such as:

  - Upgrades to sections of the existing footways and shared-use footway/cycleways along Bury Lane and Station Road in Hatfield Peverel

  - The de-trunked A12 London Road in Rivenhall End; Inworth Road south of Kelvedon

  - Provision of a footway or shared-use footway/cycleway on new access roads and link roads including at Kelvedon Park (Essex Fire and Rescue Headquarters)

  - Reinstatement of safe access to existing bus stops in Rivenhall End

13.10.86 Once operational, the proposed scheme would improve active travel opportunities, which would support improved health outcomes associated with increasing physical activity. The overall effect on health is therefore predicted to be **positive**.

Physical and visual access to greenspace and outdoor recreation

13.10.87 The proposed scheme would remove existing severance between PRoW networks to the north and south of the de-trunked A12 at Boreham (Payne's Lane) and within Witham (footpath 95). This would improve access to areas of open space to the north-east and south-east of Chelmsford for residents of Boreham, and access to the PRoW network and areas of open space to the

south of Witham for residents of east Witham. The proposed new alignment of NCN Route 16, which takes users via a dedicated footbridge for WCH instead of through the existing junction 23, would improve the attractiveness of this route for some recreational users.

13.10.88 The proposed scheme may affect visual access to greenspace, particularly from isolated residential dwellings and PRoW located in close proximity to the new junction 21 between Hatfield Peverel and west Witham, south and south-east of the new junction 22 east of Witham, adjacent to the new Prested Hall/Threshelfords Overbridge, south of the new A12 alignment between Feering and Marks Tey, and south and south-east of junction 25 at Marks Tey.

13.10.89 At this stage of the assessment, the effect on physical access to outdoor recreation is assessed as **positive**. However, there is uncertainty as to whether the proposed scheme would be positive or negative in terms of mental wellbeing associated with access to greenspace. An updated assessment will be provided in the Environmental Statement which will be informed by the detailed landscape and visual impact assessment as described in Section 8.4 of Chapter 8: Landscape and visual.

14 Road drainage and the water environment

14.1 Topic introduction

14.1.1 This chapter presents the results of a preliminary assessment of likely significant effects of the construction and operation of the proposed scheme on road drainage and the water environment (RDWE). This follows the methodology set out in the Design Manual for Roads and Bridges (DMRB) LA 113 Road Drainage and the Water Environment, Revision 1 (Highways England, 2020a) (hereafter referred to as DMRB LA 113). The spatial scope of the assessment has included features of the water environment within at least 1km of the provisional Order Limits of the proposed scheme. For certain matters, for example flood risk, the study area may vary to fully assess the impact of the proposed scheme.

14.1.2 The water environment as assessed by this chapter includes:

- Surface water:
  - Water quality (routine runoff and spillage)
  - Water resources
  - Hydromorphology
- Groundwater:
  - Water quality (routine runoff and spillage)
  - Groundwater levels and flows
  - Groundwater Dependent Terrestrial Ecosystems (GWDTE)
- Flood risk (both surface and groundwater) and surface water drainage

14.1.3 This chapter is supported by the following figures (see Appendix A):

- Figure 14.1 Key Water Environment Features
- Figure 14.2 Aquifer Designations
- Figure 14.3 Potential Groundwater Receptors
- Figure 14.4 Existing Fluvial Flood Risk
- Figure 14.5 Existing Surface Water Flood Risk
- Figure 14.6 Existing Groundwater Flood Risk
- Figure 14.7 Change in Flood Risk for 1% AEP Plus 65% Climate Change Event

14.1.4 A Preliminary Flood Risk Assessment (FRA) (Highways England, 2021a) (from this point on referred to as the Preliminary FRA) has been prepared for the proposed scheme in accordance with the requirements of the National Networks National Policy Statement (NNNPS) (Department for Transport, 2014). The assessment related to flood risk within this chapter draws upon the studies and conclusions made within the Preliminary FRA. The Preliminary FRA has been issued to the Environment Agency and Essex County Council as the Lead Local Flood Authority (LLFA) in parallel with the statutory consultation and will be updated for the Environmental Statement.

14.1.5 A Water Quality Assessment Report (WQAR) has been prepared for the proposed scheme to document the assessment process that has been undertaken based upon DMRB LA 113.

14.1.6 The assessment related to water quality for routine runoff and spillage risk during operation within this chapter draws upon the assessment and conclusions in the WQAR. The Highways England Water Risk Assessment Tool (HEWRAT) has been used to assess the water quality impacts from the proposed scheme. The WQAR has been issued to the Environment Agency and Essex County Council in parallel with the statutory consultation and will be updated for the Environmental Statement.

14.1.7 The proposed scheme's compliance with the Water Framework Directive (WFD) is provided in a separate report: the WFD Preliminary Assessment (Highways England, 2021b). This report is an update to the Preliminary WFD Assessment provided within the Environmental Scoping Report available on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

14.1.8 This updated WFD Preliminary Assessment has been issued to the Environment Agency in parallel with the statutory consultation and will be updated for the Environmental Statement.

14.2 Stakeholder engagement

14.2.1 Table 14.1 provides a summary of the key stakeholder feedback and key requirements from the Planning Inspectorate, as identified within the Scoping Opinion (Planning Inspectorate, 2021), relevant to RDWE.

14.2.2 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment (EIA) and draft Development Consent Order (DCO), will be included within the Environmental Statement.

14.2.3 Consultation has been ongoing with key stakeholders throughout development of the PEIR as summarised in Table 14.2

Table 14.1 Key stakeholder feedback for road drainage and the water environment aspect

Stakeholder	Comment	Response
Flood risk		
Planning Inspectorate	The Planning Inspectorate does not agree that flood risks from canals can be scoped out of the Environmental Statement due to the presence of the Chelmer and Blackwater Navigation within the study area.	The FRA will include the assessment of potential risk from the Chelmer and Blackwater Navigation.
	The Planning Inspectorate agrees that flooding due to reservoir failure may be scoped out of detailed assessment on the basis that such reservoirs are subject to a monitoring and maintenance regime and the probability of an event is low.	This matter has been scoped out of the assessment.
	The Planning Inspectorate agrees that coastal flooding can be scoped out of the Environmental Statement as the proposed scheme is not located near the coast, and none of the watercourses within the study area are tidal.	This matter has been scoped out of the assessment.
	The Environmental Statement should set out where floodplain compensation land will be located, how this location was determined, and effort should be made to agree the location of floodplain compensation land with the relevant statutory consultation bodies. The Environmental Statement should also include a figure(s) depicting floodplain compensation land.	The FRA will include plans and descriptions of the proposed mitigation that will inform the assessment of impacts reported in the Environmental Statement. Further discussions will be held with regulators throughout the development of the Environmental Statement to present, discuss and seek acceptance of proposed mitigation measures.
	Details of flood compensation areas, upgrading of structures to improve conveyance, and improved defences to prevent any increases in flood risk should all be included within the Environmental Statement.	The Environmental Statement will be supported by the FRA which will provide details of all the flood risk mitigation measures to ensure no significant increase in flood risk as a result of the proposed scheme.

Stakeholder	Comment	Response
Anglian Water	Consideration should be given to all potential sources of flooding, including sewer flooding, as part of the Environmental Statement and related flood risk assessment. Suggest that reference is made to any relevant records in Anglian Water's sewer flooding register as well as other information relating to flood risk as outlined in the report.	The FRA will consider the interaction of the proposed scheme with all sources of flooding. A request for sewer flooding history information has been made to Anglian Water.
Environment Agency	An Environmental Permit for Flood Risk Activities may be required for works in, under, over, or within 8m of a fluvial main river, and from any flood defence structure or culvert.	Noted, and applications for such consents would be made when the proposed scheme design is sufficiently detailed, which is likely to be after the DCO application.
	Please be aware that the fluvial climate change allowances are in the process of being updated, and the new allowances should be published early next year.	The Environment Agency have provided draft updated fluvial climate change allowances which have been applied as part of the hydraulic modelling undertaken in order to assess flood risk. Detailed results will be included in the FRA.
Drainage		
Planning Inspectorate	Further information regarding the 'desk-based assessment that was undertaken of the existing drainage network' should be included within, or appended to, the Environmental Statement.	The Preliminary FRA includes the surface water drainage design criteria for the proposed scheme. A detailed surface water drainage strategy will be produced and will be detailed in the updated FRA and Environmental Statement.
	The Environmental Statement should include full details of all existing drainage infrastructure that is to be impacted / demolished and the new drainage infrastructure that is to be constructed. A figure(s) should be provided within the Environmental Statement that presents the locations and changes to be made to the drainage infrastructure.	The Preliminary FRA includes the surface water drainage design criteria for the proposed scheme. A detailed surface water drainage strategy will be produced and will be detailed in the updated FRA and Environmental Statement.

Stakeholder	Comment	Response
Planning Inspectorate	The Environment Agency in their consultation response raised concern with the existing drainage infrastructure potentially resulting in water quality declines in watercourses once they cross the existing A12. The Environmental Statement should address this matter and effort should be made to consult on the drainage infrastructure with the Environment Agency and other relevant consultation bodies.	The Environmental Statement will include an assessment of the impact of the proposed scheme on the water quality of receiving water bodies based upon guidance provided in DMRB LA 113. Consultation with the Environment Agency and Essex County Council is ongoing regarding this matter.
	The Environmental Scoping Report states that historical map analysis indicates little change to drainage ditches since 1876. The Planning Inspectorate notes that in places within the study area of the proposed scheme there have been considerable changes to field boundaries and drainage ditches since the late 19th century, and the Environmental Statement should have more effective cross-referencing between historic map regression undertaken as part of the heritage assessment chapter and the flood, drainage and water quality section.	Historic map regression will be undertaken for the Environmental Statement for heritage, but not ditch by ditch – it is a level of detail beyond what would usually be required for an Environmental Statement.
	The Environmental Statement should include a detailed Surface Water Drainage Strategy including the locations and dimensions of any sustainable drainage systems (SuDS). The Environmental Statement should also include a figure(s) depicting the locations of SuDS.	A surface water drainage strategy will be produced that will include details of proposed SuDS. The SuDS will inform the assessment of impacts documented in the FRA and the Environmental Statement.
	The Environmental Statement should assess and state any potential impacts that the construction and operation of the proposed scheme could have on existing agricultural drainage systems, and how these impacts could affect the surrounding agricultural land.	The impact of the proposed scheme on agricultural drainage will be considered as part of the surface water drainage strategy, with any impacts included within the Environmental Statement.

Stakeholder	Comment	Response
Essex County Council	As the LLFA, Essex County Council would expect a detailed Surface Water Drainage Strategy including SuDS, water quality, and a SuDS adoption and maintenance plan to be submitted alongside the application for this scheme. In providing advice as the LLFA, Essex County Council would look to ensure sustainable drainage proposals comply with the required standards as set out in the following documents: • Non-statutory technical standards for sustainable drainage systems (Defra, 2015) • Essex County Council' s adopted Sustainable Drainage Systems Design Guide (2020c) • The CIRIA SuDS Manual (C753) (2015a) • BS8582 Code of practice for surface water management for development sites (2013)	A surface water drainage strategy will be included in the FRA that will support the Environmental Statement. Sustainable drainage will be designed in accordance with DMRB standards. Other guidance will be given due consideration where it is appropriate. For a scheme of this nature DMRB, developed by Highways England and, in parts, with the Environment Agency, is considered appropriate.
Anglian Water	At this stage it is unclear whether there is a requirement for a connection(s) to the public sewerage network for the proposed scheme (including during the construction phase). Anglian Water welcome the intention to have further consultation with the project team and other relevant bodies in respect of the drainage strategy for the proposed scheme.	Liaison will be undertaken with regulators throughout the development of the Environmental Statement. It is anticipated that connections for water supply would be required, while wastewater is uncertain at this time subject to local constraints.
Groundwater		
Planning Inspectorate	The Environmental Scoping Report states that continuous groundwater monitoring, initially for a 12-month period, is to be undertaken in a number of boreholes across the area of the proposed scheme. Monitoring data should be provided with the Environmental Statement.	Data plots of the available data at that time will support the Environmental Statement. Examples of data are shown in this Preliminary Environmental Information Report (PEIR).

Stakeholder	Comment	Response
Planning Inspectorate	Analysis of existing groundwater abstraction and potential future changes to this in the Environmental Statement must be adequately cross-referenced to the geoarchaeological section of the cultural heritage chapter, in addition to soils and geology.	The RDWE chapter will cross reference to the cultural heritage chapter. An assessment to determine if there could be any effects on heritage assets due to changes in groundwater levels will be undertaken in the cultural heritage chapter.
	The potential location of piling or dewatering work should be identified and presented within the Environmental Statement.	The locations and effects of dewatering and piling activities will be identified in the Environmental Statement.
Environment Agency	Reference should be made to the Environment Agency's groundwater protection guidance in relation to controlled discharges.	The design of infiltration measures (if incorporated) would take account of the groundwater protection requirements. Reference to the groundwater protection guidance document will be made in the Environmental Statement, if required.
	Dewatering operations may require an abstraction licence. The Environment Agency should be consulted early in the process to allow time for the licence determination process.	This is noted and will be identified as a requirement in the mitigation measures section. Any abstraction licence would be prepared separately from the EIA, which is likely to be after the DCO application.
	In terms of value to the owners, a domestic groundwater abstraction will be of very high value where it is the sole source of drinking water; risk assessments should reflect this.	It is a standard approach in EIA assessments to distinguish in terms of value between a public water supply borehole providing water to 1,000s of properties and a borehole supplying water to one property. While the value of the small private abstractions would be lower than a public supply borehole, the assessment will identify if there would be a significant impact to the individual boreholes, providing details of the mitigation required. This is reflected in the definitions provided in Table 14.19 (in Section 14.7).

Stakeholder	Comment	Response
WFD		
Environment Agency	The WFD Preliminary assessment (Highways England, 2021b) should highlight the two key objectives for WFD of no deterioration in water body status and the ultimate aim of improving all waterbodies to 'Good' status. General impacts identified currently appear to be negative, negligible or no change. There will also be the potential for positive impacts. The 2019 classification status is now available and should be used in the next stages of the assessment.	The WFD Preliminary Assessment will be updated to support the Environmental Statement and will cover these elements.
Environment Agency	The 2019 WFD classification status is now available and can be found on the catchment explorer. Specific pollutants, priority substances and hazardous priority substances need to be considered.	The WFD Preliminary Assessment will be updated to support the Environmental Statement and will cover these elements.

Stakeholder	Comment	Response
Environment Agency	The Environmental Scoping Report states: '*Ponds and un-named watercourses are unlikely to be more than low importance. However, a precautionary approach has been taken and therefore a medium value has been assigned to all but geomorphology. Receptors and attribute importance will be reconfirmed at the next stage of assessment*'. These smaller watercourses will form part of the wider WFD waterbodies (catchment maps can be provided). We would not expect to see lower levels of treatment being provided in these tributaries. The River Chelmer, River Blackwater and Roman River are all used for drinking water abstraction. These rivers and associated upstream tributaries also need to be taken into account when considering the value of the receptor.	Levels of water quality treatment required will be determined through the use of HEWRAT, the results of which also determine the magnitude of impact for the EIA. This is independent of the value of a receiving watercourse. The value of receptors will be based upon the criteria in DMRB (as presented in the Environmental Scoping Report). Drinking water abstraction will be one of the attributes used to establish receptor value. The value of receptors will be re-confirmed at the Environmental Statement stage as additional information is gathered. The use of DMRB LA 113 and HEWRAT allows an assessment to be made of the water quality of routine runoff discharges against the Environmental Quality Standards (EQSs) for copper and zinc (used as a proxy for other pollutants). Mitigation measures are based upon the requirement to achieve EQS standards for all watercourses. The results of the HEWRAT assessment will be used to inform the WFD assessment. The HEWRAT assessment considers the dilution capacity of the receiving watercourse and is therefore more likely to require treatment for smaller watercourses with limited dilution capacity.

Stakeholder	Comment	Response
HEWRAT		
Environment Agency	Assumptions and limitations of using the HEWRAT method will need to be clearly identified. Reference should also be made to the Essex County Council SuDS Design Guide (2020c) (and the SuDS guidance at https://www.susdrain.org) which provides guidance on water quality. It should be ensured that any opportunities to provide additional water quality treatment infrastructure beyond HEWRAT outputs are fully considered.	The assessment of water quality impacts will be based upon guidance provided in DMRB LA 113 and assessed using HEWRAT. Other methods of assessment are not deemed appropriate due to the nature of the proposed scheme. The SuDS guidance referred to states that DMRB HA 2009 (i.e. HD45/09) should be used for trunk roads and motorways. HA 2009 has been replaced by DMRB LA 113. HEWRAT has been developed with the Environment Agency for the assessment of highway schemes. This methodology is bespoke to each individual watercourse and based upon site-specific characteristics and considered the most appropriate for a scheme of this nature. HEWRAT also enables an assessment against legal compliance. Assumptions and limitations associated with this methodology will be outlined in the WQAR. Opportunities for water quality enhancements will be explored as the design develops, for example attenuation ponds will be designed to provide containment facilities in the event of an accidental spillage where feasible. The attenuation ponds would also provide an enhancement for those catchments where the HEWRAT assessments determine that mitigation is not required which would be a beneficial effect.
Essex County Council	Concerns have been flagged on the use of HEWRAT which is not considered to give suitable consideration to the potential long-term cumulative impact of development. Essex County Council ask that a comparative assessment based on the CIRIA Simple Index Approach for water treatment is also investigated.	Under the Highways Act 1980, Highways England have a right '*for the purpose of draining surface water from a highway, proposed highway, maintenance compound…, the water may be discharged into… any inland water, whether natural or artificial or any tidal waters*.' The assessment of water quality impacts will be based upon guidance provided in DMRB LA 113 and assessed using HEWRAT.

Stakeholder	Comment	Response
		DMRB LA 113 aligns with the requirements of the Water Environment (Water Framework Directive) Regulations (England and Wales) 2017, i.e. published EQS which consider the long-term impact upon water quality (annual average concentrations). HEWRAT also provides assessment related to the intermittent nature of road runoff which has been developed through research undertaken by Highways England with the Environment Agency. A cumulative assessment will be undertaken using HEWRAT for Highways England outfalls within a 1km stretch of watercourse in accordance with DMRB LA 113 guidance and reported in the WQAR. It is not deemed within the remit of the proposed scheme to assess quantitatively the water quality impacts of discharges outside of Highways England's control. It is assumed that all other discharges will be subject to the Environmental Permitting (England and Wales) Regulations 2016 (unless exempt) and any conditions associated with such permits or planning conditions via these mechanisms would themselves not cause pollution. Any discharges not subject to environmental permitting are beyond the remit of reasonable and proportionate assessment. The CIRIA Simple Index Approach is based primarily upon development and land use type. This guidance defers to DMRB (HA 2009, superseded by LA 113) for trunk roads and motorways. The Simple Index Method does not consider the characteristics of the receiving watercourse, the nature of the drainage catchment, nor the legal EQS. The Simple Index Method does not consider the potential long-term, short-term or cumulative impact of development. It is therefore not deemed to be appropriate for assessing the proposed scheme.

Stakeholder	Comment	Response
Environment Agency	As well as licensed surface water abstractions there could possibly also be *de minimus* surface water abstractions (<20m^3/d). Identifying these is not straightforward. It is possible, given the nature of the scheme, that landowners would raise this with the developer, but this should be further considered.	It is noted regarding the licensed surface water abstractions. Further information will be provided for the Environmental Statement.
Other/Multiple		
Environment Agency	Possible water resource requirements for compound facilities or construction processes should be considered.	The impact of construction activities on water resources will be considered and reported in the Environmental Statement.

Table 14.2 Record of pre-PEIR consultation undertaken with key stakeholders

Date	Stakeholder	Topic
09/06/20	Environment Agency	Meeting to present River Ter, Boreham Brook, and Rivenhall Brook baseline modelling to the Environment Agency
18/06/20	Environment Agency	Meeting to present Domsey Brook and Roman River baseline modelling to the Environment Agency
10/07/20	Environment Agency	Meeting to present the WFD and hydrogeology aspects of the Proposed Scheme to the Environment Agency
23/09/20	Environment Agency	Meeting to present River Brain and River Blackwater baseline modelling to the Environment Agency
04/11/20	Essex County Council	Meeting to present the water quality and drainage aspects of the Proposed Scheme to Essex County Council
19/11/20	Environment Agency	Meeting to discuss water quality and drainage aspects of the Proposed Scheme with the Environment Agency

Date	Stakeholder	Topic
19/01/21	Environment Agency	Meeting to present the with-scheme hydraulic modelling outputs and proposed flood mitigation to the Environment Agency
19/01/21	Environment Agency	Meeting to present the WFD (geomorphology and water quality) aspects of the proposed scheme with the Environment Agency

14.3 Legislative and policy framework

14.3.1 The NNNPS 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.

14.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraphs 5.92 to 5.97 of the NNNPS set out the requirements for an FRA to accompany the application for a project in areas at risk of flooding. Paragraph 5.91 explains that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, although essential transport infrastructure is permissible in areas of high flood risk subject to the requirements of the Sequential and Exception Tests.

- Paragraph 5.93 states that the assessment of impact should take climate change into account.

- Paragraph 5.99 states that, when determining an application, the Secretary of State should be satisfied that flood risk would not be increased elsewhere, that the most vulnerable development is located in the areas of lowest risk, and that it is appropriately flood resilient and resistant.

- Paragraph 5.109 states that the proposed scheme should be designed and constructed to remain operational and safe for users in times of flood.

- Paragraph 5.220 states that the proposed scheme should prevent both new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution.

- Paragraphs 5.221 to 5.223 require that the applicant carries out an assessment of the impacts of the proposed scheme on water quality, water resources and the physical characteristics of the water environment, as part of an Environmental Statement. It also states for those projects that are improvements to the existing infrastructure, such as road widening, opportunities should be taken to improve upon the quality of existing discharges where these are identified and shown to contribute towards WFD commitments. The NNNPS also states that the overall aim of projects should be no deterioration of ecological status in watercourses.

- Paragraph 5.226 states that in terms of WFD compliance, the overall aim of projects should be no deterioration of overall status in watercourses.

- Paragraph 5.230 states that projects are required to adhere to National Standards for SuDS, which promotes the most sustainable approach but recognises feasibility, and use of conventional drainage systems as part of a sustainable solution for any given site given its constraints.

14.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

14.4 Assessment methodology

14.4.1 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for this aspect. The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

14.4.2 The assessment of the proposed scheme's impact on RDWE follows that set out in Table 3.2 of DMRB LA 113, augmented by professional judgment where required. The RDWE assessment considers the potential impact during construction and operation to:

- surface water (quality, resources and hydromorphology)
- groundwater (quality, levels, flows and GWDTEs)
- flood risk

14.4.3 In addition, the assessment considers cumulative impacts and compliance with the WFD.

14.4.4 The assessment criteria for assessing the value of water environment receptors and the magnitude of impacts are included in the Environmental Scoping Report (Highways England, 2020d). The significance of effects will be assessed in line with Table 3.7 of DMRB LA 104 (as outlined in Chapter 5: Environmental assessment methodology).

14.4.5 For the purpose of the assessment of flood risk impacts, the proposed scheme has been classified as 'Essential Infrastructure'.

Surface water quality

14.4.6 A WQAR (Highways England, 2021c) has been undertaken for the proposed scheme to inform the PEIR. The following guidance and tools have been used for the assessment of routine runoff and accidental spillage risk:

- DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2020a).
- Highways England Water Risk Assessment Tool (HEWRAT) v2.0.4 (available from www.haddms.co.uk)
- HEWRAT Help Guide v2.0 (available from www.haddms.co.uk)

14.4.7 Data used in the assessments have been provided by the design team and the traffic modelling team. Q95 low-flow values were provided by Wallingford HydroSolutions (WHS) for selected locations as detailed in the WQAR.

14.4.8 Where low flows (i.e. less than 0.001m^3/s) have been identified in a receiving watercourse, there is potential that routine runoff could infiltrate to ground and present a risk to groundwater quality depending upon the underlying geology. These receiving watercourses have been identified at this stage and an assessment of risks to groundwater quality will be made in line with the methodology in Appendix C of DMRB LA 113 and HEWRAT. This will be reported in the Environmental Statement.

14.4.9 A simple level surface water quality assessment has been undertaken as reported in the WQAR. For those outfalls that record failures based upon the data currently available, with consideration of the embedded mitigation, further assessment will be required. This may involve a groundwater assessment based upon the methodology described in Appendix C of DMRB LA 113 using HEWRAT for those watercourses which are likely to act as soakaways due to the underlying geology. For other outfalls with failures where the receiving watercourse is unlikely to act as a soakaway, a detailed assessment will be carried out using the Metal Bioavailability Assessment Tool (M-BAT) to inform the Environmental Statement where appropriate.

14.4.10 Changes to the design or traffic modelling prior to the DCO application submission may result in reassessments using HEWRAT being required. Where this occurs, the results will be reported in the Environmental Statement and an updated WQAR as appropriate.

Hydromorphology

14.4.11 The following guidance has been used for the assessment for hydromorphology:

- Scottish Environment Protection Agency (SEPA) Good practice guide: River crossings (SEPA, 2010)
- The SuDS Manual (C753) (CIRIA, 2015a)
- River Weirs Guide (C763) (CIRIA, 2016b)
- Culvert, screen and outfall manual (C786) (CIRIA, 2019)
- SEPA Good Practice Guide: Intakes and Outfalls (SEPA, 2019)

14.4.12 A simple hydromorphology assessment has been carried out, which included a desk-based study using the sources outlined in Section 14.7 and field survey to support the desk study.

14.4.13 In support of the PEIR, the WFD Preliminary Assessment has been updated following the Environmental Scoping Report (Highways England, 2020d) to reflect updates to the proposed scheme design.

Groundwater

14.4.14 The assessment to determine the significance of effects for the groundwater environment in the PEIR is largely qualitative, based on professional judgement. On receipt of complete ground investigation (GI) data for the Environmental Statement, quantitative assessments for certain aspects will be undertaken, including dewatering impact assessments and for discharges to groundwater. This includes establishing a basic conceptual site model as outlined in Appendix A of DMRB LA 113 to include details of:

- groundwater flow directions
- depth to groundwater
- aquifer layering and hydraulic characteristics
- groundwater interaction with surface water and GWDTEs

14.4.15 The conceptual site model is used to determine how the construction and operation of the proposed scheme could impact on identified groundwater receptors and how impacts could vary over time with the different phases of construction and operation.

14.4.16 Within the Environmental Statement, potential GWDTEs will be further assessed to establish if there is a potential linkage between the proposed scheme and groundwater supporting the feature. Assessment of the GWDTEs will take into account UK Technical Advisory Group on the Water Framework Directive (UKTAG) guidance for establishing the groundwater dependency of sites (UKTAG, 2005).

Flood risk

14.4.17 The Preliminary FRA has been produced in accordance with the technical guidance to the National Planning Policy Framework (NPPF) and demonstrates compliance with the requirements of the NNNPS, specifically that the proposed scheme will:

- remain operational and safe for users in times of flood
- not increase flood risk elsewhere

14.4.18 The flood risk design criteria and requirements for the Preliminary FRA have been shared through consultation with the Environment Agency, Essex County Council (as the LLFA) and other relevant stakeholders.

14.4.19 The Preliminary FRA demonstrates the proposed scheme’s compliance with the NNNPS by including:

- an assessment of flood risk to the proposed scheme from all sources
- an assessment of change in flood risk from all sources as a result of the proposed scheme

- appropriate allowances for climate change according to the latest published guidance, as well as draft updated fluvial climate change allowances provided by the Environment Agency (see Table 14.1)
- an initial assessment of mitigation measures to prevent adverse impacts on flood risk
- details of completion of the Sequential and Exception Tests

14.4.20 Hydraulic modelling of main rivers has been undertaken to confirm baseline fluvial flood risk, inform the design process and assess the impact of the proposed scheme. Early liaison has been undertaken with the Environment Agency to review the baseline hydraulic models. Hydraulic modelling of certain ordinary watercourses is ongoing and will inform the Environmental Statement.

14.5 Assessment assumptions and limitations

14.5.1 The assessment for this PEIR is based on the current design. Design of the proposed scheme and construction activities is ongoing (including highways structures, drainage design, watercourse crossings and outfalls that are of particular relevance to RDWE) and may change depending on the ongoing design development.

14.5.2 The specific construction activities, and design of the main and satellite compounds and construction drainage, have not been fully developed. Therefore, impacts based on these have not been assessed at this stage.

14.5.3 The assessment has been based on the preliminary drainage strategy which assumes all discharges are to watercourses. If, following further design of the drainage system, discharges are to ground and groundwater, impacts will be assessed in the Environmental Statement.

14.5.4 The full GI data have not been received to inform the RDWE assessments. Desk study information has been used where site-specific GI data are not available. The full GI dataset will inform the Environmental Statement and updated FRA.

14.5.5 It is assumed all proposed mitigation would be maintained appropriately.

Surface water quality

14.5.6 Assumptions and limitations relating to the HEWRAT assessments are detailed in the WQAR. Data related to watercourse characteristics used in the assessments have, at this stage, been based upon desk-based sources and photos taken during ecological site visits.

14.5.7 It has been assumed that those low-flow watercourses that act as soakaways are more appropriately assessed using the HEWRAT method for groundwater assessments as described in DMRB LA 113, rather than the HEWRAT method for routine runoff to surface waters.

Hydromorphology

14.5.8 The assessment of hydromorphological impacts to main rivers within the study area has been informed by site walkovers. The ordinary watercourses assessment is wholly based on a desk study.

14.5.9 It has been assumed that drainage from new impermeable areas would be attenuated to match the existing greenfield runoff rates and that peak discharge rates from existing paved areas would not increase.

14.5.10 It has been assumed that the reconnection of the River Blackwater to its floodplain as mitigation would be achieved by regrading of the watercourse banks which would require excavation of bank material and landscaping. Further information on the need for flood compensation and improved connectivity is discussed in the Preliminary FRA.

14.5.11 Where temporary haul roads cross the watercourses, it has been assumed that culvert crossings would be constructed and have therefore been assessed as such.

Groundwater

14.5.12 The preliminary design of the borrow pits with respect to length, depths and widths is available. The preliminary borrow pit dewatering impact assessment is based on the limited design information and draft GI data available at the time of writing this PEIR. Further assessment of borrow pit dewatering will be undertaken in the Environmental Statement, including simple calculations to estimate the extent of impact from borrow pit dewatering.

14.5.13 It is assumed that borrow pits will be left open once excavated and water levels in or below the pits will equilibrate with groundwater levels in the surrounding aquifers.

14.5.14 Cross-sections of proposed widened existing cuttings are currently not available. Therefore, the depth that these widenings would extend to and the extent of the widenings is unknown at this stage. Further information will be used to inform the Environmental Statement.

14.5.15 It is assumed that construction compounds would only require shallow excavations with no dewatering required.

Flood risk

14.5.16 Information regarding baseline flood risk has been obtained from desk-based sources, available GI information and hydraulic modelling outputs. Hydraulic modelling has been completed to assess fluvial flood risk and inform the Preliminary FRA. This hydraulic modelling includes the appropriate climate change allowances in accordance with Environment Agency guidance last updated in 2020 (Environment Agency, 2020c), as well as draft (unpublished) updated fluvial climate change allowances provided by the Environment Agency.

14.5.17 The assessment of groundwater flood risk presented in this PEIR is based on desk study information which includes British Geological Survey (BGS) groundwater flooding susceptibility maps. A GI is being conducted over three

phases. Once the full package of GI data is received and interpreted and the design has been finalised, the groundwater flooding assessment will be revisited and included in the updated FRA and Environmental Statement.

14.5.18 Hydraulic modelling to inform the assessment of potential impacts is ongoing for a number of construction and operational elements of the proposed scheme. Therefore, it has not been possible to assess the flood risk impacts of the following elements at this stage (details of completed modelling and impact assessment of these elements will be included in the Environmental Statement and accompanying updated FRA):

- Boreham Brook temporary works culvert extension and haul road (at approximately National Grid Reference (NGR) TL 7461 0987)
- River Blackwater Ashman's Bridge temporary adjacent haul road (at approximately NGR TL 8556 1766)
- WCH route realignment including footbridge crossing the River Blackwater south of Ashman's Bridge (at approximately NGR TL 8556 1763)
- Permanent crossings of five ordinary watercourses (7, 21, 21A, 23, 26) identified as requiring hydraulic modelling in order to assess flood risk implications (see Figure 14.1)

14.5.19 In order to assess flood risk from the majority of ordinary watercourses, the Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping is considered to sufficiently represent the risk associated with ordinary watercourses (Preliminary FRA is available for more details). The RoFSW mapping does not take climate change into account for the 1% (1 in 100) Annual Exceedance Probability (AEP) flood event. The 0.1% (1 in 1,000) AEP RoFSW mapping has been adopted as a proxy for an assumed 1% (1 in 100) AEP plus climate change flood event extent.

14.5.20 Topographic surveys have been undertaken to inform hydraulic modelling, but no site walkover surveys have been completed to date to inform the assessment of impacts. The current intention is to undertake site walkover (non-intrusive) surveys to inform the assessment prior to completion of the Environmental Statement.

14.5.21 A data request has been made to Anglian Water for details of drainage infrastructure near the proposed scheme. This data will be included in the updated FRA and Environmental Statement.

14.5.22 It is assumed in the assessment that all SuDS and drainage networks would be fully maintained and managed as per standard guidance and practice.

14.5.23 Where hydraulic modelling has been undertaken, there are uncertainties and limitations associated with the modelling. For example, where topographical survey of ground elevation is not currently available, lower resolution Light Detection and Ranging (LiDAR) data have been used instead (the Preliminary FRA provides additional details of model assumptions and limitations).

14.6 Study area

14.6.1 The study area for the RDWE aspect has been based on professional judgement and is defined by applying a 1km buffer around the provisional Order Limits of the proposed scheme (see Figure 14.1). This extent could increase prior to DCO application submission should the potential for impacts beyond this area be identified as the design evolves.

14.6.2 HEWRAT allows for the cumulative assessment of discharges of routine runoff on the same stretch of watercourse within 1km of each other. Therefore, a 1km study area is deemed appropriate for surface water quality. However, where a discharge extends beyond this, the study area will be adjusted accordingly. The public water supplies located downstream of the proposed scheme and outside the study area will also be considered with the study area enlarged, where appropriate, to take account of this.

14.6.3 Due to the nature of riverine processes and features along watercourses, which directly or indirectly interact with the proposed scheme, a 1km study area is considered appropriate.

14.6.4 For the groundwater study area, given the relatively low sensitivity of the hydrogeological conditions (up to Secondary A aquifers for superficial deposits and the bedrock being almost entirely defined as unproductive strata), a study area of 1km is considered appropriate.

14.6.5 The study area of 1km has been revised for each watercourse as required to ensure that all flood risk impacts are considered.

14.7 Baseline conditions

Baseline sources

14.7.1 The baseline conditions have been established based on the following sources:

- A12 Chelmsford to A120 Widening Scheme Preliminary Flood Risk Assessment (Highways England, 2021a)
- Aerial imagery (Google Earth, 2021)
- Anglian River Basin Management Plan and Annexes (Environment Agency, 2018)
- Braintree and Witham Surface Water Management Plan (SWMP) and modelling outputs (AECOM, 2016a)
- Braintree District Council Level 1 Strategic Flood Risk Assessment (SFRA) Update (AECOM, 2016b)
- BGS Susceptibility to Groundwater Flooding mapping (BGS, 2020)
- BGS GeoIndex mapping at 1:50,000 scale (BGS, 2021a)
- Chelmsford City Council Level 1 and Level 2 SFRA (JBA Consulting, 2018)

- Colchester Borough Council Level 1 and Level 2 SFRA Update (AECOM, 2016c; 2017)
- Contemporary Ordnance Survey maps (Ordnance Survey, 2021a)
- Designation data and mapping from Natural England's MAGIC map application (Department for Environment, Food and Rural Affairs (Defra), 2021)
- DMRB CG 501 Design of highway drainage systems (Highways England, 2020p)
- Detailed River Network Mapping (Environment Agency, 2021a)
- Drainage CCTV survey (Jacobs, 2020b)
- Envirocheck report (Landmark Information Group, 2016)
- Environment Agency Catchment Data Explorer (Environment Agency, 2021b)
- Environment Agency Flood Map for Planning (Environment Agency, 2021c)
- Environment Agency Historic Flood Map (Environment Agency, 2021d)
- Environment Agency Long Term Flood Risk Information Mapping (Environment Agency, 2021e)
- Environment Agency Risk of Flooding from Reservoirs (Environment Agency, 2020d)
- Environment Agency Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance datasets (Environment Agency, 2021f)
- Environment Agency Water Quality Archive (Environment Agency, 2021g)
- Essex Abstraction Licensing Strategy (Environment Agency, 2017)
- Geomorphological site survey (carried out in June 2017)
- Highways Agency Drainage Data Management System (HADDMS) (Highways England, 2021d)
- Historical Ordnance Survey maps (National Library of Scotland, 2021)
- Mid-Essex Level 1 SFRA (Scott Wilson, 2007)
- Mid-Essex Level 1 SFRA, Appendix D Maldon Supplementary Report (Maldon District Council *et al*., 2008)
- OS Open Rivers dataset (Ordnance Survey, 2021b)
- Q95 data (WHS, 2020)
- Statutory Main River Map (Environment Agency, 2020e)

14.7.2 GI works are currently ongoing. The GI works have been split into three phases of work:

- Phase 1 – from the southern extent of the proposed scheme (junction 19) to the River Brain (east of the existing junction 21) and proposed borrow pit locations
- Phase 2 – in the centre of the proposed scheme from the River Brain to the River Blackwater (east of the existing junction 23)
- Phase 3 – from the River Blackwater to the northern extent of the proposed scheme (junction 25)

14.7.3 Draft GI information is currently available for Phase 1. Data collection and interpretation for Phase 2 and Phase 3 have not been completed at this stage. Therefore, within this chapter only draft GI data from Phase 1 are available to support the assessment of baseline conditions and potential impacts. The data from all GI phases will be used in subsequent reporting of the baseline conditions and impact assessment within the Environmental Statement.

14.7.4 In relation to groundwater, the GI includes the following:

- Installation of groundwater monitoring boreholes
- Measurement of groundwater levels in monitoring boreholes over a 12-month period, with the installation of groundwater level data loggers in selected boreholes
- Groundwater sampling and chemical testing from selected boreholes (see Chapter 10: Geology and soils, for further details of the groundwater chemical testing)
- Permeability testing in selected boreholes (rising and falling head tests)
- Soakaway testing to aid the drainage design

Baseline conditions

Surface water features

14.7.5 The proposed scheme has the potential to impact numerous surface water features within the study area. The characteristics of the watercourses are summarised in Table 14.3 and identified in Figure 14.1. The flood risk characteristics of these watercourses are summarised in Table 14.17.

14.7.6 The main rivers (watercourses whose regulation falls to the Environment Agency) within the study area (from west to east) are:

- River Chelmer
- Boreham Brook
- River Ter
- River Brain

- Rivenhall Brook
- River Blackwater
- Domsey Brook
- Roman River

14.7.7 Ordinary watercourses (whose regulation is the responsibly of the LLFA, which is Essex County Council for the proposed scheme) which have the potential to be impacted by the proposed scheme have been numbered for ease of reference and are presented on Figure 14.1.

Table 14.3 Surface water bodies within the study area

Watercourse	Description
River Chelmer (main river)	The source is north-west of Braintree, approximately 32km north-west of the proposed scheme. It flows through predominantly rural land with some small urban areas before flowing through Chelmsford. The A12 crosses the River Chelmer within the study area, south-east of Chelmer Village. The proposed scheme is not anticipated to cross the River Chelmer. Channel form is trapezoidal and protected by embankments and reinforcement, with impounded flows controlled by weirs and locks. Bed substrate comprises mainly silts and sands with some gravel.
Ordinary Watercourse 1b (tributary of the River Chelmer)	Ordinary Watercourse 1b originates approximately 1km west of the proposed scheme, in Dukes Park industrial estate, north of Chelmer Village and east of the A12. It flows eastwards through pastoral agriculture and managed recreational land, through the A12 culvert and towards the River Chelmer. Planform is straight, lacking morphological features within the channel, and is encroached by vegetation along unshaded lengths. The channel planform appears largely unchanged with the exception of a realignment following the construction of the A12 from 1983.
Ordinary Watercourse 1a (tributary of the River Chelmer)	Ordinary Watercourse 1a has its source approximately 0.5km west of the proposed scheme, in Springfield Business Park, north of Chelmer Village and west of the A12. The channel flows east, where it is culverted beneath the industrial estate, and flows into a small reservoir beneath the A12 via a culvert and towards its confluence with Ordinary Watercourse 1. The channel is largely impounded upstream of the A12, while downstream it acts a field drain and boundary. With the exception of some channel widening, the watercourse is hydromorphologically inactive. Historically, the watercourse has been used as a field drain, pre-dating historical maps (pre-1874). Modifications began from 1983 with the construction of the A12, where it was culverted, and then further culverted and impounded following the expansion of Springfield Business Park (present day).
Ordinary Watercourse 1 (tributary of the River Chelmer)	Ordinary Watercourse 1 originates at Colchester Road, approximately 0.5km west of the proposed scheme, in Springfield Business Park. The channel flows eastwards through numerous road culverts in the business park, through the A12 culvert and towards the River Chelmer, while exhibiting a largely straight planform. The channel is generally a culverted drainage channel upstream of the A12 and acts as a field boundary and drain downstream, and is hydromorphologically inactive.

Watercourse	Description
Ordinary Watercourse 2 (tributary of the River Chelmer)	Ordinary Watercourse 2 originates north of Springfield Business Park approximately 0.5km west of the proposed scheme, exhibiting a straightened planform. The channel flows south-east passing through industrial land and several culverts including the A12 crossing. Downstream of the A12, the channel flows through arable agricultural land before joining Ordinary Watercourse 1. The watercourse is a straightened drainage channel, lacking significant depositional features and erosion. It was identified as a field boundary in 1874 mapping and was modified by the construction of Springfield Business Park and the A12, which took place from 1983.
Boreham Brook (main river)	Boreham Brook is a tributary of the River Chelmer with its source to the north of the A12 at Brent Hall, approximately 3km north-east of the proposed scheme. The channel flows through agricultural land with a predominantly sinuous planform. The watercourse is culverted under the A12, Roman Road and other local access roads before its confluence with the River Chelmer. Hydromorphological characteristics include low-energy, homogeneous flow; absence of depositional features such as bars and riffles; and a homogeneous, gently sinuous planform immediately downstream of the culvert, with channel readjustment. Historical analysis suggests the channel planform has not altered considerably since the earliest known maps (1874). However, the channel was impounded by a mill dam at Boreham Mill, which has since been deconstructed (since 1952).
Ordinary Watercourse 28 (tributary of the River Ter)	Ordinary Watercourse 28 has a predominantly straight planform and originates north of the proposed scheme. From its source, the watercourse flows south past pastoral agricultural land, through the A12 culvert and through arable agricultural land before draining into the River Ter. Desk-based hydromorphological observations suggest the channel acts as a field boundary and drainage channel lacking in significant depositional features and erosion. Historical analysis suggests it was realigned in 1949, while culverting for the A12 took place from 1983.

Watercourse	Description
River Ter (main river)	The River Ter is a tributary of the River Chelmer and has its source west of Braintree at Stebbing Green. With a sinuous planform, it flows through woodland, agricultural land and small urban areas. The watercourse is culverted under the A120, A131 and A12, as well as several local access roads before its confluence with the River Chelmer. Hydromorphological observations of the channel suggest the A12 caused it to be realigned. Upstream of the A12, the channel has a straight, heavily modified planform, with impounded flow compared with a more natural channel downstream. Structures include several culverts, spillways and weirs.
Ordinary Watercourse 31/31b (tributary of the River Ter)	Ordinary Watercourse 31/31b has a predominantly straight planform and originates approximately 0.2km north of the A12. From there, it flows south-east through pastoral agricultural land, through the A12 culvert and through arable agricultural land before draining into the River Ter spillway. Desk-based hydromorphological observations suggest that the channel acted as a field boundary and drain. It lacks any significant depositional features or erosion, appearing over-vegetated, with no changes likely since 1937 (according to historical maps).
Ordinary Watercourse 7 (tributary of the River Blackwater)	Ordinary Watercourse 7 has its source north-east of the A12 and Hatfield Peverel and has a predominantly straight planform. The watercourse flows south-east as it passes through arable agricultural land present both up- and downstream of the A12 culvert before meeting the River Blackwater. Hydromorphological observations (desk study) suggest the channel acts as a land boundary and drainage channel exhibiting no depositional features or extents of erosion. Historical analysis suggests the current channel planform pre-dates historical mapping (pre-1874). Culverting of the channel at side roads was recorded from 1971, with the A12 (previously Roman Road) upgrade from 1983.
Ordinary Watercourse 32 (tributary of the River Blackwater)	Ordinary Watercourse 32 has its source south of the A12. It is largely straight and passes through arable agriculture areas before draining into the River Blackwater. The channel acts as a field boundary and drain, exhibiting no significant depositional features or erosion, appearing largely dry and overgrown by vegetation.

Watercourse	Description
Ordinary Watercourse 9 (tributary of the River Blackwater)	Ordinary Watercourse 9 originates north-east of the A12 at Witham. From there, the channel typically flows east, flowing through residential areas prior to crossing the A12 and passing though arable agricultural land before draining into a series of spillway channels linked to the River Blackwater. The channel is used as a drainage channel, lacking morphological variation.
River Brain (main river)	The River Brain originates north-west of Braintree near Great Bardfield, approximately 22km north-west of the proposed scheme. Upstream of Braintree, the watercourse is named Pods Brook. The river channel has a predominantly sinuous planform but has been straightened in places. Land use includes woodland, agricultural land and large urban areas including Braintree and Witham. The watercourse is culverted under the A12 before its confluence with the River Blackwater. Hydromorphological observations suggest the channel has a uniform and trapezoidal cross-section, and had been realigned from 1937. Channel substrate mainly consists of gravels to fines, while flows are largely homogeneous and unenergetic. Banks are steep.
Ordinary Watercourse 9a (tributary of the River Blackwater)	Ordinary Watercourse 9a has its source east of the A12 and Witham, and flows southwards to the River Blackwater. The channel acts as a drainage channel, exhibiting no significant depositional features or erosion. The channel was realigned from 1974, exhibiting no sign of change since then.
Ordinary Watercourse 10 (tributary of the River Blackwater)	Ordinary Watercourse 10 has its source in Western Industrial Estate, east of the A12, in Witham. From there the predominantly straightened channel flows typically south-east, likely culverted beneath the industrial estate, out of the A12 culvert and towards the River Blackwater. Hydromorphological observations suggest the channel is a drainage channel lacking morphological features. Historical analysis suggests the channel has been mainly used as a field boundary but was extensively culverted for an industrial estate from 1971, and for the A12.
Ordinary Watercourse 11 (tributary of the River Blackwater)	Ordinary Watercourse 11 has its source near to Forest Road in Witham, west of the A12 – flowing south-east towards the River Blackwater, passing beneath an industrial estate and the A12, and past a quarry and pastoral agriculture land, while exhibiting a gently sinuous planform. Hydromorphological observations (desk study) suggest the channel acts as a field boundary and drainage channel. Where visible, the channel lacks depositional features. Historical analysis suggests the channel was excavated from 1955 and culverted from 1993.

Watercourse	Description
Ordinary Watercourse 12 (tributary of the River Blackwater)	Ordinary Watercourse 12 has its source at Rivenhall Oaks Golf course, north-east of the A12. From there the channel flows south-east towards Ordinary Watercourse 11, exhibiting a predominantly gently sinuous planform as it passes through both pastoral and arable agricultural land and a quarry. Hydromorphological observations suggest the channel acts as a land boundary and drainage channel with no depositional features or erosion, appearing largely dry. Historical analysis suggests the channel has not altered since 1874, with the exception of being culverted and realigned for the A12 from 1983.
Ordinary Watercourse 13a (tributary of the River Blackwater)	Ordinary Watercourse 13a has its source south of the A12, from where it flows south through agricultural fields, through two reservoirs and towards the River Blackwater. The channel has a straightened planform. Desk-based hydromorphological observations suggest the channel is a surface water pathway with no distinguishable channel.
Ordinary Watercourse 13 (tributary of the River Blackwater)	Ordinary Watercourse 13 has its source south of the A12, from where it flows south through agricultural fields, Coleman's Reservoir and towards the River Blackwater. The channel has a straightened planform. Desk-based hydromorphological observations suggest the channel acted as field boundary and drain and lacked significant depositional features or erosion. The construction of Coleman's Reservoir from 1990 has since formed part of the channel's drainage system.
Ordinary Watercourse 15a (tributary of Rivenhall Brook)	Ordinary Watercourse 15a has its source south of the A12, from where it typically flows south-east towards Rivenhall Brook. The channel passes arable agricultural land and a deciduous plantation, exhibiting a largely straight planform. Hydromorphological observations suggest the channel acts as a field boundary and drain and is mostly obscured by riparian vegetation. Where visible, the channel appears dry and featureless.
Ordinary Watercourse 15 (tributary of Rivenhall Brook)	Ordinary Watercourse 15 has its source north of the A12 near to the east bank of Rivenhall Brook. The straightened channel flows through deciduous woodland as it flows south-east towards Rivenhall Brook. The channel acts as a field boundary and drainage channel for a plantation, and displays a lack of significant depositional features and erosion. Historical analysis suggests the drainage channel was excavated from 1938 and has remained since, only culverted from 1983 for the A12.

Watercourse	Description
Rivenhall Brook (main river)	Rivenhall Brook discharges into the River Blackwater to the east of Rivenhall End. The channel has its source at a network of drainage channels approximately 300m north-east of Tye Green, and approximately 7.5km north-west of the proposed scheme. Predominantly exhibiting a straightened planform, Rivenhall Brook generally flows south-east through arable and pastoral agricultural land towards the River Blackwater approximately 900m south-east of Rivenhall End. Hydromorphological observations suggest the channel has a uniform and trapezoidal cross-section. Channel substrate mainly consists of gravels and fines while flows are largely homogenous and unenergetic. Banks are steep, consisting of sand and soil.
Ordinary Watercourse 17 (tributary of the River Blackwater)	Ordinary Watercourse 17 originates north of the A12 and has a gently sinuous planform. The channel initially flows south-west through plantation woodland, towards the A12, before flowing south-east, passing beneath the A12 and towards the River Blackwater, as it flows by recreational land and arable agriculture. Hydromorphological observations suggest the channel is largely used as a field boundary and drainage channel.
River Blackwater (main river)	The River Blackwater originates at Braintree. The upstream length of this watercourse is referred to as River Pant, where its source is located approximately 32km north-west of the proposed scheme in the Common. The channel has a predominantly sinuous planform and flows through agricultural land, woodland and several urban areas before its confluence with the River Chelmer. Hydromorphology observations suggest that the River Blackwater is significantly influenced by modifications including the A12 which led to channel realignment in 1983. Flow is largely non-variable with sediment ranging from homogeneous fine sediment upstream of the A12, to gravels downstream. Erosion is limited to bank scour upstream of the confluence with the River Brain, while depositional features mainly consist of accumulations of fine sediment along the channel margins. Structures include channel crossings such as bridge structures and culverts, and bank reinforcement, which have influenced uniformity in channel form and features.
Ordinary Watercourse 33 (tributary of the River Blackwater)	Ordinary Watercourse 33 originates at Church Hill upstream of the proposed scheme. It flows in a southerly direction.

Watercourse	Description
Ordinary Watercourse 18 (tributary of the River Blackwater)	Ordinary Watercourse 18 originates along Highfields Lane, Kelvedon, south of the A12. The channel exhibits a straightened planform as it flows north-west towards the River Blackwater. This channel acts as a field boundary and field drain. Historical analysis suggests the channel was excavated from 1968 and has not been altered since excavation.
Ordinary Watercourse 21 (tributary of the River Blackwater)	Ordinary Watercourse 21 originates at Windmill Hill, south of the A12. From its source the channel flows typically north-west towards the A12 and the River Blackwater. The channel has a straightened planform as it passes both pastoral and arable agricultural land. This is a field drain. Historical analysis suggests channel modification has been limited to realignment near to the confluence with the River Blackwater from 1968 and the A12 culvert from 1983.
Ordinary Watercourse 35 (tributary of the River Blackwater)	Ordinary Watercourse 35 originates by Ewell Hall Chase upstream of the proposed scheme. It flows in a northerly direction.
Ordinary Watercourse 21a (tributary of the River Blackwater)	Ordinary Watercourse 21a has its source south-east of the A12, where it flows north-west through an A12 culvert and towards the River Blackwater, passing arable agricultural fields and exhibiting a straightened planform. Desk-based hydromorphological observations suggest the channel acts a field drain. Historical analysis suggests the channel was realigned from 1973 following construction of the A12 and a sewage works.
Domsey Brook (main river)	Domsey Brook originates approximately 0.5km north of the A12 at Marks Tey, passing through agricultural land and woodland before crossing the A12 upstream of its confluence with the River Blackwater at Kelvedon. The river channel has a predominantly sinuous planform. Hydromorphological observations suggest the channel exhibits a uniform, trapezoidal cross-section, which had been realigned for the A12 from 1969. The river is a low-energy environment with homogeneous bed substrate dominated by silt. The channel lacked significant extents of depositional features and erosion with the exception of the presence of gravel deposits localised to Inworth Road bridge. Structures include the A12 where the channel has been historically realigned to accommodate its associated channel crossing.

Watercourse	Description
Ordinary Watercourse 34 (tributary of Domsey Brook)	Ordinary Watercourse 34 originates by Inworth upstream of the proposed scheme. It flows in a northerly direction.
Ordinary Watercourse 23 (potential tributary of Domsey Brook)	Ordinary Watercourse 23 has its source north of the A12 and London Road, from where it flows south towards London Road, bordered by residential properties. The channel is a straightened drainage ditch exhibiting a homogeneous channel. The channel appears dry, while historical maps do not depict its presence.
Ordinary Watercourse 37b (tributary of Domsey Brook)	Ordinary Watercourse 37b has its source south of the A12, from where it flows south towards Ordinary Watercourse 37, passing arable agriculture and managed recreational land, while exhibiting a largely straightened planform. The channel acted as a field boundary and drain, and lacked significant depositional features and erosion, appearing overgrown by vegetation. Historical analysis suggests the channel has remained unchanged since its excavation prior to the earliest historical mapping (pre-1874).
Ordinary Watercourse 37 (tributary of Domsey Brook)	Ordinary Watercourse 37 has its source south of the A12, from where it flows south towards Domsey Brook, passing arable agriculture and managed recreational land, while exhibiting a largely straightened planform. The channel acts as a field drain and lacks significant depositional features and erosion, appearing overgrown by vegetation. Historical analysis suggests the channel has remained unchanged since its excavation prior to the earliest historical mapping (pre-1874).
Ordinary Watercourse 24 (tributary of Domsey Brook)	Ordinary Watercourse 24 has its source south of the A12, where it flows south-east towards Ordinary Watercourse 37 exhibiting a straightened planform as it passes arable agricultural land. It acts as a field drain.
Ordinary Watercourse 40 (tributary of Domsey Brook)	Ordinary Watercourse 40 is a drainage ditch originating south of Easthorpe Road.

Watercourse	Description
Ordinary Watercourse 39 (potential tributary of Domsey Brook)	Ordinary Watercourse 39 is a drainage ditch originating south of Easthorpe Road. It flows in a southerly direction.
Ordinary Watercourse 38 (tributary of Domsey Brook)	Ordinary Watercourse 38 has its source immediately south of the A12, where it flows south before meandering east towards Domsey Brook. The channel has a largely straightened planform as it passes arable agricultural land. Desk-based hydromorphological observations were mostly obscured by riparian vegetation, but suggest the watercourse acts as a field drain.
Ordinary Watercourse 38b (tributary of Domsey Brook)	Ordinary Watercourse 38b has its source immediately south of the A12, where it flows south before meandering east towards Ordinary Watercourse 38. It is largely straightened and passes arable agricultural land and a plantation. It acts as a morphologically inactive field drain.
Ordinary Watercourse 42 (potential tributary of Domsey Brook)	Ordinary Watercourse 42 is a drainage ditch originating south of the A12 near Potts Green.
Ordinary Watercourse 41 (potential tributary of Domsey Brook)	Ordinary Watercourse 41 is a drainage ditch originating between Easthorpe and Potts Green.
Ordinary Watercourse 36b (tributary of Roman River)	Ordinary Watercourse 36b originates in Marks Tey just north-west of the A12 and the Crescent. The channel has a largely straightened planform as it flows north-west, passing pastoral and arable agricultural land, residential properties, and a railway and road culvert before draining into the Roman River. This acts as a field drain with a paucity of morphological features.

Watercourse	Description
Ordinary Watercourse 36 (tributary of Roman River)	Ordinary Watercourse 36 originates in Marks Tey. It flows in a northerly direction.
Ordinary Watercourse 26 (potential tributary of Roman River)	Ordinary Watercourse 26 originates south-east of the A12. The channel has a straightened planform, passing arable agricultural land as it flows north towards Ordinary Watercourse 36b. This acts as a field drain with a small number of morphological features.
Roman River (main river)	Roman River originates north of the A12, approximately 7km north-west of the proposed scheme in Willow Wood. From there, the watercourse passes through woodland and agricultural land before crossing the A12. Downstream of this, the channel flows through woodland, agricultural land and an urban area before its confluence with the River Colne. Hydromorphological observations suggest the channel has been straightened and realigned for the existing A12 (from 1973); its cross-section is trapezoidal. Flow is largely uniform; bed sediment comprises fine to coarse gravels.
Ponds, lakes and reservoirs	There are several ponds, lakes and reservoirs within the study area, most appearing to be man-made. These will be further assessed for the Environmental Statement.

Surface water quality

14.7.8 The Environment Agency Catchment Data Explorer website classifies WFD water bodies according to their ecological and chemical status and whether they have been heavily modified or not. Water bodies are required to achieve 'good' ecological and chemical status (or potential, if designated as heavily modified or artificial) by 2021 or 2027. Table 14.4 summarises the current overall, chemical and physico-chemical status of WFD monitored water bodies within the study area.

14.7.9 All of the water bodies 'fail' for chemical status. The failures, based upon 2019 published data, are mostly due to priority hazardous substances, notably polybrominated diphenyl ethers (PBDE) and mercury and its compounds which all water bodies fail; perfluorooctane sulphonate (PFOS) which the Chelmer, Brain, Blackwater (Combined Essex) and Roman River fail; and Tributyltin compounds which the Blackwater (Combined Essex) water body fails. Cypermethrin (an insecticide and priority substance) is also recorded as a cause of failure in the Brain water body.

14.7.10 Vehicles and road runoff are not typically considered as significant sources of these pollutants. PFOS can be found in car polish and textiles, and PBDE found in parts for vehicles and car seats. Several of these pollutants are banned in the UK with pollution now restricted to historical use.

14.7.11 Phosphate status is recorded as 'poor' with the exception of Boreham Tributary and Domsey Brook. This pollutant is typically associated with wastewater treatment works rather than with highway runoff. Roman River also has a 'poor' status and 'moderate' status for ammonia and dissolved oxygen, respectively. The Catchment Data Explorer website identifies the pollution pressures for the catchments as presented in Table 14.4.

14.7.12 As shown in Table 14.3, there are other watercourses in the study area, including Rivenhall Brook (a main river), unnamed tributaries and unnamed drains (see Figure 14.1). These watercourses are not classified as WFD water bodies, and therefore water quality data are not readily available for these watercourses. It is assumed, at this stage, that these watercourses would face similar pollution pressures to the larger watercourses with water quality likely to be influenced by surrounding land uses which are mainly related to agriculture and transport.

14.7.13 Data available on the Environment Agency Water Quality Archive website have been presented for selected pollutants relevant to road drainage in Table 14.5. The Water Quality Archive data shown in Table 14.5 is an average of the last 10 sample records for each variable. Additional water quality data will be sought from the Environment Agency, if available, to inform the Environmental Statement.

Table 14.4 Current WFD status (2019, Cycle 2) for surface water bodies within the study area

Water body ID	**GB105037033530**	**GB105037033910**	**GB105037033940**	**GB105037041140**	**GB105037041160**	**GB105037033870**	**GB105037034150**
Water body name	Chelmer (d/s confluence with Can)	Boreham Tributary	Ter	Brain	Blackwater (Combined Essex)	Domsey Brook	Roman River
Water body type	River	River	River	River	River	River	River
Hydromorphological designation	Heavily modified	Not designated	Not designated	Heavily modified	Heavily modified	Heavily modified	Heavily modified
Overall ecological status	Poor	Good	Moderate	Moderate	Moderate	Good	Moderate
Overall chemical status	Fail	Fail	Fail	Fail	Fail	Fail	Fail
Overall water body classification	Poor	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Pollution pressures	Urban and transport Agriculture and rural land management Water industry	No pressures reported	Urban and transport Agriculture and rural land management Water industry	Urban and transport Agriculture and rural land management Water industry	Urban and transport Agriculture and rural land management Water industry Industry	No pressures reported	Urban and transport Agriculture and rural land management Water industry

Table 14.5 Baseline water quality data and watercourse classifications

Source	Environment Agency Water Quality Archive (averaged)							Environment Agency Catchment Data Explorer (2019 classification)					WHS
Watercourse	**Sample location** (up or downstream of proposed scheme)		**Sample date (of those samples used to obtain average) range**	**pH**	**Temp (°C)**	**Oxygen dissolved % saturation**	**Alkalinity to pH 4.5 as $CaCO_3$ (mg/l)**	**Cu**	**Zn**	**Fe**	**Pb** and its compounds	**Cd** and its compounds	**Q95 (m^3/s)**
Domsey Brook	589896 219945 (near Messing Lodge)	Approx. 3.5km d/s	Nov 2014 – March 2017	7.74	10.56	85.45	282.90	-	-	-	-	-	0.013
River Ter	578870 210688 (Crabbs Bridge)	Approx. 1.3km d/s	Jun 2019 – March 2020	8.08	10.81	92.17	223.00	High	High	High	Good	Good	0.049
River Brain	581755 214768 (Guithavon Flume)	Approx. 1.8km u/s	June 2019 – March 2020	7.99	11.05	85.46	233.30	High	-	High	-	-	0.062
River Blackwater	584473 215824 (Appleford)	Approx. 1.5km d/s	July 2019 – March 2020	8.07	10.22	86.11	245.00	High	High	High	Good	Good	0.206

Source	Environment Agency Water Quality Archive (averaged)							Environment Agency Catchment Data Explorer (2019 classification)					WHS
Watercourse	**Sample location** (up or downstream of proposed scheme)		**Sample date (of those samples used to obtain average) range**	**pH**	**Temp (°C)**	**Oxygen dissolved % saturation**	**Alkalinity to pH 4.5 as $CaCO_3$ (mg/l)**	**Cu**	**Zn**	**Fe**	**Pb** and its compounds	**Cd** and its compounds	**Q95 (m^3/s)**
Roman River	594670 221800 (Heckford Bridge)	Approx. 4.0km d/s	July 2019 – Jan 2021	7.85	9.74	86.64	237.00	-	-	High	-	-	0.007
River Chelmer	579437 209045 (Rushes Lock)	Approx. 7.7km d/s	Feb 2015 – July 2019	8.16	13.06	97.78	210.90	High	High	High	Good	Good	0.739

Hydrology and low flows

14.7.14 The Q95 value of a watercourse is the flow, in cubic meters per second, which is equalled to or exceeded 95% of the time (based on flow records). This low-flow value is relevant when assessing water quality as it is representative of a worst-case dilution scenario. Table 14.5 presents the Q95 values of several main rivers at locations where they are crossed by the proposed scheme. The WQAR contains the Q95 values of other assessed watercourses.

Existing drainage network

14.7.15 As presented in the Environmental Scoping Report (Highways England, 2020d) a desk-based assessment was undertaken of the existing drainage network serving the A12 between junctions 19 (Boreham interchange) and 25 (Marks Tey interchange). This identified different types of primary drainage elements as follows:

- Concrete surface water channels with catchpit gratings at regular intervals along the longitudinal centreline of the channel
- Kerb inlet gullies and traditional kerb/gully drainage (most commonly located through small urban and residential areas)
- Combined kerb drainage (incorporated where it is not feasible to use methods such as concrete surface water channels and filter drains)

14.7.16 Drainage surveys were undertaken throughout 2020 and recorded approximately 60 existing outfalls across the Proposed scheme extent. The Highways England Priority Drainage assets programme classifies outfalls in accordance with their potential to pollute receiving waters. Outfalls can be classified as any of six categories which describe the level of risk to a receiving watercourse. Categories include A (very high), B (high), C (moderate), D (low), X (risk addressed) or 'Not Determined' for those lacking data. According to HADDMS information, there are over 150 outfalls recorded within the scheme extent. All the outfalls are Category C, D or "Not determined". The Category C and D outfalls are recorded as having had a baseline assessment only which is based upon non-site specific data and thus their current risk category has not been verified. Existing drainage assets will be confirmed as part of future design stages and risk categories verified.

Abstraction licences

14.7.17 The majority of the study area falls within the Essex Abstraction Licensing strategy area. There are 18 surface water abstraction locations within the study area, all for agricultural use (Landmark Information Group, 2016). Three of these are located immediately adjacent to the existing A12 within the study area. Further small-scale surface water abstractions could be present within the study area but not recorded within the Envirocheck report. It has been noted through public consultation that some landowners are not connected to a mains water supply.

14.7.18 It is acknowledged that there are abstractions downstream of the proposed scheme for public water supply that are located outside the 1km study area. Existing Envirocheck data (Landmark Information Group, 2016) includes three

surface water public water supply points: two on the River Blackwater and one on the River Chelmer, approximately 5km downstream of the proposed scheme. Updated abstraction licence data will be obtained to inform the Environmental Statement.

Discharge consents

14.7.19 Envirocheck data (Landmark Information Group, 2016) records 27 Environmental Permits (surface water discharge consents) within the study area. Receiving watercourses are as follows:

- Tributary of Rivenhall Brook and Rivenhall Brook
- River Brain
- Tributary of River Chelmer
- Unknown Tributary of River Ter
- Tributary of River Blackwater and River Blackwater
- Tributary of Roman River and Roman River
- Tributary of Boreham Brook and Boreham Brook
- Tributary of Domsey Brook

14.7.20 Updated Environmental Permit data relating to discharges to surface waters will be obtained to inform the Environmental Statement.

Surface water dependent nature conservation sites

14.7.21 Within the study area there are several nature conservation sites. This includes Brockwell Meadows Local Nature Reserve (LNR) and Whetmead LNR. There are also numerous Local Wildlife Sites (LWS) with surface water connections, a number of which are listed below. Further details are presented in Chapter 9: Biodiversity.

- Brockwell Meadows LWS
- Boreham Gravel Pits LWS
- Riverview Meadows LWS
- Blackwater Plantation LWS
- Hoo Hall Meadows LWS
- Braxted Park LWS
- Kelvedon Hall Wood LWS
- Coggeshall Farm LWS
- Feering Marsh LWS
- Domsey Brook Pasture LWS

14.7.22 The nature conservation sites with an element of dependency upon the surface water environment, and the extent to which these sites would potentially be impacted by changes in water quality or flows, will be identified and assessed for the Environmental Statement.

14.7.23 Marks Tey Brickpit Site of Special Scientific Interest (SSSI) is located within the study area; however, this is designated for its geological interest and thus has not been used to determine the value of water environment receptors. The SSSI is described further in Chapter 10: Geology and soils.

14.7.24 Drinking water safeguard zones (surface water) are located within the study area. These are designated areas in which the use of certain substances must be carefully managed to prevent the pollution of drinking water sources. These zones are areas where land use is causing pollution of raw water, typically from pesticides. Action is targeted in these zones so that extra treatment of raw water can be avoided. There are four surface water safeguard zones in the study area:

- SWSGZ1029 – between Chelmsford and Hatfield Peverel (directly passed through by the proposed scheme)
- SWSGZ1028 – between Hatfield Peverel and Marks Tey (directly passed through by the proposed scheme)
- SWSGZ1200 – between Marks Tey and Beacon Ends (directly passed through by the proposed scheme)
- SWSGZ1027 – north of Marks Tey (not passed through by the proposed scheme)

14.7.25 Nitrate vulnerable zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate pollution is typically associated with agricultural land use and not related to highways. The study area falls within four surface water NVZs (2017 designations):

- Colne NVZ
- River Blackwater NVZ
- River Chelmer NVZ
- Roman River NVZ

Fisheries and water dependent species

14.7.26 Two water bodies in the study area have been classified for fish under the WFD. The Roman River and the River Blackwater achieve ‘High’ and ‘Moderate’ status respectively for the fish element.

14.7.27 Aquatic surveys were undertaken across five sites in 2017 and six sites in 2020 within the study area. The six sites were Boreham Brook, Domsey Brook, the River Blackwater, River Brain, River Ter and Roman River. Full details of the survey will be presented in the survey reports included with the Environmental

Statement. Across all survey sites in 2017 and 2020, four species of conservation interest were found:

- Brown trout (*Salmo trutta*)
- Bullhead (*Cottus gobio*)
- European eels (*Anguilla anguilla*)
- River/Brook Lamprey (*Lampetra planeri*)

14.7.28 The presence of brown trout across all survey sites means these watercourses are classified as salmonid waters.

Hydromorphology

14.7.29 Figure 14.1 shows the location of all fluvial geomorphological receptors within the study area. There are eight main rivers found within the study, which are summarised in Table 14.3.

14.7.30 A total of 37 ordinary watercourses are located within the study area. These are individually assigned numbers and summarised in Table 14.3.

14.7.31 In addition to the main rivers and ordinary watercourses, numerous unnamed watercourses acting as drainage channels do not interact with the proposed scheme but are located within the study area. These watercourses have predominantly straight planforms and trapezoidal cross-sections. Historical analysis suggests changes in land use, the development of man-made water bodies from 1970, such as gravel pits and ponds, and the construction of infrastructure including the A12 have all impacted surrounding watercourses. Changes include the realignment and/or culverting of watercourses as well as watercourses being disconnected or abandoned from the local river network.

14.7.32 In addition to the drainage channels, there are numerous small ponds, gravel pits and lakes, with most concentrated between junction 19 and junction 23 (Kelvedon South interchange) of the A12, particularly between Kelvedon and Hatfield Peverel. The ponds and lakes are generally offline, with some remaining online and part of the river network.

14.7.33 According to the WFD assessment, there are eight WFD water bodies identified within the study area: seven are WFD surface water bodies and one is groundwater. Information on each WFD water body is summarised in Table 14.4 and Table 14.6.

14.7.34 Also, two transitional and coastal (TraC) water bodies are the Blackwater (GB520503714000) and Colne (GB520503713800), which lie downstream of the study area (approximately 15-20km), and receive flows from the River Chelmer, River Blackwater and Roman River. However, considering the distance between these TraC WFD water bodies and the study area, they have been scoped out of the WFD compliance assessment.

14.7.35 The single groundwater body is the Essex Gravels (GB40503G000400). This relates to a superficial aquifer. The bedrock underlying the site is predominately London Clay which is designated by the Environment Agency as unproductive strata (Defra, 2021).

Table 14.6 Groundwater WFD water body parameters

Element	Essex Gravels
ID	GB40503G000400
Overall water body classification	Poor
Quantitative status	Good
Chemical status	Poor

Groundwater

Desk-based identification of receptors and background information

14.7.36 Details of the geology are provided in Chapter 10: Geology and soils. The mapped superficial deposits (Defra, 2021) are classified mainly as Secondary A and Secondary undifferentiated aquifers with pockets of Secondary B aquifer between junctions 19 and 20b (Hatfield Peverel North interchange). Small pockets of unproductive strata are also shown in the vicinity of Rivenhall End. See Table 14.7 for details of the aquifer designations for each geological unit within the study area.

Table 14.7 Strata aquifer designations within the study area

Superficial deposits	Aquifer designation
Alluvium	Secondary A
River terrace deposits	Secondary A
Head deposits	Secondary undifferentiated
Interglacial lacustrine deposits	Unproductive strata
Lowestoft Formation (formerly known as Boulder Clay)	Secondary undifferentiated
Glaciofluvial deposits	Secondary A
Brickearth	Secondary B
Bedrock	**Aquifer designation**
London Clay Formation	Unproductive strata
Lambeth Group (at depth and does not occur at the surface in the study area except in one small area)	Secondary A
Thanet Formation (at depth and does not occur at the surface in the study area except in two small areas)	Secondary A
Chalk Group (Upper and Middle Chalk) (at depth and does not occur at the surface in the study area)	Principal

14.7.37 In terms of the bedrock, the London Clay Formation which underlies the majority of the proposed scheme is designated as unproductive strata. The Lambeth Group and Thanet Formation, which are present beneath the London

Clay Formation, are classified as Secondary A aquifers. One small area of Thanet Formation and Lambeth Group (undifferentiated) is mapped as subcropping to the west of Kelvedon. One small area of the Thanet Formation is mapped as subcropping in the east of Witham. No Chalk is mapped as outcropping within the study area, but it is present at depth underlying the Thanet Formation and Lambeth Group throughout the study area.

14.7.38 The aquifer designations are shown on Figure 14.2.

14.7.39 Groundwater vulnerability maps provide an assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties. The groundwater vulnerability map (Defra, 2021) shows that the majority of the proposed scheme lies on aquifers with medium to low vulnerability. The areas of Thanet Formation and Lambeth Group outcrop are medium to high vulnerability, whilst there are also some areas shown as unproductive.

14.7.40 The proposed scheme lies over a groundwater NVZ (Sandlings and Chelmsford G78).

14.7.41 A high level assessment of groundwater levels reported in borehole logs shown on the BGS GeoIndex website (BGS, 2021a) shows that groundwater levels are encountered in the superficial deposits at varying depths, and frequently the borehole logs show groundwater is not encountered during drilling. However, the logs do also show that in certain areas groundwater can be encountered at relatively shallow depth, within 1m or 2m of the ground surface. Water levels identified in the Phase 1 GI are discussed in the next sub-section, first specifically along the main alignment and then the groundwater condition for each of the five borrow pits is summarised.

14.7.42 Large parts of the proposed scheme overlie the Essex Gravels WFD groundwater body (GB40503G000400) (Environment Agency, 2021b). This currently has ‘poor’ overall status due to its poor chemical quality and an objective of achieving ‘good’ status by 2027. The only area which does not lie within this groundwater body is east of Feering at NGR TL 87864 20002 where the proposed scheme does not lie within a designated WFD groundwater body. However, the extreme northern end of the proposed scheme, to the north of Marks Tey at NGR TL 91649 23820, is within the Essex Gravels WFD groundwater body.

14.7.43 In total, 20 licensed groundwater abstractions have been identified within the study area of the proposed scheme (Landmark Information Group, 2016). See Figure 14.3. These abstractions are mainly associated with agricultural abstractions for spray irrigation although a small number of other uses are recorded. Of particular note is a public water supply borehole situated on Inworth Road less than 10m from the proposed scheme which is licensed to Anglian Water. It is understood that this abstracts from the Chalk at depth and as such would be protected by the overlying London Clay deposits which are understood to extend to approximately 60m below ground level. Liaison with Anglian Water is ongoing in relation to this borehole, potential effects will be considered further in the Environmental Statement.

14.7.44 It is currently uncertain whether the other abstractions are from the shallow superficial deposits or from the confined Chalk. However, based on the borehole logs available on the BGS GeoIndex site (BGS, 2021a), for some of the boreholes it is more likely that the groundwater is abstracted from the superficial deposits (most likely to be sand and gravel deposits which form the Secondary A superficial aquifers). Further information on abstractions that may be impacted by the proposed scheme will be obtained for the assessment presented in the Environmental Statement.

14.7.45 Although not shown as a licensed abstraction in the 2016 data (Landmark Information Group, 2016), it is likely that groundwater dewatering is currently taking place at Coleman's Farm Quarry, situated in the vicinity of junction 22 (Colemans interchange). Sections of the quarry which the proposed scheme would cross are due to be infilled prior to construction.

14.7.46 The groundwater source protection zone (SPZ) map (Defra, 2021) shows that the northern section of the proposed scheme, north of Kelvedon, lies within a total catchment protection zone (SPZ3). This SPZ3 is associated with the Chalk abstractions to the north of the proposed scheme. Due to the protection offered by the overlying London Clay, there would not be any impacts from the proposed scheme on the abstractions for which the SPZ3 is defined. The Environment Agency has stated that:

'*this zone is based upon groundwater travel times within the saturated geology (including the Chalk aquifer). When considering contamination within this zone, if this occurs at the surface, the travel time through unsaturated ground needs to be considered in addition to the travel time in the saturated zone (aquifer). Where a low permeability layer exists above the aquifer, times may be very large*.'

14.7.47 A further SPZ is defined for a public water supply abstraction 3km to the south of the provisional Order Limits which abstracts from the shallow gravel aquifer. The total catchment zone (SPZ3) for this abstraction extends to within 1km of the provisional Order Limits.

14.7.48 Groundwater abstractions of less than 20m^3/day do not require a licence from the Environment Agency. The location of unlicensed groundwater abstractions (private water supplies (PWSs)) may be recorded by the local authority. This information has been obtained and has identified 14 groundwater abstractions within the study area. However, the councils' records may not be complete as there is no requirement for the owners of PWSs to report certain types of abstractions to the local authority. See Figure 14.3 for the location of the PWSs which have been identified at this stage.

14.7.49 GWDTEs are wetlands which critically depend on groundwater flows or chemistry. An initial assessment of the locally designated ecological sites has been undertaken as indicated in Table 14.8 to determine the potential groundwater dependency of the LWSs, LNRs and sites defined as coastal and floodplain grazing marsh priority habitat. Further sites have been identified as part of a Phase 1 habitat survey (Chapter 9: Biodiversity). Table 14.8 shows the details for these potential GWDTEs and Figure 14.3 shows their location. Further assessment of those potential GWDTEs which may be impacted by the proposed scheme will be made and reported on in the Environmental Statement.

Table 14.8 Potential GWDTEs within the study area and an initial assessment of their groundwater dependency

Potential GWDTE name	Description of site	Potential groundwater dependency
Boreham Road Gravel Pits LWS	A series of lakes of various sizes surrounded by woodland with an area of diverse habitat of scrub, swamp and open water. Former gravel pits likely to contain groundwater in continuity with habitat features.	High
Braxted Park LWS	Mosaic of semi-improved meadows, broadleaved woodland, parkland, open water, reed and sedge beds. Presence of wet willow woodland is an indicator of groundwater dependency.	High
Brockwell Meadows LNR and LWS	Former floodplain meadows. Vegetation on site indicative of potential groundwater dependency. Adjacent to watercourse with potential for shallow groundwater.	High/medium
Coggeshall Hall Farm LWS	Mosaic of open Cricket-bat willow plantations, with some flower-rich grassland and associated hedgerows. Adjacent to a river, but no clear indication of shallow groundwater. Willow indicative of potential groundwater dependency.	Medium
Copford Hall Wood North LWS	Ancient wood remnant on steep, gravelly ground, partially replanted with conifers and Ash. No evidence of shallow groundwater in mapping although adjacent to a watercourse. Described vegetation not considered indicative of groundwater dependency.	Medium/low
Domsey Brook Pasture LWS	Meadow of dry grassland with wet and waterlogged grassland in the vicinity of a drain, indicative of potential for shallow groundwater.	Medium
Feering Marsh LWS	Marsh bordering the River Blackwater. Mapped issues and drains are indicative of shallow groundwater.	High
Hoo Hall Meadow LWS	Meadow gently sloping in a south-westerly direction to a marshy area adjacent to a stream channel. Issues mapped flowing into the site are an indicator of shallow groundwater.	High/medium
Inworth Wood LWS	Ancient wood with varied understorey structure and largely comprising of sapling regeneration following recent coppicing in central areas. The south-eastern block is more recent woodland. No features mapped that could be indicative of shallow groundwater.	Low
Keeper's Cottage Wood LWS	Ancient watercourse hedgerows that have grown out into the intervening field to form damp woodland. No clear evidence of shallow groundwater.	Medium

Potential GWDTE name	Description of site	Potential groundwater dependency
Kelvedon Hall Wood LWS	Ancient wood extensively replanted with conifers. No features mapped that could be indicative of shallow groundwater.	Low
Long Wood Complex LWS	Mixed woodland. Issues mapped on site, indicative of shallow groundwater.	High
Marks Tey Brick Pit LWS	Brownfield wildlife habitats, including scrub woodland, marsh, open water habitats and flower-rich, sparsely vegetated ground.	High/medium
Marshy Grassland 1	Area recently planted with white willows, grassland with abundant wetland tall herbs. Issues recorded on site indicative of shallow groundwater.	High/medium
Marshy Grassland 2	Small area of marshy grassland within a golf course. No clear evidence of shallow groundwater, but vegetation indicative of dependency.	Medium
Marshy Grassland 3	Area adjacent to Domsey Brook, with abundant hard rush and wetland tall herbs and scattered scrub of dewberry, dogwood and grey willow. No clear evidence of shallow groundwater, but vegetation indicative of dependency.	Medium
Mope Wood Complex LWS	Ancient woodland containing a number of ancient woodland indicators. Drain could be indicative of potential shallow groundwater, but the described vegetation is not generally groundwater dependent.	Low
Pits Wood LWS	Wood with a diverse canopy and scrub composition. Ponds forming in the hollows have a variety of marginal species. Old gravel pit suggests potential for shallow groundwater.	Medium
River Chelmer LWS	Watercourse and the associated marginal vegetation. No clear evidence of shallow groundwater but could be in connectivity with the river.	Medium/low
Riverview Meadows LWS	Flood-plain grasslands supporting a tall sward with trees and wet marsh associated with the former river course channel. Mapping of collects is indicative of shallow groundwater and the described vegetation is indicative of groundwater dependency.	High
Sparkey Wood LWS	Ancient broadleaved woodland with a varied structure and ancient woodland indicator species present. Described vegetation not indicative of groundwater dependency.	Low
Spitman's Gardens	Lowland mixed deciduous woodland. Mapped sinks indicative of potential shallow groundwater.	Medium

Potential GWDTE name	Description of site	Potential groundwater dependency
The Grove LWS	Scrub dominated by grey willow in low-lying very wet area by a stream. Mapped drains indicative of potential shallow groundwater.	Medium
The Old Rectory Meadows LWS	Floodplain meadows within managed estate. No mapped features that would indicate shallow groundwater.	Low
Titbeech Wood LWS	Replanted with a variety of broadleaved and coniferous species for commercial timber production. Vegetation description not indicative of potential groundwater dependency.	Low
Toppinghoehall Wood LWS	Mixed woodland. No mapped features that would be indicative of potential shallow groundwater.	Low
Wet woodland 1	Small stand of secondary woodland along River Ter, with canopy of alder, ash and grey willow, and mature white willow. Mapped issue potentially indicative of shallow groundwater.	Medium
Wet woodland 2	Alder woodland along Roman River. Adjacent to open water pond that could be in connection with shallow groundwater.	Low/medium
Wet woodland 3	Narrow fringe of woodland around a fishing lake, with alder and willow dominating around the lake edge and pedunculate oak higher up the banks. Vegetation description indicative of potential groundwater dependency.	Medium
Wet woodland 4	Broadleaved woodland dominated by white willow over former aggregate quarry. Mapped issues potentially indicative of shallow groundwater.	Medium
Wet woodland 5	Alder and willow dominated woodland fringing a lake. Adjacent to open water which may be connected with shallow groundwater in gravel deposits.	Medium
Wet woodland 6	Alder and willow dominated woodland around a fishing lake. Vegetation description indicative of potential groundwater dependency.	Medium
Wet woodland 7	Alder woodland along River Blackwater, on ground below low terrace to the west of the river. Dominated by large alder trees with eutrophic ground vegetation. Vegetation description indicative of potential groundwater dependency. Mapped issues potentially indicative of shallow groundwater.	High

Potential GWDTE name	Description of site	Potential groundwater dependency
Wet woodland 8	Mature woodland of crack and white willow with fenny field layer with abundant hemp agrimony. Vegetation description indicative of potential groundwater dependency.	Medium
Wet woodland 9	Wet woodland along Domsey Brook. Woodland around eastern end of pond basin, dominated by grey willow and white willow. Vegetation description indicative of potential groundwater dependency.	Medium
Wet woodland 10	Stand of mature and early mature alder trees along Roman River. Stand of crack willow dominated woodland at the end of the basin in which a pond sits. Vegetation indicative of potential groundwater dependency.	Medium
Whetmead LNR	Grassland, scrub and lagoons providing a variety of habitats. The grassland is to be developed and managed as a wildflower meadow. Adjacent to a watercourse and mapped drains potentially indicative of shallow groundwater.	High/medium

Phase 1 GI data (draft)

14.7.50 Draft GI data are only available for the Phase 1 investigation area (western extent of the proposed scheme) with investigation for the remainder of the proposed scheme ongoing. The following provides a brief summary and initial interpretation of the draft hydrogeological data collected along the main alignment within the Phase 1 area followed by the hydrogeological GI data for the borrow pits.

14.7.51 Where recorded in the Phase 1 investigation, groundwater strikes and seepages were generally within 3m of the ground surface as shown in Table 14.9. In most instances the rise in groundwater level was less than 1m, but a maximum of 3.95m was recorded in WS1509 (see Figure 10.1, which supports Chapter 10: Geology and soils, for borehole locations). This indicates that there can be a degree of confinement (i.e. that groundwater is under pressure) where the Lowestoft Formation is present, but that generally unconfined conditions are present.

Table 14.9 Depth of water strikes in Phase 1 investigation holes

Water strike depth (mbgl)	No. of holes/trial pits
0 to 2	7
2 to 3	22
3 to 4	8
4 to 8	4
Deeper than 8	1

14.7.52 The groundwater strike data shown in Table 14.10 indicate that groundwater is typically encountered in the sand and gravel deposits associated with the glaciofluvial deposits, river terrace deposits and Lowestoft Formation, but can also be encountered in silt or clay deposits.

Table 14.10 Geological strata in which the water strikes were recorded

Strata for water strike	No. of holes/trial pits
Gravel	18
Sand	10
Silt	2
Clay	12

14.7.53 Groundwater monitoring has taken place with manual dip measurements at monthly intervals and by installing groundwater level data loggers in 18 boreholes within the Phase 1 area of the proposed scheme. Groundwater monitoring is ongoing.

14.7.54 For those boreholes in Phase 1 with a logger installed, groundwater levels in most of the boreholes do show a response to rainfall events, although generally variations in groundwater levels are relatively small (less than 0.5m) as shown for example in BH1014 in Plate 14.1. The most notable exception to this is in BH+RC1164A where groundwater levels vary by up to 5m in response to individual rainfall events (Plate 14.2). BH+RC1164A is completed in clayey deposits at the base of the Lowestoft Formation with a screened interval from 5.5 to 9.0 metres below ground level (mbgl). WS1507 also shows significantly more variation, with the borehole initially being recorded as dry over the summer of 2020 but with levels rising to the ground level between early October and mid-November 2020 in response to wetter conditions (Plate 14.3).

14.7.55 In the vicinity of Witham at NGR TL 8088 1284 to TL 8285 1369 along the main alignment, the groundwater level data loggers (including those installed for borrow pits) show an unusual water level response, and appear to be responding to an abstraction, with rapid rises and falls in the water level of around 0.5m which do not appear to be a response to rainfall. Borehole BH2041 is an example of where this occurs (Plate 14.4). No abstractions, which could be responsible for the magnitude of these fluctuations, have currently been identified in this area and the response will require further consideration as more groundwater level data are collected.

Plate 14.1 Groundwater levels in BH1014

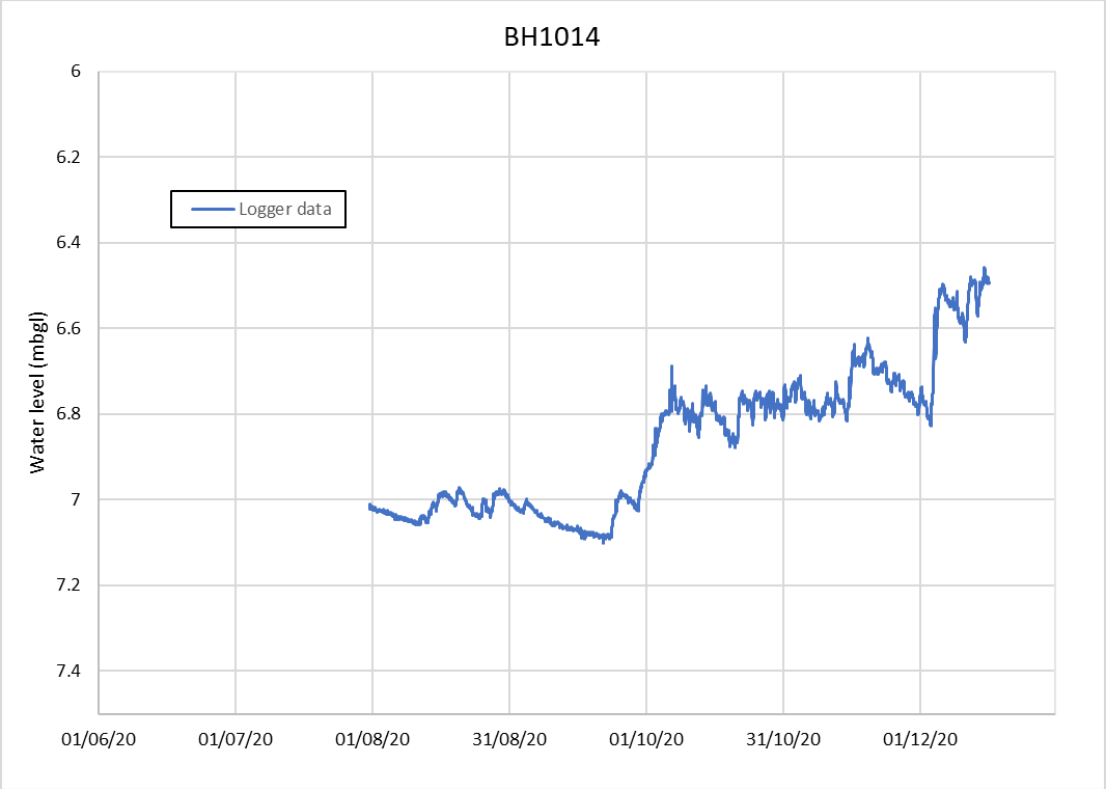


Plate 14.2 Groundwater levels in BH+RC1164a

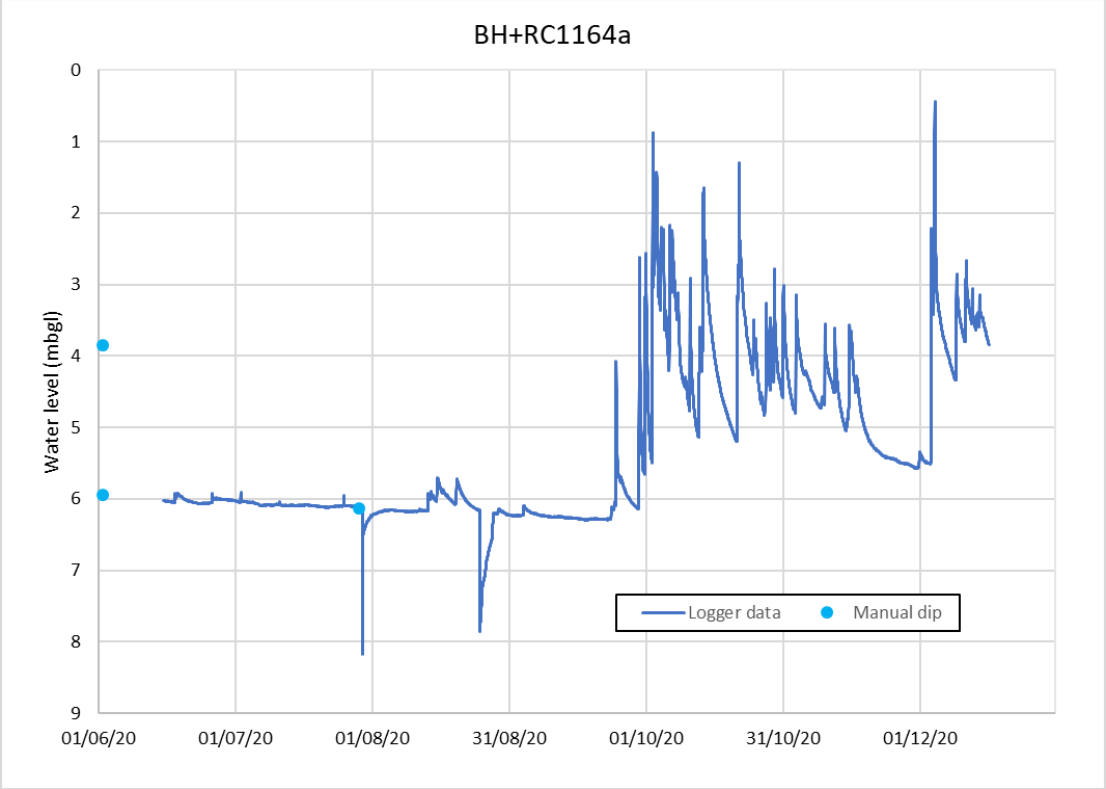
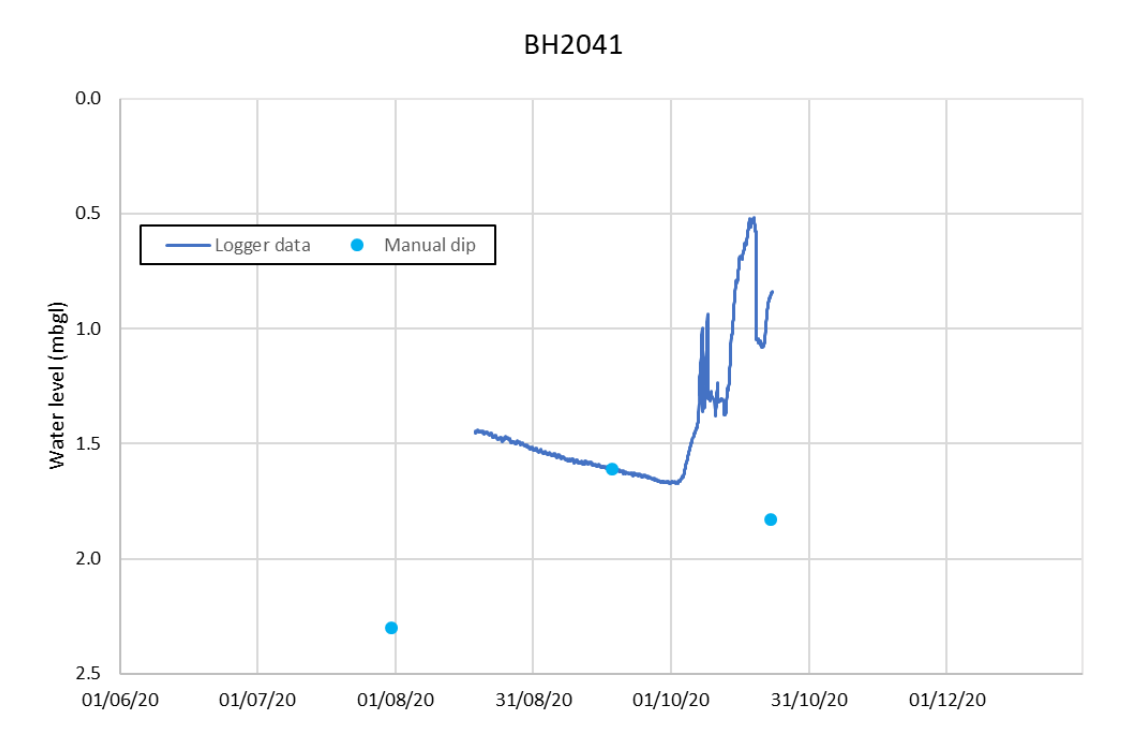


Plate 14.3 Groundwater levels in WS1507

Plate 14.4 Groundwater levels in BH2041



14.7.56 For those boreholes and window sample holes completed as groundwater monitoring points that can be readily accessed, manual measurements of groundwater levels have been undertaken on an approximately monthly basis. However, the data were collected over a relatively short period (in some cases only two dip values are available) and are unlikely to include winter-high maximum levels or record longer-term very dry or wet periods which may increase the range in groundwater levels. Table 14.11 shows that, typically, groundwater levels in each borehole vary by less than 2m.

Table 14.11 Variation in groundwater levels in Phase 1 groundwater monitoring points

Variation in groundwater levels (m)	No. of boreholes
<0.5*	31
0.5 to 1	10
1 to 2	9
2 to 3	8
>3	3

* Includes boreholes which were recorded dry on all occasions.

14.7.57 As shown in Table 14.12, the groundwater monitoring shows that measured groundwater levels are typically within 4m of the ground surface. There is no clear pattern to the distribution of the depth to groundwater across the alignment within the Phase 1 area.

Table 14.12 Minimum depth to groundwater recorded in Phase 1 groundwater monitoring points

Shallowest groundwater level recorded (mbgl)	No. of boreholes
0 to 2	19
2 to 4	22
4 to 6	16
>6	3

14.7.58 Groundwater levels relative to ordnance datum (i.e. as metres above ordnance datum (mAOD)) indicate that groundwater levels in the superficial deposits generally reflect the ground surface contours. Groundwater flows from the interfluves to the lower-lying valleys of the major rivers including the River Chelmer and River Blackwater.

Hydrogeological summary of borrow pits

14.7.59 Table 14.13 to Table 14.16 provide a summary of the hydrogeological conditions in each of the four identified borrow pits.

Table 14.13 Hydrogeology of borrow pit E

Characteristic	Description
Superficial deposits	Largely mapped by the BGS as Lowestoft Formation (Diamicton) with an area of head deposits in the easternmost area of the site. The GI data show generally a clay deposit overlying glacial fluvial sand and gravel deposits.
Encountered groundwater conditions	Groundwater was generally not encountered during borehole drilling with the shallowest recorded water strike being at 4.1mbgl, with the water level rising to 3.2mbgl in 20 minutes (BH2031). None of the 16 trial pits encountered groundwater. Rest water levels in completed boreholes are typically shown as being 10mbgl to 15mbgl. Shallower groundwater was only encountered in the south-west of the site, with a rest water level of approximately 4mbgl recorded in BH2031 where the London Clay was found to be shallower. Based on the available groundwater level data and topography, groundwater flow direction is likely to be in a broadly south-easterly direction.
Permeability	Permeability variable head tests were undertaken in four boreholes completed in the sands and gravels. Data from the tests are currently being evaluated.

Table 14.14 Hydrogeology of borrow pit F

Characteristic	Description
Superficial deposits	Largely mapped by the BGS as Lowestoft Formation (Diamicton) with an area of brick earth in the centre of the site. The GI data show generally a clay deposit with occasional gravel bands.
Encountered groundwater conditions	Based on available data groundwater is expected to be relatively shallow over most of the site (all but one of the boreholes recorded groundwater levels within 2m of the ground surface). However, groundwater was generally recorded as not being encountered during borehole drilling with only one borehole recording a water strike, and this being at 7.4mbgl, with the water level rising to 7.2mbgl in 20 minutes (BH2038). Four of the 12 trial pits encountered groundwater. Based on the available groundwater level data and topography, groundwater flow direction is likely to be in a broadly easterly to south-easterly direction towards the River Blackwater.
Permeability	Permeability variable head tests were undertaken in four boreholes completed largely in the sands and gravels. Data from the tests are currently being evaluated.

Table 14.15 Hydrogeology of borrow pit I

Characteristic	Description
Superficial deposits	Mapped by the BGS as Lowestoft Formation (Diamicton) in the north and west with head deposits in the south and east. The GI data show generally a dominantly clay deposit overlying glacialfluvial sand and gravel deposits. The dominant sand and gravel deposit is encountered at around 10mbgl in many of the boreholes.
Encountered groundwater conditions	Based on available data the groundwater level is expected to generally be at around 3mbgl to 5mbgl. Groundwater was recorded during borehole drilling in five of the eight boreholes with the water strikes being recorded at between 3.2mbgl and 10.0mbgl. The water levels rose by 2m to 3m in most of the boreholes following the strike, indicating a degree of groundwater confinement. Five of the 11 trial pits encountered groundwater seepages. In the monitoring boreholes, the shallowest rest water levels in five boreholes are shown as typically being 3mbgl to 4mbgl, and in the remaining three the rest water level is shown as being within 1m of the ground surface. Based on the available groundwater level data and topography, groundwater flow direction is likely to be in a broadly southerly direction towards the Rivenhall Brook.
Permeability	Permeability variable head tests were undertaken in six boreholes completed in the sands and gravels, and clay. Data from the tests are currently being evaluated.

Table 14.16 Hydrogeology of borrow pit J

Characteristic	Description
Superficial deposits	Largely mapped by the BGS as Lowestoft Formation (Diamicton) with patches of river terrace deposits (sand and gravel). The GI data show generally a clay deposit overlying glacialfluvial sand and gravel deposits.
Encountered groundwater conditions	Based on available data groundwater levels are variable across the site. Groundwater was recorded during borehole drilling in three of the 14 boreholes with the water strikes being recorded at 0.4mbgl, 2.2mbgl and 5.2mbgl. The water levels showed small rises following the strike. Only three of the 42 trial pits encountered groundwater seepages. In the 14 monitoring boreholes, three have been recorded as being dry and a fourth recorded a groundwater level of approximately 9mbgl to 10mbgl. In the other boreholes, shallower groundwater levels were recorded ranging from approximately 0.6mbgl to 4.0mbgl. Based on the available groundwater level data and topography, groundwater flow direction is likely to be in a broadly north-westerly direction towards the Domsey Brook and River Blackwater.
Permeability	Permeability variable head tests were undertaken in nine boreholes completed in the sands and gravels, and clays. Data from the tests are currently being evaluated.

Flood risk

14.7.60 A Preliminary FRA has been prepared for the proposed scheme in accordance with NNNPS requirements. A full description of the flood risk baseline is presented in the Preliminary FRA and summarised below.

Fluvial flood risk

14.7.61 Hydraulic modelling has been undertaken as part of the Preliminary FRA where the proposed scheme would have the potential to impact main rivers. The following events have been modelled: 5% (1 in 20) AEP; 1% (1 in 100) AEP; and 1% (1 in 100) AEP plus a climate change uplift.

14.7.62 It is not anticipated that the proposed scheme would impact the River Chelmer. Consequently, this watercourse has not been hydraulically modelled to inform the Preliminary FRA.

14.7.63 Climate change uplifts applied have been based on the latest available published Environment Agency guidance, given the design life of the proposed scheme, which are based on UK Climate Projections 2009 (UKCP09). The Environment Agency have provided draft updated fluvial climate change allowances, based on UK Climate Projections 2018 (UKCP18) prior to their anticipated publication later in 2021. These have also been applied in order to inform the assessment of impact and the potential need for mitigation (the Preliminary FRA provides further details of the climate change uplift values applied).

14.7.64 The Environment Agency's Flood Map for Planning (2021c) defines flood zones 2 and 3:

- flood zone 3: areas with greater than a 1% (1 in 100) AEP of fluvial flooding
- flood zone 2: areas between 0.1% (1 in 1000) and 1% (1 in 100) AEP of fluvial flooding

14.7.65 However, the flood extents derived from the hydraulic modelling undertaken in support of the Preliminary FRA are considered to be more accurate than the Environment Agency's Flood Map for Planning flood zones (given the improved resolution of the input data, use of topographic channel survey and hydrology assessments undertaken to inform the modelling) and have therefore been used to determine the baseline fluvial flood risk.

14.7.66 The River Chelmer has not been modelled as part of the Preliminary FRA as it is considered that the proposed scheme would have a negligible impact on River Chelmer floodplain based on the Environment Agency's Flood Map for Planning (2021c) flood zone mapping.

14.7.67 Sheet 1 of Figure 14.4 indicates Environment Agency flood zones for the River Chelmer. Sheets 2 to 11 of Figure 14.4 indicate the extent of the hydraulic models of main rivers that have informed the Preliminary FRA. The Preliminary FRA provides a full description of the baseline fluvial flood risk where the proposed scheme is located in areas at risk of fluvial flooding, as summarised in Table 14.17

Table 14.17 Summary of baseline fluvial flood risk from main rivers

Source of fluvial flood risk	Geographic area	Baseline fluvial flood risk*
River Chelmer floodplain	East of Chelmsford	The River Chelmer has not been modelled as part of the Preliminary FRA as the proposed scheme would not interact with the River Chelmer floodplain based on the Environment Agency's Flood Map for Planning (2021c) flood zone mapping. According to this mapping, the land surrounding the River Chelmer where the river runs southwards along the eastern side of the existing A12 east of Chelmer Village is classified as flood zone 2 and 3 (width of flood zone 2 floodplain at this point is approximately 900m).
Boreham Brook floodplain	Existing A12 crossing of the Boreham Brook, south-west of Boreham	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling predicts flooding immediately upstream of where the Great Eastern Main Line railway and A12 cross the watercourse in the 1% (1 in 100) AEP plus climate change flood event but not for the more frequent events modelled. The modelling also shows that there is flooding between the A12 and the B1137 for all events modelled. For the 1% (1 in 100) AEP plus climate change flood event, one property adjacent to the watercourse approximately 1.1km upstream of the A12 crossing is within the modelled flood extent within the study area.
River Ter floodplain	Existing A12 crossing of the River Ter, west of Hatfield Peverel	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that there is some flooding upstream of the Great Eastern Main Line railway and upstream of the existing A12 crossing for all events modelled. For the 1% (1 in 100) AEP plus climate change flood event, no properties are located within the modelled flood extent within the study area.
River Brain floodplain	Existing A12 crossing of the River Brain, south-east of Witham	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that for the 1% (1 in 100) AEP plus climate change flood event, approximately 20 properties that occupy low ground adjacent to the watercourse are within the modelled flood extent within the study area, approximately 1km upstream from the existing A12 River Brain crossing.

Source of fluvial flood risk	Geographic area	Baseline fluvial flood risk*
River Blackwater floodplain	East of Witham	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. The model results show that the flood extent just reaches the existing A12 highway at its western extent at one location; however, this is limited to very shallow water in the 1% (1 in 100) AEP plus climate change flood event. For the 1% (1 in 100) AEP plus climate change flood event, five properties are within the modelled flood extent within the study area: two approximately 0.5km downstream of the confluence with the River Brain to the south, and three approximately 0.5km north of Little Braxted to the north.
Rivenhall Brook floodplain	Existing A12 crossing of the Rivenhall Brook, south-east of Rivenhall End	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that flooding occurs alongside Rivenhall Brook upstream of the Granary Farm access road where in-channel flows get locally constricted for all events modelled. The modelling also found that around Rivenhall End village and the existing A12, Rivenhall Brook maximum flood levels remain largely in-bank for the 5% (1 in 20) AEP event, but there is some flooding for the 1% (1 in 100) AEP event. The 1% (1 in 100) AEP plus climate change flood event exhibits flooding for almost all the modelled reach. For the 1% (1 in 100) AEP plus climate change flood event, no properties are located within the modelled flood extent within the study area.
River Blackwater floodplain	Existing A12 crossing of the River Blackwater (Ashman's Bridge), south-west of Kelvedon	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. Significant flooding is predicted to occur downstream of Ashman's Bridge alongside Coleman's and The Willow Reservoirs. Immediately upstream and downstream of the existing A12 crossing, the River Blackwater remains in-bank for the 5% (1 in 20) AEP event, while it gets out-of-bank for the higher events. For the 1% (1 in 100) AEP plus climate change flood event, there are approximately 60 properties within the modelled flood extent within the study area. The nearest flooded property is approximately 600m upstream from the existing A12 River Blackwater crossing. The majority of the flooded properties within the model domain are approximately 2–2.3km upstream of the existing A12 River Blackwater crossing.

Source of fluvial flood risk	Geographic area	Baseline fluvial flood risk*
Domsey Brook floodplain	Existing A12 crossing of the Domsey Brook, south of Feering	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that Domsey Brook exhibits consistent out-of-channel flow for all modelled AEP events in this area. This modelling found that for the 1% (1 in 100) AEP plus climate change flood event, one small industrial site on the B1023, just downstream of the A12 crossing, is inundated for all flood events modelled. No residential properties are located within the modelled flood extent within the study area.
Domsey Brook floodplain	Existing A12 crossing of Domsey Brook, west of Easthorpe	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that significant flooding occurs upstream of the existing A12 where flows are constricted by the existing A12 crossing for all events modelled. Between the existing A12 crossing and Easthorpe Road (approximately 1.5km downstream), some isolated flooding occurs for the 5% (1 in 20) and 1% (1 in 100) AEP events, while it floods more significantly for the 1% (1 in 100) AEP plus climate change flood event. For the 1% (1 in 100) AEP plus climate change flood event, no properties are located within the modelled flood extent within the study area.

Source of fluvial flood risk	Geographic area	Baseline fluvial flood risk*
Roman River floodplain	Existing A12 crossing of the Roman River, north-west of Copford	Hydraulic modelling of this watercourse has been undertaken as part of the Preliminary FRA. This modelling found that, for the 5% (1 in 20) AEP flood event, no flooding occurs within the model reach. During the 1% (1 in 100) AEP flood event, minor flooding occurs directly upstream of both the existing A12 and London Road; however, the flood extent is limited to the immediate floodplain. For the 1% (1 in 100) plus climate change flood event, due to the limited capacity of the railway bridge (approximately 60m upstream of the existing A12 crossing), flows back-up and spread north-east and north-west along the upstream toe of the railway embankment. The watercourse immediately downstream from the existing A12 crossing has no flooding as the river channel and the road bridge both have sufficient capacity. For the 1% (1 in 100) AEP plus climate change flood event, a wider flood extent occurs from approximately 600m upstream of the B1408 (London Road) where the channel switches from modified to natural form. For the 1% (1 in 100) AEP plus climate change flood event, one property is located within the modelled flood extent within the study area upstream of the railway crossing culvert, to the north-east.

*where the ‘1% (1 in 100) AEP plus climate change flood event is referenced, this refers to the modelling undertaken that incorporates the most-recently published fluvial climate change allowances (i.e. 65% climate change uplift), not the draft updated fluvial climate change allowances provided by the Environment Agency (see Table 14.1) which will be published later in the year.

14.7.68 Ordinary watercourse is the term used to define all remaining rivers/watercourses within the UK not designated as main rivers. Activities on these watercourses are administered by the LLFA. There are 30 ordinary watercourses within the study area that would be crossed by the proposed scheme (see Table 14.3, Figure 14.1).

14.7.69 A preliminary assessment was adopted for each of the proposed scheme ordinary watercourse crossing structures to determine the flow conditions through the structure. For this assessment, the Revitalised Flood Hydrograph (ReFH) method has been used to estimate the peak design flow for each watercourse crossing. Where the preliminary assessment suggested that the proposed scheme could have an adverse flood impact, or an existing flood risk to the A12 was identified, it was deemed that these watercourses should be hydraulically modelled to analyse these crossings in greater detail.

14.7.70 The preliminary assessment determined that for five ordinary watercourses (7, 21, 21A, 23, 26) hydraulic modelling is required to inform the assessment of impact. The hydraulic modelling is not yet available to inform this PEIR but will be completed to inform the Environmental Statement. The following events will be assessed: 5% (1 in 20) AEP (functional floodplain); 1% (1 in 100) AEP; and 1% (1 in 100) AEP plus an allowance for climate change. When completed, the results will inform the updated proposed scheme design, including any required mitigation.

14.7.71 For the ordinary watercourses which have not been hydraulically modelled, a review of the Environment Agency's Detailed River Network (2021a), the Environment Agency's RoFSW mapping (2021f), the Braintree and Witham SWMP modelling outputs (AECOM, 2016a), and the analysis undertaken as part of the ongoing drainage strategy for the proposed scheme has been undertaken to assess the baseline flood risk. The flood risk associated with these watercourses is detailed in the Preliminary FRA and has been summarised in the surface water flood risk sub-section below.

14.7.72 The remainder of the study area is designated as flood zone 1 (less than 0.1% (1 in 1,000) AEP of fluvial flooding).

Surface water flood risk

14.7.73 Surface water (water accumulating and/or flowing across the ground surface) also presents a risk within the study area based on the Environment Agency's Detailed River Network mapping (2021a), the RoFSW mapping (2021f) and the Braintree and Witham SWMP modelling outputs (AECOM, 2016a) (see Figure 14.5).

14.7.74 There are areas shown to be at risk of surface water flooding immediately adjacent to all of the main rivers, but these areas are largely located within the fluvial floodplain extent associated with those watercourses and are therefore likely to be associated with flows from these watercourses, and consequently are discussed in the fluvial flood risk sub-section above.

14.7.75 The RoFSW and SWMP mapping have been reviewed to inform the assessment of the fluvial flood risk for the smaller watercourses not evident in the Environment Agency's Flood Map for Planning. These identify apparent overland flow routes that are actually associated with the ordinary watercourses identified.

14.7.76 Other areas of surface water flood risk are located mainly within localised topographic depressions or against existing road embankments. It should be noted that the high level models often used for large-scale surface water mapping may not take full account of the influence of existing drainage and culverts and may therefore overestimate flood risk in some areas.

14.7.77 There are several significant overland flow routes and other areas of high surface water flood risk within the study area. The Preliminary FRA provides further information on the location and extent of surface water flood risk across the study area.

Flooding from groundwater

14.7.78 Groundwater flooding occurs where water levels beneath the ground rise above the ground surface. In some instances, groundwater can emerge at surface level following heavy or prolonged rainfall events and can contribute to existing flooding from other sources.

14.7.79 The local SFRAs were viewed to assess the groundwater flood risk within the study area. The groundwater mapping within these SFRAs is based on the Environment Agency's Areas Susceptible to Groundwater Flooding mapping. The mapping shows the susceptibility rating displayed on a 1km grid where geological and hydrogeological conditions show groundwater might emerge. A summary of the assessment included in the SFRAs is presented in the Preliminary FRA.

14.7.80 In addition to the SFRAs, BGS Susceptibility to Groundwater Flooding mapping data were obtained (BGS, 2020) to further determine the groundwater flood risk to and from the proposed scheme. The BGS groundwater flood susceptibility classifications are provided in Table 14.18, with the zones shown in Figure 14.6.

Table 14.18 Classification of groundwater flood susceptibility areas

Classification	Groundwater flooding susceptibility	Description
A	Very low and low	Limited potential for groundwater flooding to occur
B	High and moderate	Potential for groundwater flooding of property situated below ground level
C	Very high	Potential for groundwater flooding to occur at the surface
Elsewhere (onshore)	None	Not considered to be prone to groundwater flooding

14.7.81 Groundwater flood susceptibility associated with the proposed scheme can be generally described as moderate to high or very high. As shown in Figure 14.6, the principal areas categorised as very high susceptibility to groundwater flooding are close to Chelmsford south of junction 19 (Boreham interchange), and the stretch broadly parallel with the River Blackwater between junction 22 (Colemans interchange) and junction 24 (Kelvedon North interchange). For these areas with a susceptibility to groundwater flooding, there is potential for the emergence of groundwater at the surface.

14.7.82 In general, the difference in groundwater susceptibility correlates with a change in superficial geology. Areas with no susceptibility to groundwater flooding (i.e. areas not classified as very low to low, moderate to high and very high), tend to be underlain by glacial till, the main area being the stretch between junction 24 and junction 25 (Marks Tey interchange). Areas with high susceptibility to groundwater flooding are typically underlain by glaciofluvial deposits.

14.7.83 Areas close to main rivers are also more likely to be susceptible to groundwater flooding than surrounding areas. Within the study area, more than 80% of the land adjacent to the River Chelmer and River Blackwater has the potential for groundwater flooding to occur at the surface. In the north of the study area, less than 25% of the area is susceptible to groundwater flooding at the surface.

14.7.84 As the proposed scheme is located at, or below, ground level at several locations, there is a risk that groundwater flooding could affect the proposed scheme (cuttings and junctions) during both its construction and operational phases, if not managed. The key elements of the design of relevance to groundwater flooding are the deep excavations required where new road cuttings and the new junction 24 are proposed.

14.7.85 The Preliminary FRA provides further detail on groundwater flood risk across the study area including information on groundwater in the superficial deposits and bedrock groundwater.

Other flood sources and historical records

14.7.86 There is water supply and sewerage infrastructure near the proposed scheme in various areas due to the location of residential and other properties (e.g. Chelmsford, Boreham, north of Hatfield Place, Hatfield Peverel, Witham, Rivenhall End, north of Essex County Fire and Rescue Service, south-east and north-east of Gore Pit, and Marks Tey). A data request has been made to Anglian Water for details of the drainage infrastructure near the proposed scheme. At the time of writing, these data have not been made available but will be taken into account for the Environmental Statement. No records of confirmed instances of sewer flooding have been included in the local SFRAs, and the risk of flooding from water supply infrastructure can generally be considered low.

14.7.87 A review of the Environment Agency Flood Map for Planning (2021c) reveals that there is one area benefiting from flood defences located within the study area, to the east of Chelmer Village (see Figure 14.4). In this area the flood defence infrastructure is designed to protect a residential area within Chelmer Village from the River Chelmer, north-west of the existing A12 crossing of the River Chelmer. The proposed scheme would not interact with the flood defence infrastructure or with the area it defends. In the event of a failure of the defences, the area at risk of inundation would be the residential area to the west of the defences.

14.7.88 The Chelmer and Blackwater Navigation is the canalisation of the Rivers Chelmer and Blackwater in Essex. The Navigation connects Chelmsford with the tidal estuary of the River Blackwater. Flood risk from the Chelmer and Blackwater Navigation is considered within the fluvial flood risk sub-section.

Future baseline

14.7.89 Over the anticipated lifetime of the proposed scheme (100 years) changes to the baseline as a consequence of climate change would likely occur, including a likely increase in the frequency and magnitude of flood events.

14.7.90 Baseline conditions for water quality could change over the anticipated lifetime of the proposed scheme as a consequence of climate change which may lead to a change in both low and high flows in watercourses, leading to subsequent changes in dilution capacity. Land use changes and measures to improve watercourses in line with legislative objectives may also result in an improvement in baseline water quality.

14.7.91 In terms of future hydromorphological baselines, increased fluvial flows could facilitate erosion, specifically where it may already be present. However, given the stable nature of most of the watercourses within the study area, extensive changes to baseline conditions would be unlikely.

14.7.92 In terms of changes to the groundwater baseline environment, the most likely change relates to dewatering activities associated with Coleman's Farm Quarry in the vicinity of junction 22. When the quarry stops dewatering, groundwater levels will rise. The other licensed abstractions and PWSs are assumed to continue operating at the same regimes as assessed at the time of the EIA.

14.7.93 The future baseline accounting for climate change has been assessed in line with the latest published Environment Agency guidance for increases in fluvial flows and rainfall intensity that is based on UKCP09. The Environment Agency has provided draft updated fluvial climate change allowances based on UKCP18 prior to their anticipated publication later in 2021. These draft updated climate change allowances have also been assessed where available. The Preliminary FRA provides further details of how future climate change has been considered in the assessment of flood risk.

Value and sensitivity of receptors

14.7.94 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria used to assess the sensitivity of receptors. Impacted receptors in the study area have been assigned a value based on criteria in DMRB LA 113 (Highways England, 2020a) and using professional judgement. Table 14.19 summarises the value of receptors identified within the study area.

14.7.95 The Environmental Scoping Report assumed a value of medium for water quality for all unnamed watercourses as a precautionary approach in the absence of flow data. Since the scoping report, Q95 data have been obtained for the watercourses and these have been used to refine the value for some of the unnamed watercourse receptors. Based upon this criteria (as per DMRB LA 113 guidance), 30 watercourses have been categorised as low value receptors as presented in Table 14.19. At this stage ponds, lakes and reservoirs have not been individually identified as receptors for water quality, and thus a precautionary approach has been taken with these receptors and they have been assigned a value of medium as in the Environmental Scoping Report.

Table 14.19 Value of receptors in the study area for road drainage and the water environment

Value / sensitivity	RDWE matter	Description	Examples within the study area
Very high	Surface water quality	Watercourse having a WFD classification shown in the River Basin Management Plan (RBMP) and a Q95≥1.0m^3/s. Salmonid river.	Boreham Brook/Tributary, Domsey Brook, River Blackwater, River Brain, River Ter, Roman River.
	Hydromorphology	A watercourse that appears to be in complete natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence.	No receptors of this value within the study area.
	Groundwater	Water feeding GWDTEs with a high or moderate groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and SSSIs.	No receptors of this value within the study area.
		Groundwater quality associated with SPZ1 (Inner Protection Zone) associated with licensed abstractions.	SPZ1 associated with Inworth Road groundwater abstraction.
	Flood risk[1]	Essential infrastructure or highly vulnerable development.	Railway line within the study area to the north-east of junction 19. Existing A12.
High	Surface water quality	Watercourse having a WFD classification shown in RBMP and a Q95 <1.0m^3/s.	River Chelmer.
	Hydromorphology	A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences.	River Blackwater.

Value / sensitivity	RDWE matter	Description	Examples within the study area
	Groundwater	Principal or Secondary A aquifer providing locally important resource or supporting a river ecosystem.	River terrace deposits and Kesgrave Catchment Subgroup (see Table 14.7 for further examples).
		Groundwater quality associated with SPZ2 (Outer Protection Zone) associated with licensed abstractions.	No receptors of this value within the study area.
		Groundwater flow, yield and quality associated with extensive non-licensed PWSs (i.e. feeding 10 or more properties or supplying large farming/animal estates).	No receptors of this value within the study area.
		Water feeding GWDTEs of low groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, SACs, SPAs and SSSIs; or water feeding highly or moderately groundwater dependent GWDTEs with a national non-statutory UK Biodiversity Action Plan (BAP) priority.	Groundwater discharging to 13 potential GWDTEs, such as Whetmead LNR.
		Grade I, II* and II listed buildings[2].	Boreham House and others as detailed in Chapter 7: Cultural heritage.
		Scheduled monuments[2].	Rivenhall Long Mortuary Enclosure and others as detailed in Chapter 7: Cultural heritage.
		Buildings of regional importance.	Schools, hospitals etc.
	Flood risk[1]	More vulnerable development.	Residential properties, for example within Witham near the existing A12 River Brain crossing.

Value / sensitivity	RDWE matter	Description	Examples within the study area
Medium	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q95>0.001m^3/s.	Rivenhall Brook, Ordinary Watercourses 13, 14, 16, 19, 32 and 37. Ponds, lakes and reservoirs.
	Hydromorphology	A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse has a limited range of fluvial processes and is affected by modification or other anthropogenic influences.	Boreham Brook, River Chelmer, River Ter, River Brain, Domsey Brook, Roman River, Rivenhall Brook, Baddow Meads Ditch, Ordinary Watercourse 11.
	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Secondary B or Secondary undifferentiated aquifer.	Lowestoft Formation (see Table 14.7 for further examples).
		Groundwater quality associated with SPZ3 (Source Catchment Protection Zone) associated with licensed abstractions and with licensed abstractions for which no SPZ is defined.	SPZ3 at north of the proposed scheme.
		Groundwater flow, yield and quality associated with small-scale PWSs (i.e. feeding fewer than 10 properties).	14 private abstractions, such as abstraction at Domsey Chase.
		Water feeding GWDTEs of low groundwater dependence with a national non-statutory UK BAP priority; or water feeding highly or moderately groundwater dependent GWDTE sites with no conservation designation.	Groundwater discharging to 23 potential GWDTEs, such as Toppinghoehall Wood LWS.
		Buildings of local importance.	Residential properties.
	Flood risk[1]	Less vulnerable development.	Commercial properties within the study area, for example in Rivenhall End in proximity to the existing A12.

Value / sensitivity	RDWE matter	Description	Examples within the study area
Low	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q95≤0.001m^3/s.	Ordinary Watercourses 1 to 12, 15, 15a, 17, 18, 20, 21, 23, 24, 26, 28, 31, 31b, 33 to 36, 38 to 42.
	Hydromorphology	A highly modified watercourse that has been changed by channel modification or other anthropogenic pressures. The watercourse exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes and not likely to be affected by modification.	Coleman's Farm Ditch, Ordinary Watercourses 1B, 1a, 1, 2, 3a, 28, 28a, 7, 7A, 9, 9a, 10, 12, 13, 13a, 15, 15a,17, 18, 21, 21a, 23, 23a, 24, 24a, 26, 26a, 29, 29a, 29b and 30, all unnamed watercourses, all ponds and lakes.
	Groundwater	Unproductive strata.	London Clay.
		Undesignated historic buildings.	Eight undesignated historic buildings.
	Flood risk[1]	Water compatible development.	Rivenhall Oaks Golf Centre north-west of Rivenhall End.

[1] Highly vulnerable development, more vulnerable development, less vulnerable development and water compatible development are defined in the NPPF.

[2] The impact to these receptors from dewatering will be assessed in the cultural heritage chapter of the Environmental Statement.

14.8 Potential impacts

14.8.1 Potential impacts on the water environment could arise from a number of direct and indirect sources during the construction and operational phases of the proposed scheme. This section summarises these potential impacts.

Construction

14.8.2 Temporary construction impacts on the water environment that would last for all, or part of, the construction phase are likely to include the following.

Surface water quality

14.8.3 During construction, there are generally two sources of pollutants: sediments and the use of potentially polluting substances.

14.8.4 There would be an increased pollution risk from sediments being mobilised in runoff which could reach watercourses via the drainage network and impact water quality. This could occur through a variety of construction related activities such as during earthworks (i.e. regrading and construction of new embankments), vegetation clearance and topsoil stripping (i.e. for borrow pits located adjacent to Ordinary Watercourses 7, 15, 21, 21a and 32), through the movement of heavy machinery/vehicles and runoff from stockpiles. There is a high likelihood of silt being generated from construction activities which would be greater after rainfall events. Dewatering activities can also result in the release of sediment-laden discharges to watercourses.

14.8.5 During construction, there is a risk of surface water contamination from the accidental spillage of fuels, lubricants, cements, grouts, hydraulic fluids or other harmful substances, stored and used for construction activities. These could be stored and used throughout the proposed scheme, although the main storage areas would be in the construction compounds. Leaks and spills of these materials could migrate from the ground surface into surface watercourses via runoff or could directly enter watercourses.

14.8.6 The use of cementitious materials, such as concrete, has the potential to contaminate surface waters, including altering its pH (becoming more alkaline). This is most likely to occur if concrete is used within a watercourse, such as for new outfalls or culverts.

14.8.7 Temporary construction drainage would be used to ensure the collection of rainfall runoff from construction areas, compounds and haul roads. This has the potential to be contaminated with pollutants, and should the drainage discharge to a watercourse, this would provide a pathway for pollutants.

14.8.8 The risks of pollution are greater where works occur within or immediately adjacent to a watercourse, such as during the construction or modifications of outfall structures and culverts. There is also a higher risk where works would take place close to existing gullies or drains forming part of the existing highways drainage network. The drainage network creates a pathway for pollutants to reach the watercourse.

14.8.9 Discharge consents would be required for controlled discharges to surface waters during construction (such as those from dewatering activities). It is assumed that, unless an activity is exempt, these would require Environmental Permits (discharge) from the Environment Agency. Any permit conditions would be met to ensure that pollution of the water environment is prevented. Controlled discharges to surface waters have thus not been considered further.

Surface water resource

14.8.10 During construction, surface water may need to be abstracted for construction purposes which, unless exempt, would require an abstraction licence. The location, timing, duration and quantities of water required are not known at this stage so have not been assessed. This will be considered further in the Environmental Statement as more construction information becomes available.

Hydromorphology

14.8.11 Replacement of the bed and banks of the watercourse channel, specifically as a result of culvert extensions, outfall structures or general construction activities, could lead to potential loss in natural bed and bank features, particularly where these sections are close to structures.

14.8.12 Changes to local flow dynamics following adaptations to the road drainage network (including outfall structures), extended culverts, and both widened and newly constructed bridges could lead to an impact to surface water receptors, and hydromorphological change downstream of any structure put in place.

14.8.13 Bed and bank scour have the potential to occur locally to new or extended culverts and outfall structures. The inclusion of new or widened bridges, outfalls and drain confluences could also change sediment and/or flow dynamics locally to promote areas of localised scour.

14.8.14 There is potential for localised changes to sediment transport dynamics and conveyance following channel realignments, some of which could cause localised extensions and reductions of the channel length.

14.8.15 There is potential for release of fine sediment following excavations of floodplain compensation areas and reconnection of floodplain areas to river channels. The latter would also expose banks to localised scour.

Groundwater

14.8.16 During construction, there is a risk of groundwater contamination from the accidental spillage of fuels, lubricants, cements, hydraulic fluids or other harmful substances, stored and used during the construction phase. These could be stored and used throughout the proposed scheme, although the main storage areas would be in the construction compounds. Leaks and spills of these materials could migrate from the surface into aquifers and subsequently to secondary receptors such as groundwater abstractions and GWDTEs.

14.8.17 The use of cementitious materials such as concrete has the potential to contaminate groundwater, including altering its pH (becoming more alkaline). This is most likely to occur if concrete is used below the water table, including where dewatering may temporarily lower the water table which is then left to rebound into the concrete. Wash out water from concrete batching plants also have the potential to impact on groundwater quality if discharged to ground.

14.8.18 There is a risk of physical contamination of groundwater from ground disturbance from activities such as soil stripping (including stripping for haul roads and construction compounds), construction of cuttings, attenuation ponds and foundations, and through piling. This disturbance has the potential for increased sediment in aquifers reaching groundwater dependent features.

14.8.19 Piling has the potential to create preferential pathways for contamination from the surface to groundwater.

14.8.20 Dewatering may be required during the construction of below-ground features, such as cuttings and foundations. This could result in localised drawdown of groundwater and changes to the groundwater flow direction. This could then impact on groundwater receptors such as abstractions and GWDTEs where they are located within the radius of influence of the dewatering. Discharge of the abstracted water could also have an impact on the receiving environment (surface water or groundwater). The effect of discharging groundwater contaminated from historical land contamination is assessed in Chapter 10: Geology and soils.

14.8.21 In the absence of final groundwater level data, it has been assumed that all cuttings and widenings with a depth greater than 1m have the potential to intercept groundwater and require dewatering during construction. The locations of these cuttings and widenings are shown on Figure 14.3. An initial assessment has been made of the likelihood of whether each cutting is likely to require groundwater dewatering. Likelihoods of high, moderate or low have been attributed, depending on the depth of the cutting and, where known, local groundwater levels. Those assessed as having a high or moderate likelihood of dewatering are listed in Table 14.20. Further assessment of dewatering requirements at the cuttings and widenings will be undertaken for the Environmental Statement once GI data, including groundwater levels, have been obtained.

Table 14.20 Cuttings and widenings with the potential to intercept groundwater

Cutting ID	Location	Maximum depth (mbgl)	Groundwater level (mbgl)*	Likelihood of dewatering
C1	Mainline	4.9	Data collection ongoing	Moderate
C4	Mainline	3.1	Data collection ongoing	Moderate
C5	Mainline	4.4	Data collection ongoing	Moderate
W1	Mainline	As existing cutting	1.5	Moderate
W3	Mainline	As existing cutting	1.8	Moderate
W4	Mainline	As existing cutting	Data collection ongoing	Moderate
W5	Mainline	As existing cutting	Data collection ongoing	Moderate

Cutting ID	Location	Maximum depth (mbgl)	Groundwater level (mbgl)*	Likelihood of dewatering
W6	Mainline	As existing cutting	Data collection ongoing	Moderate
CJ2	J22	4.6	Data collection ongoing	Moderate
CJ3	J22	4.1	Data collection ongoing	Moderate
CJ4	J24	8.2	Data collection ongoing	High
CJ5	J24	7.5	Data collection ongoing	High
CJ6	J24	7.6	Data collection ongoing	High
CJ7	J24	4.8	Data collection ongoing	Moderate
CJ8	J24	7.7	Data collection ongoing	High
CJ9	J24	5.8	Data collection ongoing	High
CJ11	J19	3.0	3.1	Moderate
WJ4	J19	As existing junction	3.1	Moderate

* Draft GI data collected for Phase 1 of the GI only. Data collection is ongoing

C – Cutting

W – Widening of an existing A12 cutting

CJ – Cutting for construction of a junction

WJ –Widening of an existing junction cutting

14.8.22 Dewatering would also likely be required during excavation of the borrow pits. Dewatering would be undertaken through the use of sump pumps at the low points within the borrow pits, with drains to transfer the groundwater into the sump. An initial assessment of groundwater levels indicates that dewatering is likely to be required at borrow pit I and borrow pit J and may be required at borrow pit F. Based on the current information, dewatering is unlikely to be required at borrow pit E as set out in Table 14.21. As with the cuttings, an initial assessment of the likelihood of whether each borrow pit is likely to require groundwater dewatering has been undertaken. This has determined the likelihood for dewatering (high, moderate or low) depending on the depth of the borrow pit and the local groundwater levels. Further assessment of dewatering effects of the borrow pits will be undertaken for the Environmental Statement once final GI data, including further groundwater level data, have been obtained.

Table 14.21 Borrow pits' potential to intercept groundwater

Borrow pit	Anticipated depth (mbgl)	Typical groundwater level (mbgl)	Likelihood of dewatering
Borrow pit E	2.5	3.2	Low
Borrow pit F	2.5	2.2	Moderate
Borrow pit I	12.0	1.9	High
Borrow pit J	5.0	1.7	High

14.8.23 Dewatering impacts on other receptors, such as the potential for subsidence of existing infrastructure due to ground settlement as the groundwater table is lowered or the potential for dewatering to impact on heritage assets sensitive to groundwater change and impacts on groundwater/surface water interactions, will be assessed in the Environmental Statement once the extent of dewatering impacts is determined.

14.8.24 Temporary construction drainage would be used to ensure the collection of rainfall runoff from construction areas, compounds and haul roads. This has the potential to reduce the amount of rainfall recharging the superficial aquifers.

Flood risk

14.8.25 Construction works (including stockpiled materials) in fluvial, overland and groundwater flow paths, fluvial floodplain, or any in-channel works could lead to flow being impeded or a loss of floodplain volume and a potential increase in flood risk.

14.8.26 For several construction scheme elements which are considered to have the potential to impact fluvial flood risk, hydraulic modelling has been (or is being) undertaken:

- Haul road running along the eastern edge of the proposed scheme east of Witham (situated within River Blackwater floodplain) (modelling complete – negligible impact on flood risk)
- Haul road south of the mainline Boreham Brook crossing (would cross Boreham Brook via temporary culvert) (modelling ongoing)
- Haul road and piling rig south of Ashman's Bridge (within River Blackwater floodplain) (modelling ongoing)

14.8.27 An indicative haul road is proposed to be aligned along the toe of the eastern embankment of the proposed A12 alignment at the western crossing of Domsey Brook (NGR TL 8772 1910). This alignment shows that the haul road would cross a main river (and associated floodplain) as well as an existing pond. Design of this haul road is ongoing, but it is anticipated that it will be relocated onto the proposed main alignment as the design develops.

14.8.28 Sediment, construction materials and equipment stored in the floodplain or on flow paths could be washed downstream where it could block watercourse channels, land drains and sewers and increase the risk of flooding.

14.8.29 During construction works, existing surface water flow paths could be disrupted and altered (e.g. due to site clearance, earthworks, and excavation work). This could lead to an increase in flood risk.

14.8.30 Construction drainage to watercourses or to ground could increase the rate and volume of runoff and increase the risk of blockages in watercourses that could lead to flow being impeded, and potentially increase flood risk.

14.8.31 Construction works could cause an increase in the rate and volume of surface water runoff by increasing impermeable areas or by reducing permeability by compacting soils.

14.8.32 The proposed scheme includes the construction of a number of areas in cutting (see Figure 14.6 and the Preliminary FRA for more details). Several borrow pits would also be required to supply suitable aggregate for the proposed scheme's construction. Dewatering activities associated with these works could increase fluvial, overland and groundwater flow paths, and potentially increase flood risk.

14.8.33 Excavations could potentially damage existing sewers or water supply infrastructure and lead to flooding.

Operation

14.8.34 Operational and permanent construction impacts of the proposed scheme on the water environment are likely to include the following without appropriate mitigation.

Surface water quality

14.8.35 Surface water quality has been assessed using the HEWRAT tool and is summarised below with a detailed assessment presented in the WQAR.

14.8.36 There are two main types of pollution from roads during the operational phase: road runoff and accidental spillage risk. During routine operation, pollutants such as suspended solids, heavy metals, hydrocarbons, herbicides and de-icing materials (i.e. salts) can be present in the routine runoff from the road surface. These come from a variety of sources such as:

- fuel and other oil deposits on the road surface due to leakage
- hydrocarbons from exhaust deposits
- lead, copper, zinc, iron and cadmium deposits from exhaust emissions, brake dust and tyre wear
- synthetic rubber deposits from tyre wear
- herbicides from vegetation management activities
- chemicals used in windscreen washes such as detergents or de-icer
- de-icing agents such as road salt, but also potentially including trace amounts of impurities such as cyanide, metals and clays

14.8.37 These pollutants, when combined with rainfall, can runoff into the highway drainage system which discharges to a watercourse. This can directly or indirectly impact the water quality and the aquatic habitat within a receiving watercourse and the following potential impacts could occur:

- Suspended solids could smother substrate and increase turbidity with a consequent reduction in light penetration and lowering of oxygenation
- Heavy metals in soluble form would be more 'bio-available' and particularly toxic; some heavy metals would also be sediment-bound
- The main types of hydrocarbons would be polycyclic aromatic hydrocarbons (PAHs); PAHs are of particular concern as they are toxic to freshwater organisms
- De-icing agents could cause high levels of Biological Oxygen Demand (BOD) where de-icing agents other than rock salt are used

14.8.38 The following pollutants have been incorporated within the assessment process (HEWRAT):

- Soluble pollutants associated with acute pollution impacts, for dissolved copper and zinc
- Sediment-bound pollutants associated with chronic pollution impacts, total copper, zinc, cadmium, pyrene, fluoranthene, anthracene, phenanthrene and total PAH

14.8.39 Pollution from maintenance activities during the operational phase, such as the use of herbicides and de-icing salts as a result of responsive activities, are difficult to predict and design for.

Hydromorphology

14.8.40 Operational impacts on hydromorphology would include the following:

- Replacement of the bed and banks of the channel as a result of culvert extensions and/or creation.
- Changes to local flow dynamics following adaptations to the road drainage network (i.e. outfall structures), extended culverts, both widened and newly constructed bridges, improved floodplain connectivity and new compensation areas.
- Bed and bank scour localised to new or extended culverts, new or widened bridges, outfalls and drain confluences. This would also be the case for reconnected floodplains, whereby localised bed and bank scour could take place as flooding recedes.
- Localised and temporary changes to flow regime and dynamics as a result of the improved floodplain connectivity and excavated compensation areas. This would also lead to increased fine sediment availability once inundated and could lead to local changes in sediment transport dynamics.

- Localised changes to sediment transport dynamics and conveyance following channel realignments, some of which cause localised extensions and reductions of the channel length.

Groundwater

14.8.41 There would be pollution risks from routine runoff during the operational life of the proposed scheme if drainage is discharged to the ground or groundwater, although current proposals are for drainage to discharge to surface waters. Potential substances would primarily consist of silts, hydrocarbons and dissolved heavy metals, which may migrate to groundwater bodies. Spills on the carriageway, may occur as the result of a traffic accident, would also have the potential to impact on groundwater if polluting substances entered the drainage system and the system was not fully lined.

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

14.8.43 The long-term impact of embankments could result in local compaction of the superficial aquifer deposits, as well as reduce local recharge where the ground would be covered. This could result in a decrease in groundwater quantity available to secondary receptors.

14.8.44 The inclusion of cuttings and widenings as part of the proposed scheme may create a long-term dewatering impact during operation so that groundwater does not flow onto the carriageway. Any permanent drainage for cuttings would drawdown groundwater levels in the locality of the cutting. Cuttings and widenings on the online and offline sections of the mainline, junctions and side roads have been identified as shown in Table 14.20.

14.8.45 Assessment of the long-term impact on local receptors from cuttings will be undertaken for the Environmental Statement once final GI data, including groundwater levels, have been obtained.

14.8.46 Following excavation and extraction of the minerals from the borrow pits, dewatering, if required, would cease. As such, there would be no long-term dewatering impact from borrow pits. The surface water level in each borrow pit would be allowed to equilibrate with that in the aquifer adjacent to the borrow pit. Groundwater flows may be permanently altered locally at each borrow pit due to the loss of saturated aquifer within the borrow pit footprint. The presence of open water in connection to the aquifer may also provide a rapid pathway for any contaminant to reach groundwater, increasing the vulnerability of the aquifer to pollution.

14.8.47 The increase in areas of hardstanding as part of the proposed scheme, with road drainage discharged to surface waters, has the potential to reduce recharge to the superficial aquifer, impacting on groundwater levels and flows.

Flood risk

14.8.48 There would be an increased risk of fluvial flooding as a result of loss of floodplain storage or in-channel structures restricting watercourse flow.

14.8.49 There would be an increased risk of flooding (fluvial, surface water, sewer and drainage infrastructure) due to increases in the rate and volume of runoff caused by an increase in impermeable surfaces.

14.8.50 Where proposed scheme elements coincide with areas of existing groundwater flood risk, these may lead to an increased risk of groundwater flooding. Where subsurface activities are in an area of significant groundwater presence, risk of groundwater flooding may be increased.

14.8.51 Where deep foundations for new overbridges and gantries or sheet piling are located within areas of existing groundwater flood risk, these could form a barrier to groundwater flow, thereby locally increasing the groundwater flood risk up-gradient.

14.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

14.9.1 Embedded (or design) mitigation are those measures that have been incorporated during the design process to avoid or reduce environmental impacts. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

14.9.2 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

Surface water quality

14.9.3 Embedded mitigation for the proposed scheme as part of the current design includes the incorporation of attenuation ponds and swales as part of the drainage strategy. While primarily included for flood risk attenuation purposes, these ponds have a secondary benefit by providing treatment to road runoff prior to discharge. The HEWRAT assessments undertaken at this stage have informed whether further mitigation is required, as presented in Section 14.10.

Hydromorphology

14.9.4 At this stage, no embedded mitigation for watercourses has been confirmed as part of the design.

Groundwater

14.9.5 At this stage, no embedded mitigation for groundwater has been confirmed as part of the design.

Flood risk

14.9.6 Flood risk has been a consideration throughout the evolution of the proposed scheme design (see Chapter 3: Assessment of alternatives). Previous iterations of the alignment would have included a new bypass and encroachment into the River Blackwater floodplain. The alignment was refined to reduce the encroachment of junction 23 into the River Blackwater flood zone.

14.9.7 The decision was taken to retain the existing River Ter Bridge structure, as opposed to widening this structure or replacing with a new wider structure. Retaining the existing River Ter Bridge reduced the flood risk impacts of the proposed scheme on the River Ter floodplain.

Standard mitigation

14.9.8 Standard mitigation are those measures that would be expected to occur on a typical highways scheme due to legislative requirements or standard sector practices.

Construction

14.9.9 A first iteration of the Environmental Management Plan (EMP) will be produced alongside the Environmental Statement for the DCO application. A second iteration of the EMP would be produced for the construction phase (see Chapter 5: Environmental assessment methodology, for more details).

14.9.10 The EMP will include measures that would be undertaken during construction to mitigate temporary effects on the water environment. The EMP will include a range of measures, which accord with legal compliance and good practice guidance when working with or around sensitive water resources. These measures would include the following:

- Measures to control the storage, handling and disposal of potentially polluting substances during construction. Measures relating to the control of small or more significant spillages would be included in an Outline Water Management Plan which would be included within the EMP along with measures to support an emergency pollution response plan.
- Management of activities within areas at risk of flooding (i.e. kept to a minimum) with temporary land take required for construction to be located outside the floodplain as far as reasonably practicable, or allowances made for floodplain control measures and contingency actions.
- Where necessary, implementation of measures to mitigate for any flood waters displaced during temporary construction works (e.g. raised storage areas, haul roads and cabins).
- Phasing of construction work such that any required floodplain compensation areas would be constructed prior to any encroachment into the floodplain caused by the proposed scheme to ensure no overall adverse impact.
- Managing the risk from groundwater flooding (during excavation) through appropriate working practices and with adequate plans and equipment in place for dewatering to ensure safe dry working environments. Management of the water removed from cuttings and borrow pits for construction dewatering activities before discharge.
- Incorporating sustainable drainage mitigation for construction work with drainage implications (e.g. increasing surface water flood risk as a result of increased impermeable area).

- Adopting the Environment Agency flood warning system during construction and developing a suitable plan which would ensure effective and safe evacuation of personnel (and plant, if safe to do so) from areas at risk on receipt of a flood warning. Areas of the Chelmer, Brain and Blackwater are within Environment flood warning areas.
- Minimise vegetation clearance along the riparian corridor and floodplain.
- Where possible, site layout would ensure stockpiles are stored more than 10m from an adjacent watercourse.
- Utilise measures (e.g. cofferdams) during the construction of the outfalls in order to prevent flows contacting the working area and entraining sediment downstream during construction.
- Aligning temporary construction outfalls downstream, making sure they do not protrude into the channel.
- Temporary culverts (if required) carrying haul roads across watercourses would be as short as is practicable and tied into the beds and banks to prevent bank instability. This would involve submerging the invert below the bed substrate to prevent bed scour, knickpoint formation and to maintain sediment conveyance. In addition, wingwalls would be aligned with the banks to prevent fluvial processes from outflanking the culvert.
- Reinstate the channel appropriately following the deconstruction of temporary structures in the channel or channel banks (i.e. culverts and outfalls). This would prevent knickpoint formation or additional channel instabilities from occurring.
- Place green bed and bank reinforcement along areas that have evidence of erosion during the construction of haul roads and watercourse crossings associated with the highway structures and outfalls. This would help mitigate construction impacts and look to reduce the likelihood of increased bed and bank erosion.

14.9.11 CIRIA guidance would be adopted as standard mitigation as appropriate from the following publications:

- Environmental Handbook for Building and Civil Engineering Projects (3 Parts: C512, C528 and C529) (CIRIA, 2000a-c)
- Control of water pollution from construction sites. Guidance for consultants and contractors (C532) (CIRIA, 2001)
- Control of water pollution from linear construction projects. Site guide (C649) (CIRIA, 2006)
- Groundwater control: design and practice, second edition (C750) (CIRIA, 2016a)
- Environmental good practice on site guide (fourth edition) (C741) (CIRIA, 2015b)

14.9.12 Pollution from maintenance activities can be controlled through good operational management regimes by the road operator. The prevention of ice formation and the de-icing of highways within the UK is carried out almost exclusively using rock salt complying with BS 3247: Specification for salt for spreading on highways for winter maintenance (British Standards Institution, 2011). Rock salt is applied typically in the winter months and therefore only spread on the highway on a small number of days per year. In the Memorandum of Understanding between Highways England and the Environment Agency, it is agreed that:

- Prior to the use of de-icing agents other than rock salt, Highways England should consult with the Environment Agency.
- The Environment Agency does not require Highways England to apply for consent for normal routine maintenance operations, including the application of de-icing agents. However, the Parties are aware that the application of de-icing agents can have impacts on water quality in receiving watercourses, in particular by causing high levels of Biological Oxygen Demand and hence the Parties are committed to investigating alternatives to conventional products currently in use.

14.9.13 Where required, Environmental Permits for any temporary water discharges or dewatering of cuttings and borrow pits would be obtained by the Contractor from the Environment Agency prior to undertaking any dewatering activities.

14.9.14 An assessment of piling methodologies would be undertaken to confirm that the preferential flow paths would not be created.

14.9.15 Where practicable, precast concrete structures would be used to minimise the impact of wet cementitious materials on groundwater and surface water quality.

Operation

Highway drainage

14.9.16 The current drainage design includes ponds (wet-based) and swales for the purpose of attenuation and water quality treatment. Initial assessments on the current design have identified that additional mitigation is likely to be required for some outfalls in order to pass the EQS and to reduce the short-term (i.e. acute) solubles and sediment impacts. Where HEWRAT assessments indicate further mitigation is likely to be necessary, additional pollution control measures will be incorporated into the design as it progresses and this will be reported in the Environmental Statement. The current drainage design criteria are outlined in the Preliminary FRA.

14.9.17 Maintenance and management of the drainage network and assets would be required as part of the operation of the proposed scheme as per standard guidance and practice.

Hydromorphology

14.9.18 Standard operational hydromorphological mitigation regarding the design of drainage outfalls would comply with CIRIA guidance (i.e. Culvert, screen and outfall manual (C786) (CIRIA, 2019)) and consider the SEPA Good Practice Guide: Intakes and Outfalls (SEPA, 2019). These may include:

- aligning the outfall downstream of the receiving watercourse and locating along a straight, stable channel
- setting the outfall back from the bank, ensuring it does not protrude into the channel
- placing the outfall along a straight and stable length of channel, which would prevent instabilities propagating up and downstream
- installing green bed and bank protection around the outfall structure to reduce the potential for bed and bank scour associated with increased flows
- tying the outfall to the bed and banks, using wing walls for example, to prevent the likelihood of fluvial processes outflanking the outfall structure

Watercourse realignments

14.9.19 The proposed scheme would require realignment of a number of watercourses:

- Rivenhall Brook (main river)
- Domsey Brook (main river)
- Roman River (main river)
- Ordinary Watercourses 12, 15, 17, 18 and 24

14.9.20 Various measures would be implemented to mitigate potential impacts on the water environment, including:

- maintaining the existing gradient of the channel and ensuring the channel does not shorten facilitating downstream channel adjustment and erosion
- conversely, ensuring the channel gradient does not over-lengthen, reducing the overall length of the realigned reach and facilitating aggradation of fine sediment
- where possible, encouraging natural processes and flow variation by excavating a gently sinuous planform
- transposing natural bed material present along the existing channel
- installing decomposable geotextile bank protection along the upper banks to encourage vegetation establishment and channel stabilisation
- watercourse realignments would be designed such that they would not cause an increase in flood risk (see Preliminary FRA for additional information)

Watercourse crossings (bridges and culverts)

14.9.21 Various measures would be implemented to mitigate the potential impacts of proposed watercourse crossings on the water environment.

14.9.22 Flood risk will be considered in the design of watercourse crossings (e.g. sizing of new culverts) as far as reasonably practicable in order to reduce the impact these would have on flood risk. The drainage design criteria (included in the Preliminary FRA) include a requirement for proposed new culverts and extensions of existing culverts to be designed such that they would not result in an increase in flooding (for up to the 1% (1 in 100) AEP plus climate change event).

14.9.23 Standard hydromorphological mitigation would comply with good practice and CIRIA guidance. These may include:

- Culverts:
  - Upgrades to existing or construction of new culverts would include culvert diameters that match that of the natural channel
  - Minimal length of newly constructed culverts and extensions to prevent loss of the natural bed and banks
  - Bury the invert beneath the natural bed of watercourses to allow the continuation of sediment conveyance and reduce the impact on local flow dynamics
  - Tie-in new and extended culverts with the bank to prevent the outflanking of the culvert by fluvial processes
  - Install baffles along the culvert bed to encourage flow variation, sedimentation and the restoration of the natural riverbed and sediment conveyance
- Bridges:
  - New bridges would be constructed crossing straight and stable lengths of watercourse to prevent any potential undermining of any aspects of the bridge structure, subject to the requirements of the road alignment
  - Foundations would be buried deep enough to minimise or prevent the need for bed and bank reinforcement, bridges, weirs or aprons
  - The bridge soffit would accommodate peak discharge and not obstruct the conveyance of sediment, woody debris and flows
  - Bed and bank reinforcement would only be considered if potential erosion due to new or extended structures cannot be prevented
  - If piers are required for the new or existing bridges, they would be designed to allow the passage of large woody debris

Additional mitigation

Surface water quality

14.9.24 A need for additional mitigation has been identified as described above in the standard mitigation section, and this is discussed in the WQAR. The specific measures required will be developed as the design progresses and will be reported in the Environmental Statement.

Hydromorphology

14.9.25 Ordinary Watercourse 11 would require increased scour protection on the banks adjacent to the outfall to reduce impacts from the structure and associated drainage. This would require river engineers to assess the requirements of scour protection. However, the use of geotextile scour protection would be preferable and placement of sediment with a grain size greater than the mean grain size along the bank toes would aid in stabilisation. These measures could also be implemented during construction to limit the impacts on in-channel processes observed along the channel.

14.9.26 The culvert present at Ordinary Watercourse 11 is extensive and much greater in length compared to the width of the highway structure it is proposed to sit beneath. Further mitigation would involve shortening this culvert to a width similar to that of the highway structure footprint. This would limit the extent of natural bed and bank material being replaced.

14.9.27 Furthermore, monitoring of bank erosion could be undertaken to assess further impacts to the channel and inform whether further mitigation of the banks is required. This would involve geomorphological walkover surveys over the course of two years from construction. If practicable, two surveys would take place each year. The surveys would observe geomorphological processes and determine how they change with each successive survey.

14.9.28 Ordinary Watercourse 10 would be crossed by a haul road on a bend. The watercourse itself would be realigned, however at this stage it is unclear whether this would take place prior to the construction of the haul road and the temporary crossing. The crossing may therefore need to be relocated so that it crosses the channel on a straight length rather than a bend (to be confirmed in the Environmental Statement).

14.9.29 Outfalls located on the channel bends of the following watercourses would be relocated to straight lengths of the channel, away from channel bends:

- River Chelmer
- River Blackwater
- Boreham Brook
- River Ter
- Domsey Brook
- Roman River

Groundwater

14.9.30 Where the further assessments to be undertaken for the Environmental Statement identify significant impacts from any proposed drainage infiltration methods, further mitigation measures may be required.

14.9.31 Where the further assessments identify significant impacts from cutting, widening or borrow pit dewatering, further mitigation measures may be required for specific locations. The requirement for additional mitigation will be identified for the Environmental Statement, but could include:

- the use of sheet piling to minimise groundwater inflows into excavations
- the recharge of abstracted groundwater back to the aquifer to maintain groundwater levels and flows to secondary receptors such as abstractions and GWDTEs
- minimising the depth of excavations such that no or minimum groundwater dewatering is required
- staging dewatering such that nearby excavations are not being dewatered at the same time
- undertaking excavations at times when groundwater levels are naturally at their lowest
- lowering of pumps in licensed abstraction boreholes or PWSs below the temporary revised groundwater table
- re-drilling of water well(s) where water user abstraction wells are not deep enough to accommodate pump lowering
- providing alternative water supplies during construction (for example from a road tanker or connecting the property to the water mains)

Flood risk

14.9.32 Modelling has identified three locations at which the proposed scheme could have a significant impact on fluvial flood risk (see Figure 14.7). These are summarised below, and further detail is included in the Preliminary FRA:

- When modelled, during the 1% (1 in 100) AEP plus 65% climate change flood event, the extension of the existing culvert at the Boreham Brook crossing would increase flood risk (maximum increase 0.02m) to approximately 17,500m^2 of agricultural land upstream of the crossing without mitigation.
- When modelled, during the 1% (1 in 100) AEP plus 65% climate change flood event, the new offline Rivenhall Brook culvert crossing and associated watercourse realignment would increase flood risk (maximum increase 0.6m) to approximately 4,000m^2 of agricultural land adjacent to the realigned channel immediately upstream of the crossing without mitigation (although this is considered to be conservative due to the modelling approach taken, refer to Preliminary FRA for details).

- When modelled, during the 1% (1 in 100) AEP plus 65% climate change flood event, the extension of the existing Domsey Brook west crossing structure and associated watercourse realignment would, if unmitigated, increase flood risk (maximum increase 0.01m) to approximately 27,500m^2 of agricultural land and greenfield areas upstream of the crossing.

14.9.33 At the current stage of scheme development, the approach that would be taken to two of these areas of increased flood risk (Boreham Brook and Domsey Brook west crossings) has not yet been confirmed. Three approaches are being considered for these areas:

- Agreement of the increased flood risk with the landowner where the land use would potentially be suitable, for example on certain arable areas. If this approach is pursued then at these locations the proposed scheme would have a significant impact on flood risk. However, as the impact would be agreed with the landowner, additional mitigation would not be proposed. It should be noted that such an approach has not yet been discussed with potentially affected landowners.

- Provision of excavated compensatory floodplain storage as mitigation in order to reduce the increased flood risk caused by the proposed scheme.

- A combination of both excavated flood mitigation areas to reduce the increased flood risk caused by the proposed scheme plus agreement with affected landowner(s) that any residual increased flood risk would be acceptable.

14.9.34 The area of increased flood risk that would be caused by the new offline Rivenhall Brook culvert crossing is situated between the existing A12 and the proposed scheme. It is not anticipated that any flood mitigation would be required in this location as the land area of increased flood risk would be acquired by Highways England for the purpose of the proposed scheme and will remain as soft landscaping (this land does not contain any receptors which could be harmed by flood water).

14.9.35 Proposed scheme elements (operational and construction) identified as having the potential to impact fluvial flood risk and requiring further analysis or hydraulic modelling to determine whether mitigation would be required are summarised below (the Preliminary FRA provides further details). Assessment of these elements is ongoing, and results will be included in the Environmental Statement and accompanying updated FRA:

- As stated in Section 14.5, five ordinary watercourses (7, 21, 21A, 23, 26) will be modelled in order to understand and assess the flood risk impact the proposed scheme would have on these receptors. In advance of the detailed hydraulic modelling, provisional floodplain compensation areas have been allocated (see Figure 14.1) as mitigation for the potential impact of the proposed scheme. Their requirement will be confirmed in the Environmental Statement.

- A number of proposed scheme elements (e.g. works associated with construction of haul roads and proposed walking, cycling and horse riding (WCH) routes) have been identified as requiring additional investigation in order to understand and plan for the risk of flooding during construction and operation. An assessment of the potential impacts of these elements on flood risk and the design of any mitigation required will be included within the Environmental Statement.

Enhancement

Surface water quality

14.9.36 Surface water quality may be improved by using attenuation ponds to treat road runoff where HEWRAT assessments already indicate an acceptable level of pollution discharges without such features in place. There is minimal treatment along the majority of the existing A12 (i.e. some filter drains) thus treatment of runoff from the scheme would be a betterment compared to the existing situation. Mitigation for spillage risk is not deemed to be required; however, the attenuation ponds may provide containment facilities where none currently exist, leading to a betterment.

Hydromorphology

14.9.37 At this stage, no opportunities for enhancement to the hydromorphology of watercourses have been identified within the study area.

Groundwater

14.9.38 At this stage, no opportunities for enhancement to groundwater have been identified within the study area.

Flood risk

14.9.39 As the proposed scheme design develops, opportunities for flood risk betterment will be explored. For example, borrow pits or floodplain compensation areas will be assessed for their potential to provide flood risk betterment elsewhere.

14.10 Assessment of likely significant effects

Construction

Surface water quality

14.10.1 There is a risk of suspended solids and polluting substances used during the construction process (e.g. fuel, cement) discharging to watercourses through the surface water highway drainage system or directly via overland flow, with works adjacent to watercourses posing the greatest risk. There is always a residual risk of accidental spillage incidents occurring that could have an adverse effect on surface water bodies. Works close to receptors, such as the construction or modification of bridges and culverts, and compounds located near to watercourses, pose the greatest risk, and for these watercourses there could be a moderate or major adverse effect. However, standard mitigation, to be set out in the EMP, would reduce this impact to negligible and it is unlikely there would be significant effects.

Hydromorphology

14.10.2 Subject to the implementation of all mitigation measures (see Section 14.9), most construction activities would be unlikely to lead to significant effects on geomorphology. Those construction activities assessed to cause significant impacts to watercourses are summarised in Table 14.22.

14.10.3 The indicative haul road is currently shown to cross Unnamed Watercourse 10 at a bend in the channel. This could have significant impacts to the flow regime and in-channel processes leading to extensive erosion and adjustment to the channel up- and downstream of the temporary culvert. However, as the haul road design remains ongoing, a re-design relocating the crossing to a straight length of channel would mitigate any such significant effects. Further detail is provided as additional mitigation in Section 14.9.

14.10.4 The construction of culverts would require in-channel working as well as vegetation stripping. This would likely lead to temporary changes to the flow regime and dynamics, compact the bed substrate and increase the likelihood of bank scour and destabilisation. This would potentially impact sediment transport dynamics along the channel.

14.10.5 Impacts would largely be localised and temporary and would be mitigated with standard practices as discussed in Section 14.9. However, Ordinary Watercourse 11 would be extensively culverted. Given the observed lateral adjustment along the channel, impacts arising from construction works could exacerbate erosional processes along the channel. However, impacts would be alleviated if both standard and additional mitigation practices are carried out.

14.10.6 The residual effects on the discussed receptors reflect the use of proposed mitigation described in Section 14.9.

WFD compliance

14.10.7 Impacts and potential mitigation on WFD water bodies are described in the updated WFD Preliminary Assessment. Potential impacts would include:

- Fine sediment mobilisation risking the deterioration of fish
- Macrophytes and invertebrate WFD quality elements
- Potential impediment to fish passage
- Loss of habitat

14.10.8 There would be water quality changes on a local scale as a result of construction activities and potential silt-laden runoff of pollutants. Hydromorphological changes include fine sediment accumulation and potential bed and bank destabilisation from construction activities. Additional bed and bank erosion as a result of new and extended culverts, realignments and outfalls is also likely. Most impacts would likely be temporary and localised to the area of works.

Table 14.22 Construction phase hydromorphology residual effects

Description of impact	Watercourse name	Value	Significance of effect (pre-mitigation)	Mitigation measures	Significance of effect (post-additional mitigation)
Local changes to flow conditions during construction of the outfalls, cut-off drains and highway structures (including culverts, bridges and side roads)	Ordinary Watercourse 11	Medium	Moderate adverse	Carry out standard and additional mitigation described in Section 14.9	Slight adverse
Loss of riparian vegetation	Ordinary Watercourse 11	Medium	Moderate adverse		Slight adverse
Changes to local flow dynamics and sediment transport dynamics during the use of the haul roads	Ordinary Watercourse 10	Low	Moderate adverse		Slight adverse

Groundwater

14.10.9 Subject to the implementation of all mitigation measures (as listed in Section 14.9), there would be no likely significant effects from construction activities on groundwater receptors (summarised in Table 14.23).

14.10.10 For the Environmental Statement, the following updated assessments will be undertaken once the results from all phases of the GI are received to confirm that there are no likely significant effects. These updated assessments will identify any requirement for implementation of additional mitigation measures (as listed in Section 14.9):

- Dewatering assessment for cuttings, widenings and borrow pits, quantifying the extent of drawdown and potential impacts on receptors.
- Further assessment of potential GWDTE dependency on groundwater is required to categorise the sensitivities of each site. This will concentrate on the GWDTEs closest to the elements of the proposed scheme that could impact on the groundwater environment. This will be undertaken utilising UKTAG guidance (UKTAG, 2005).
- The above assessments will consider the potential for effects on surface water features which may be in connection with groundwater.

14.10.11 For some locations, principally in the Phase 3 GI area in the east of the proposed scheme, winter-high groundwater levels will not be available for the assessments. In these situations, estimates of maximum groundwater levels will be made based on the data that are collected and considering the data that have been collected over the winter of 2020/21 for other areas of the proposed scheme.

Table 14.23 Construction phase groundwater residual effects

Potential impact	Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Accidental spillage of fuels, lubricants, cements, hydraulic fluids or other harmful substances, stored and used during the construction phase leading to groundwater contamination and at groundwater receptors such as abstractions and GWDTEs.	Moderate adverse	Standard construction methods and mitigation measures as outlined in Section 14.9 including potential additional mitigation measures	Slight adverse
Use of cementitious materials such as concrete leading to groundwater contamination and at groundwater receptors such as abstractions and GWDTEs.	Moderate adverse		Slight adverse
Ground disturbance from activities such as soil stripping, construction of cuttings, attenuation ponds and foundations, and through piling leading to physical contamination of groundwater and at groundwater receptors such as abstractions and GWDTEs.	Moderate adverse		Slight adverse
Creation of preferential pathways for contamination from the surface to groundwater through piling.	Moderate adverse		Neutral
Localised drawdown of groundwater and changes to the groundwater flow direction from dewatering activities. This could then impact on groundwater receptors such as abstractions and GWDTEs.	Moderate adverse		Slight adverse
Discharge of the abstracted water.	Moderate adverse		Slight adverse
Temporary construction drainage reducing the amount of rainfall recharging the superficial aquifers.	Slight adverse		Neutral

Flood risk

14.10.12 Subject to the implementation of all mitigation measures (as listed in Section 14.9), there are no likely significant effects from construction activities on flood risk (summarised in Table 14.24). The Preliminary FRA provides details of how the proposed mitigation would achieve this.

14.10.13 A number of proposed scheme construction elements have been identified as requiring further analysis and hydraulic modelling to determine whether further location-specific flood mitigation would be required in any of these locations (for more information, see Section 14.5 and Section 14.9):

- Boreham Brook temporary works culvert extension and haul road (at approximately NGR TL 7461 0987)
- River Blackwater Ashman's Bridge temporary adjacent haul road (at approximately NGR TL 8556 1766)

14.10.14 It is unlikely that either of these construction elements, for which analysis and modelling are currently ongoing, would result in any significant effects once any required mitigation has been applied. The results of these investigations will be detailed in the Environmental Statement and accompanying updated FRA.

14.10.15 The proposed scheme includes a haul road crossing the River Blackwater floodplain (at approximately NGR TL 8301 1446). Hydraulic modelling of this haul road has been undertaken and has confirmed that it would have negligible impact on flood risk.

Table 14.24 Construction phase flood risk residual effects

Potential impact	Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Construction works (including stockpiled materials) in fluvial, overland and groundwater flow paths, fluvial floodplain, or any in-channel works could lead to flow being impeded or a loss of floodplain volume and a potential increase in flood risk.	Large adverse	Standard construction methods and mitigation measures as outlined in Section 14.9	Neutral
Sediment, construction materials and equipment stored in the floodplain or on flow paths could be washed downstream where it could block watercourse channels, land drains and sewers and increase the risk of flooding.			
During construction works, existing surface water flow paths could be disrupted and altered (e.g. due to site clearance, earthworks and excavation work). This could lead to an increase in flood risk.			
Construction drainage to watercourses or to ground could increase the rate and volume of runoff and increase the risk of blockages in watercourses that could lead to flow being impeded, and a potential increase in flood risk.			
Construction works could cause an increase in the rate and volume of surface water runoff from an increase in impermeable areas or by reducing permeability by compacting soils.			
Dewatering activities associated with proposed scheme areas in cutting and with borrow pits could increase fluvial, overland and groundwater flow paths, and potentially increase flood risk.			
Excavations could potentially damage existing sewers or water supply infrastructure and lead to flooding.			

Operation

Surface water quality

Spillage risk assessments

14.10.16 As DMRB LA 113 guidance stipulates, a simple level spillage risk assessment has been undertaken for the proposed scheme using HEWRAT. Results show that all discharges from the proposed scheme pass with a calculated annual probability of a serious pollution incident to be less than the 1 in 100 year return period (1% AEP) DMRB standard, which is within acceptable limits, and thus mitigation is not deemed to be required. As the spillage risk achieves the required standards in DMRB LA 113, the magnitude of impact on water quality has been influenced by the routine runoff results.

Routine runoff assessments

14.10.17 Routine runoff simple assessments have been undertaken using HEWRAT. The full details of the methodology, data used and results at this stage are presented in the WQAR. The results of the HEWRAT assessments have been used to inform the magnitude of impact. This has been reported, along with the significance of effect, in the WQAR. At this stage the results presented can be considered precautionary in the absence of more detailed assessment and design information.

14.10.18 Detailed assessments using the Metal-Bioavailability Assessment Tool (M-BAT) have not yet been undertaken due to the current stage in the design process and programme. The key output of the M-BAT is an estimate of the bioavailable concentration of a metal under the conditions found at a site, which can then be compared with the $EQS_{bioavailable}$ to assess compliance. Ambient Background Concentrations (ABC) can also be considered where EQS failures occur.

14.10.19 For the assessment of sediments, a Step 2 Tier 1 assessment has been undertaken which considers the river width of a receiving watercourse only. A Step 2 Tier 2 assessment will be undertaken which considers alternative channel dimensions and this will be reported in the Environmental Statement.

14.10.20 In the absence of detailed assessment results, impacts cannot be ruled out at this stage. Where appropriate, the detailed assessments will be carried out for the Environmental Statement. It is likely that appropriate mitigation can be incorporated to minimise adverse impacts in the majority of locations so that effects are not significant.

14.10.21 DMRB CG 501 Design of Highway Drainage Systems (Highways England, 2020p) provides guidance on the principles of pollution and flow control. Table 8.6.4N3 in DMRB CG 501 presents possible flow control measures and their indicative treatment efficiencies for the removal of contaminants. These treatment efficiencies have been used in the HEWRAT assessments to inform the mitigation required. This methodology is described further in the WQAR.

Hydromorphology

14.10.22 Subject to the implementation of mitigation described in Section 14.9, most operational activities and structures would be unlikely to cause any significant effects. Details of those which are likely to remain significant following mitigation are summarised in Table 14.25.

14.10.23 Outfalls are currently proposed on, or adjacent to, the bends of the following watercourses:

- River Chelmer
- Boreham Brook
- Domsey Brook
- River Ter
- River Blackwater
- Roman River

14.10.24 If located on bends, outfalls can lead to significant effects on flow dynamics and in-channel processes, potentially leading to extensive erosion and channel adjustment. However, with the implementation of standard mitigation measures described for outfalls in Section 14.9, it is assumed that such outfalls would be relocated. By moving the outfalls to straight lengths of the channel, away from bends or irregular meandering sequences, as seen along the River Ter, impacts would likely reduce.

14.10.25 The presence of a culvert would lead to adverse effects on watercourses. The artificial walls and bed of the culvert would replace the natural bed and bank material. This would confine the watercourse and potentially cause scour up- and downstream of the culverts, as well as impounding flows upstream potentially leading to fine sediment deposition at the inlet. If geomorphological processes are already present (i.e. lateral adjustment) these impacts could propagate up- and downstream of the new culvert as a result of channel confinement.

14.10.26 With the standard mitigation discussed in Section 14.9, most impacts would likely be mitigated, leading to slight adverse effects on receptors. However, Ordinary Watercourse 11 would be extensively culverted, replacing significant lengths of the channel bed and banks with the artificial walls and bed of the culverts. As the watercourse was observed to be laterally adjusting, channel confinement would likely move to unconfined lengths of the channel and lateral adjustment could intensify. However, additional mitigation measures described in Section 14.9 could provide some relief from such impacts.

14.10.27 Following channel realignment of Rivenhall Brook, Ordinary Watercourse 15a would be disconnected from its source. This would likely cause flow to cease leading to an ephemeral flow regime dependant on antecedent rainfall events.

14.10.28 Increased connectivity between the channel and floodplain for Boreham Brook and Domsey Brook would likely be of benefit to the watercourse. Such reconnection would lead to localised and temporary changes in flow regime and stream power during flood events. This would likely lead to accretion across the floodplain and facilitate floodplain habitat development.

14.10.29 The residual effects on the discussed receptors reflect the use of proposed mitigation found in Section 14.9.

WFD compliance

14.10.30 Impacts to and potential mitigation for WFD water bodies are described in the updated WFD Preliminary Assessment. Changes to local water quality and quantity could alter the composition of biological communities and physico-chemical quality elements. Hydromorphological changes include fine sediment accumulation, flow impoundments at culverts and bridges, and potential bed and bank destabilisation. Most impacts are likely to be localised to the works and temporary, as the watercourses adjust to the new or upgraded features.

Table 14.25 Operational residual effects on hydromorphology

Description of impact	Watercourse name	Sensitivity	Significance of effect (pre-mitigation)	Mitigation	Significance of effect (post- additional mitigation)
Loss of lengths of the natural bed and banks impacting the morphological characteristics of the watercourse arising from the discharge of water from the outfall	Boreham Brook	Medium	Moderate adverse	Apply standard mitigation practices described in Section 14.9 (i.e. relocate outfalls to straight lengths of channel away from bends)	Slight adverse
	Domsey Brook	Medium	Moderate adverse		Slight adverse
	River Ter	Medium	Moderate adverse		Slight adverse
	Roman River	Medium	Moderate adverse		Slight adverse
	River Blackwater	High	Moderate adverse		Slight adverse
	River Chelmer	High	Moderate adverse		Slight adverse
Loss of lengths of the natural bed and banks impacting the morphological characteristics of the watercourse arising from presence of new, or extended/widened, culverts and bridges	Ordinary Watercourse 11	Medium	Large adverse	Apply standard and additional mitigation practices described in Section 14.9	Slight adverse

Description of impact	Watercourse name	Sensitivity	Significance of effect (pre-mitigation)	Mitigation	Significance of effect (post- additional mitigation)
Local changes to flow conditions during channel realignments	Ordinary Watercourse 15a	Low	Moderate adverse	No mitigation available. Watercourse is an off take of Rivenhall Brook and would cease	Moderate adverse
Changes to flow and flow dynamics as a result of the improved floodplain connectivity and flood compensation areas	Boreham Brook	Medium	Minor beneficial	Not applicable	Slight beneficial
	Domsey Brook	Medium	Minor beneficial		Slight beneficial

Groundwater

14.10.31 There would be pollution risks from routine runoff during the operational life of the proposed scheme if drainage is discharged to the ground. However, it is currently proposed that all road drainage would be discharged to surface water although this is subject to confirmation following completion of the GI. This will be confirmed for the Environmental Statement, and if infiltration methods are proposed then further assessment will be undertaken. There is also the potential for a proportion of the discharges to watercourses with low flows to infiltrate to the ground and this will be considered in the Environmental Statement in line with the HEWRAT methodology in DMRB LA 113.

14.10.32 Whetmead LNR and LWS is the only groundwater receptor identified that could potentially be impacted by sheet piling. Further assessment of the sensitivity of the potential GWDTE to changes in groundwater flow will be undertaken for the Environmental Statement to assess the magnitude of any potential impact.

14.10.33 Long-term dewatering from cuttings would be needed if groundwater levels were to rise above the pavement level. This is most likely to occur in the deepest cuttings such as the new junction 24. A preliminary assessment of the likelihood of dewatering being required at each cutting is provided in Table 14.20 and this would also apply to long-term impacts where there is a need for ongoing dewatering. The long-term impact of cuttings on groundwater levels and flows will be assessed for the Environmental Statement once GI data have been received.

14.10.34 The presence of areas of hardstanding for the road with drainage being discharged to surface waters would reduce recharge to the underlying aquifers. Impacts on secondary groundwater receptors from the increase in hardstanding would be limited to those receptors in very close proximity to the proposed scheme. The following receptors could be impacted by a localised reduction in the recharge:

- Marshy grassland 1
- Wet woodland 1
- Whetmead LNR and LWS
- Wet woodland 7
- Wet woodland 8
- Burghey Brook Farm groundwater abstraction

14.10.35 Further assessment of the sensitivity of these receptors will be undertaken for the Environmental Statement to establish the potential significance of any effect.

14.10.36 Following application of mitigation (as listed in Section 14.9), no potential significant effects on groundwater from operation have been identified. For the Environmental Statement, the following assessments will be required, for which results from all phases of the GI are necessary:

- Dewatering assessment for cuttings and widenings, quantifying the extent of drawdown and potential impacts on receptors
- Further assessment of potential GWDTE dependency on groundwater is required to categorise sensitivities
- The above assessments will consider the potential for effects on surface water features which may be in connection with groundwater
- Where it is identified that groundwater may discharge to watercourses which have a low flow, such that the discharged water may infiltrate into the ground, an assessment of the impact on the groundwater will be made using the HEWRAT methodology
- If the drainage strategy changes such that the drainage system includes infiltration methods, then an assessment of discharges of routine runoff to ground would be required

14.10.37 Operational phase residual effects on groundwater are summarised in Table 14.26.

Table 14.26 Operation phase groundwater residual effects

Potential impact		Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Discharges to ground of pollutants from road drainage causing groundwater contamination and at groundwater receptors such as abstractions and GWDTEs.		Neutral	Standard construction methods and mitigation measures as outlined in Section 14.9 including potential additional mitigation measures	Neutral
Permanent below-ground structures within the shallow aquifer altering groundwater levels and flows and at groundwater receptors such as abstractions and GWDTEs.	Whetmead LNR and LWS.	Moderate adverse		Slight adverse
	All other receptors.	Slight adverse		Neutral
Embankments leading to local compaction of the superficial aquifer deposits and reduced local recharge.		Slight adverse		Neutral
Localised drawdown of groundwater and changes to the groundwater flow direction from dewatering of cuttings and widenings. This could then impact on groundwater receptors such as abstractions and GWDTEs.		Moderate adverse		Slight adverse
Changes to groundwater flow locally due to the loss of saturated aquifer within the borrow pit footprint.		Slight adverse		Slight adverse
Rapid pathways through new open waterbodies within the borrow pit footprint in connection to the aquifer leading to groundwater contamination. This could then impact on groundwater receptors such as abstractions and GWDTEs.		Slight adverse		Slight adverse
Areas of hardstanding with road drainage discharged to surface waters leading to reduced recharge to the superficial aquifer. This could then impact on groundwater receptors such as abstractions and GWDTEs.	Marshy grassland 1, Wet woodland 1, Whetmead LNR and LWS, Wet woodland 7, Wet woodland 8, and Burghey Brook Farm groundwater abstraction.	Moderate adverse		Slight adverse
	All other receptors.	Neutral		Neutral

Flood risk

14.10.38 As stated in Section 14.9, hydraulic modelling has identified three locations where the proposed scheme could have a significant impact on fluvial flood risk (see Figure 14.7), which are summarised below. Further detail of the interaction between the proposed scheme and watercourses is included in the Preliminary FRA.

- The extension of the existing culvert at the Boreham Brook crossing would, if unmitigated, cause increased flood risk upstream of the crossing
- The new offline Rivenhall Brook culvert crossing structure and associated watercourse realignment would increase flood risk upstream of the crossing
- The extension of the existing Domsey Brook west crossing structure and associated watercourse realignment would, if unmitigated, increase flood risk upstream of the crossing

14.10.39 The significance of these unmitigated effects at Boreham Brook, Rivenhall Brook and Domsey Brook (west) crossings are all slight adverse (as outlined in Table 14.27).

Table 14.27 Significance of effect of Boreham Brook, Rivenhall Brook and Domsey Brook (west) crossings using DMRB LA 104 methodology

Location and proposed scheme works	Sensitivity of floodplain[1]	Magnitude of scheme impact[2]	Significance of effect[3]
Location: **Boreham Brook crossing** Proposed scheme: Widening highway embankment to the south and extending existing culvert	High (floodplain contains receptors classified as 'more vulnerable', e.g. residential properties)	Minor adverse (would cause an increase in peak flood level (maximum increase 0.02m) to approximately17,500m^2 of agricultural land upstream of the crossing)	Slight adverse[4]
Location: **Rivenhall Brook crossing** Proposed scheme: New offline culvert crossing of watercourse	Low (floodplain contains no receptors vulnerable to flooding)	Major adverse (would cause an increase in peak flood level (maximum increase 0.6m) to approximately 4,000m^2 of agricultural land adjacent to the realigned channel immediately upstream of the crossing	Slight adverse[5]

Location and proposed scheme works	Sensitivity of floodplain[1]	Magnitude of scheme impact[2]	Significance of effect[3]
Location: **Domsey Brook west crossing** Proposed scheme: Widening of existing road and lengthening of existing watercourse crossing structure	Medium (floodplain contains and is directly adjacent to receptors classified as 'less vulnerable', e.g. buildings used for shops; financial, professional and other services; buildings used for general industry)	Minor adverse (would cause an increase in peak flood level (maximum increase 0.01m) to approximately27,500m^2 of agricultural land and greenfield areas upstream of the crossing	Slight adverse

[1] Receptor sensitivity (of proposed scheme floodplain crossing) has been defined as per Table 3.70 of DMRB LA 113 which uses vulnerability of development (defined in the Flood Risk section of the Technical Guidance to the NPPF, 2012) located within the floodplain (in this case the 1% (1 in 100) AEP plus published climate change uplift floodplain has been used) crossed within the study area to define the sensitivity.

[2] Magnitude of effect has been defined as per Table 3.71 of DMRB LA 113. Flood event considered: 1% (1 in 100) AEP plus published climate change flood event.

[3] Effect significance has been determined based on Table 3.8.1 of DMRB LA 104 using the assigned importance/sensitivity of receptor and magnitude of impact using methodology defined in DMRB LA 113.

[4] DMRB LA 104 matrix results in slight/moderate adverse significance of effect. A slight adverse significance of effect has been reported, as the area for which the proposed scheme would cause an increase in flood risk contains no properties classified as 'more vulnerable' under DMRB LA 113 guidance.

[5] DMRB LA 104 matrix results in slight/moderate adverse significance of effect. A slight adverse significance of effect has been reported, as the area for which the proposed scheme would cause an increase in flood risk contains no receptors classified as vulnerable to flooding under DMRB LA 113 guidance and the increased flood risk is unlikely to impact current usage.

14.10.40 At the current stage of scheme development, the approach that would be taken at Boreham Brook crossing and Domsey Brook (west) crossing has not yet been confirmed. As such, at this stage these two locations are considered to have the potential for effects on flood risk which, although assessed using DMRB guidance as slight adverse (and therefore 'not significant'), have the potential to be considered unacceptable under NPPF guidance. Three approaches are being considered for these areas, which would be either financial compensation for increased risk, compensatory floodplain storage (excavation) or a combination of the two (see Section 14.9 for further details).

14.10.41 The area of increased flood risk that would be caused by the new offline Rivenhall Brook culvert crossing is situated between the existing A12 and the proposed scheme. It is not anticipated that any flood mitigation would be required in this location as the land area of increased flood risk would be acquired by Highways England for the purpose of the proposed scheme and will remain as unused land (i.e. this land does not contain any receptors which could be harmed by flood water).

14.10.42 A number of operational proposed scheme elements have been identified as requiring further analysis and hydraulic modelling to determine whether further location-specific flood mitigation would be required in any of these locations (for more information see Section 14.5 and Section 14.9):

- Permanent crossings of five ordinary watercourses (7, 21, 21a, 23, 26) identified as requiring hydraulic modelling to assess flood risk implications.
- A proposed WCH route is shown to cross the width of the River Blackwater floodplain to the south of Ashman's Bridge. The design and alignment of this WCH route is under review. Hydraulic modelling will be undertaken to assess flood risk implications.

14.10.43 It is unlikely that any of these operational elements of the proposed scheme, for which analysis and modelling are currently ongoing, would result in any significant effects once the required mitigation has been applied (see Table 14.28). The results of these investigations will be detailed in the Environmental Statement and accompanying updated FRA.

Table 14.28 Operational phase flood risk residual effects

Potential impact		Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Increased risk of fluvial flooding associated with main rivers as a result of loss of floodplain storage, in-channel structures restricting watercourse flow, extension of existing watercourse crossing infrastructure, or installation of new watercourse crossing infrastructure.	Boreham Brook crossing	Slight adverse	No mitigation identified at this stage.	Slight adverse (no confirmed mitigation incorporated at this stage of scheme design)
	Domsey Brook (west) crossing	Slight adverse	No mitigation identified at this stage.	Slight adverse (no confirmed mitigation incorporated at this stage of scheme design)
	Rivenhall Brook crossing	Slight adverse	It is not anticipated that any mitigation would be required at this location.	Slight adverse
	All other locations at which operational elements of the proposed scheme would cross a main river	Neutral	Following completion of hydraulic modelling, it is considered no mitigation would be required at these crossings.	Neutral (no mitigation considered required)
Increased risk of fluvial flooding associated with ordinary watercourses identified as requiring hydraulic modelling as a result of loss of floodplain storage, in-channel structures restricting watercourse flow, extension of existing watercourse crossing infrastructure, or installation of new watercourse crossing infrastructure.		Large adverse (hydraulic modelling underway)	To be determined if required through ongoing hydraulic modelling and assessment.	Unlikely to result in any significant effects following application of required mitigation

Potential impact	Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Increased risk of fluvial flooding associated with ordinary watercourses identified as not requiring hydraulic modelling as a result of extension of existing watercourse crossing infrastructure or installation of new watercourse crossing infrastructure.	Large adverse	Drainage design (see Preliminary FRA for surface water drainage design criteria).	Neutral
Increased risk of flooding (fluvial, surface water, sewer and drainage infrastructure) due to increase in the rate and volume of runoff caused by an increase in impermeable surfaces.	Large adverse	Drainage design (see Preliminary FRA for surface water drainage design criteria).	Neutral
Where the proposed scheme elements including the road, particularly in cuttings, and other infrastructure coincide with areas of existing groundwater flood risk, these may lead to an increased risk of groundwater flooding.	Large adverse	To protect flood sensitive receptors (including the new road) from groundwater flooding, groundwater seepages would be collected by the proposed road drainage system to prevent groundwater reaching the surface.	Slight adverse

Potential impact	Potential significance (pre-mitigation)	Mitigation measure to be applied	Significance (post-mitigation)
Where deep foundations for new overbridges and gantries or sheet piling would be located within areas of existing groundwater flood risk, these would have the potential to form a barrier to groundwater flow, thereby locally increasing the groundwater flood risk up-gradient.	Major adverse	All foundations and below-ground linear structures expected to intercept high groundwater levels would be designed to allow existing groundwater flow paths to function. This would prevent an increase in groundwater flood risk to flood sensitive receptors elsewhere.	Slight adverse
Ground compaction as a result of any embankments would be expected to restrict groundwater flow in the areas that coincide with shallow groundwater levels.	Moderate adverse	Embankments would be designed to allow existing groundwater flow paths to function. This would prevent an increase in groundwater flood risk to flood sensitive receptors elsewhere.	Negligible

15 Climate

15.1 Topic introduction

15.1.1 The UK Government has signed binding international agreements, such as the Paris Agreement, and introduced legislation, such as the Climate Change Act 2008, to progressively reduce national emissions of greenhouse gases (GHGs) over time. The UK is targeting to reach 'net zero' GHG emissions by 2050, in order to minimise the cumulative contribution of GHGs to global climate change. Road transport accounts for more than one-fifth of UK GHG emissions (Office of National Statistics, 2020b), with further emissions arising from the use of materials to construct and maintain the infrastructure required to operate the strategic road network.

15.1.2 It is also important that UK infrastructure projects are designed to be suitably resilient to changes in climate which could happen in the future (e.g. higher temperatures, heavier rainfall and more extreme weather events).

15.1.3 The purpose of this chapter is to provide information to enable consultees to understand potential climate effects, based on the preliminary information available at this time, and the measures proposed to mitigate such effects. In line with Design Manual for Roads and Bridges (DMRB) LA 114 Climate (Highways England, 2019f), this chapter provides a preliminary assessment of:

- the potential impact of the proposed scheme on climate (by estimating resulting changes in GHG emissions)
- the potential vulnerability of the proposed scheme to potential future changes in climate

15.1.4 This chapter is supported by the following figures (see Appendix A):

- Figure 6.1 Air Quality Assessment Study Area

15.2 Stakeholder engagement

15.2.1 Table 15.1 summarises key requirements and responses relating to climate from the Planning Inspectorate's Scoping Opinion (2021), along with comments received from other stakeholders on this aspect.

Table 15.1 Key stakeholder feedback for climate aspect

Stakeholder	Comment	Response
Planning Inspectorate	The Environmental Statement should include a description and assessment (where relevant) of the likely significant effects the proposed scheme has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.	This chapter provides a preliminary assessment of the potential effects of the proposed scheme on GHG emissions and the potential vulnerability of the proposed scheme to climate change. A more complete assessment of both of these matters will be included within the Environmental Statement based on additional and more detailed information.
Planning Inspectorate	Where relevant, the Environmental Statement should describe and assess the adaptive capacity that has been incorporated into the design of the proposed scheme. This may include, for example, alternative measures such as changes in the use of materials or construction and design techniques that will be more resilient to risks from climate change.	The measures and techniques which would be applied to improve the resilience of the proposed scheme to climate change will be described within the Environmental Statement. Potential residual effects will then be assessed in line with DMRB LA 114 Climate (Highways England, 2019f).
Essex County Council	Essex County Council has inaugurated an independent, cross-party Essex Climate Change Commission, the findings of which will be published in the first half of 2021. The applicant should have regard to this emerging advice within the Environmental Statement, as it is expected to impact on local policies and aspirations relevant to the proposed scheme.	As further information is published by the Essex Climate Change Commission, its relevance to the proposed scheme will be determined and taken into account within the Environmental Statement, where it is considered appropriate and proportionate to do so.

Stakeholder	Comment	Response
Essex County Council	Essex County Council has a commitment to formulate a Climate Action Plan to reduce carbon emissions across the county of Essex. The impact of the proposed scheme on emissions within the county and potential impact on upcoming emissions reductions goals should also be noted.	This chapter provides a preliminary assessment of the potential impact of the proposed scheme on road user GHG emissions over a 60-year appraisal period in line with DMRB LA 114. The spatial extent over which road user GHG emissions have been assessed, which covers a large part of the county of Essex, is shown on Figure 6.1. Estimated changes in GHG emissions have been compared to relevant UK carbon budgets in line with DMRB LA 114. A revised assessment of this matter, incorporating updated traffic forecasts and estimated emissions for a wider range of GHG emission sources during both construction and operation, will be included within the Environmental Statement.
Essex County Council	The importance of reducing the impact of the scheme to as close to 'net zero' as possible should be noted.	A 2050 'net zero' GHG emissions target has been set for the UK as a whole. While there is no requirement for the proposed scheme to have 'net zero' GHG emissions, it is recognised that GHG emissions associated with the proposed scheme should be minimised to contribute to the achievement of UK GHG emissions targets.
Essex County Council / Feering Parish Council	All GHGs (not just carbon dioxide (CO_2)) should be considered.	Within the Environmental Statement, emissions of all relevant GHGs will be considered, where it is practical and proportionate to do so, and expressed as emissions of carbon dioxide equivalent (CO_2e).

15.2.2 The full Scoping Opinion, as well as the applicant's response regarding how and where comments have been addressed in the Environmental Impact Assessment and draft Development Consent Order (DCO), will be included within the Environmental Statement.

15.3 Legislative and policy framework

15.3.1 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.

15.3.2 Key policy from the NNNPS relevant to this aspect is set out below:

- Paragraph 4.40 of the NNNPS states that new national networks infrastructure should typically be long-term investments which should remain operational over many decades, in the face of a changing climate. Therefore, applications should consider the impacts of climate change when planning location, design, build and operation.
- Paragraph 4.42 states that applications should consider the potential impacts of climate change, over the estimated lifetime of the new infrastructure, using the latest UK Climate Projections available at the time, and that any Environmental Statement which is prepared should identify appropriate mitigation or adaptation measures.
- Paragraph 4.43 states that applications should demonstrate that there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK Climate Projections.
- Paragraph 5.17 states that applicants need to consider carbon impacts as part of the appraisal of scheme options and to describe an assessment of any likely significant climate factors within the Environmental Statement. The NNNPS states that it is very unlikely that the impact of a road project will, in isolation, affect the ability of the Government to meet its carbon reduction targets. However, the NNNPS requires that applicants should provide both evidence of the carbon impacts of a scheme and an assessment of these impacts against the Government's carbon budgets.
- Paragraph 5.19 outlines the need for appropriate climate mitigation measures to be implemented, in both design and construction of a road scheme, so that the associated carbon footprint is not unnecessarily high.

15.3.3 In addition to the national policy set out in the NNNPS, the proposed scheme must also have regard to relevant legislation and local plans and policy. A summary of legislation and policy is provided in Appendix B. Full details of legislation and local planning policy relevant to this aspect will be detailed in the Environmental Statement.

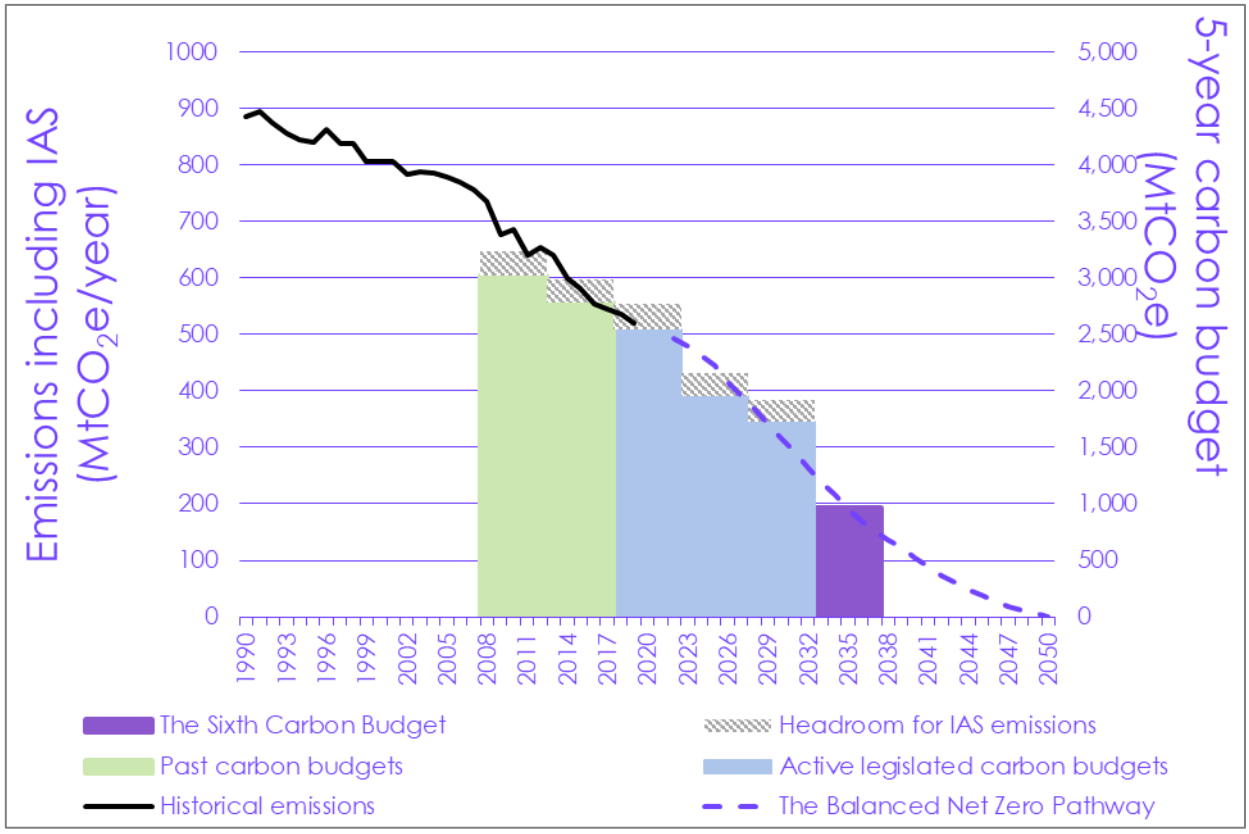
15.3.4 Under the internationally binding Paris Agreement, the UK is committed to reducing carbon emissions in line with the European Union Nationally Determined Contribution of 40% against a 1990 baseline by 2050. The UK's Climate Change Act 2008 initially committed the UK to reducing carbon emissions by 80% by 2050; however, the Act was amended in 2019 to reflect the target of achieving net zero carbon by 2050. The UK Government carbon budgets relevant to this aspect are as follows:

- The 3rd carbon budget: 2018–2022 – 2,544 million tonnes of carbon dioxide equivalent ($MtCO_2e$), equivalent to a 16% reduction in annual emissions from a 1990 baseline.
- The 4th carbon budget: 2023–2027 – 1,950$MtCO_2e$, equivalent to a 36% reduction in annual emissions from a 1990 baseline.

- The 5th carbon budget: 2028–2032 – 1,725MtCO$_2$e, equivalent to a 57% reduction in annual emissions from a 1990 baseline.
- The 6th carbon budget (which is yet to be legislated): 2033–2037 – 965MtCO$_2$e, equivalent to a 78% reduction in annual emissions from a 1990 baseline. It is also the first budget which is in line with the 2050 net zero carbon target.

15.3.5 These carbon budgets are summarised in Plate 15.1 below.

Plate 15.1 UK carbon budgets set to achieve net zero carbon by 2050 (Committee on Climate Change, 2020)



15.4 Assessment methodology

Greenhouse gas emissions

15.4.1 A preliminary assessment of the change in GHG emissions associated with the proposed scheme compared to UK Government carbon budgets has been undertaken with reference to DMRB LA 114 Climate (Highways England, 2019f), and as required by the NNNPS. As the operational phase of the proposed scheme would extend over multiple carbon budget periods, changes in GHG emissions have been estimated over each period.

15.4.2 At this preliminary stage, only road user GHG emissions have been considered. A wider, more complete range of emission sources will be considered within the Environmental Statement, as detailed in Table 15.2 (in Section 15.5).

15.4.3 Road user GHG emissions have been estimated using the methodology set out in the Transport Analysis Guidance (TAG) Data Book (Department for Transport, 2020b) and modelled traffic data, for the opening year (2027) and design year (2042) with the proposed scheme (Do-Something) and without the proposed scheme (Do-Minimum) scenarios. In order to estimate road user GHG emissions for each year of the 60-year appraisal period after scheme opening required by DMRB LA 114, estimated road user GHG emissions in the Do-Minimum and Do-Something scenarios, respectively, were assumed to change at a constant rate between 2027 and 2042, and then to remain constant between 2042 and 2086. The estimated change in road user GHG emissions as a result of the proposed scheme was then derived by subtracting the total Do-Minimum road user GHG emissions from the total Do-Something road user GHG emissions.

Vulnerability to changes in climate

15.4.4 A preliminary assessment of the proposed scheme's vulnerability to climate change has been undertaken in line with DMRB LA 114, and as required by the NNNPS. This assessment has included:

- analysis of current and projected baseline climate conditions, using appropriate UK Climate Projections, in order to identify the type and magnitude of changes in climate to which the proposed scheme could potentially be exposed
- the identification of receptors, during both the construction (e.g. workforce, plant, machinery) and operational phases (e.g. scheme assets and end users), which are potentially vulnerable to changes in climate (e.g. increased rainfall and/or temperature extremes)
- the identification of climate change related impacts (e.g. flooding or landslides) on the receptors identified, which could potentially be significant

15.4.5 At this stage, measures which will be embedded within the design of the proposed scheme to improve its resilience to potential future changes in climate are still in the process of being developed. As such, it has not yet been possible to undertake a risk assessment of potential climate change impacts on the proposed scheme (in line with DMRB LA 114). The following further steps will therefore be reported within the Environmental Statement, once more detailed design information is available:

- The identification of mitigation measures which would be embedded within the design of the proposed scheme in order to improve its resilience to climate change, in liaison with the proposed scheme design team and relevant environmental aspect specialists
- A qualitative risk assessment of potential residual impacts on the receptors identified with reference to the indicative framework set out in Table 3.39a (likelihood categories) and Table 3.39b (measure of consequence) of DMRB LA 114

Assessment of significance

15.4.6 The Environmental Scoping Report (Highways England, 2020d) sets out the criteria which will be used to assess significance for this aspect (which are also briefly summarised below). The Environmental Scoping Report can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

Greenhouse gas emissions

15.4.7 In line with DMRB LA 114, an assessment has been made as to whether estimated increases in GHG emissions as a result of the proposed scheme could have a material impact on the ability of the UK Government to meet its carbon reduction targets (and would therefore potentially be significant). While no specific guidance is provided within DMRB LA 114, or elsewhere, on the magnitude of a change in GHG emissions (relative to UK carbon budgets) which could be considered significant, for the purposes of this assessment, and based on professional judgement, changes of less than 0.1% of the relevant carbon budget have been considered to be negligible and therefore not significant.

Vulnerability to changes in climate

15.4.8 Within the Environmental Statement, in line with DMRB LA 114, the likelihood and consequence of each climate related impact will be combined in the form of a matrix to identify the significance of each impact as per Table 3.41 (significance matrix) of DMRB LA 114.

15.5 Assessment assumptions and limitations

Greenhouse gas emissions

15.5.1 The road user GHG emissions estimates presented in this report are based on data derived from the A12 PCF Stage 3 Statutory Consultation traffic model (based on a 2016 base year), and as such should be considered preliminary. A revised estimate of operational road user GHG emissions will be made when traffic data from the A12 PCF Stage 3 DCO model (based on a 2019 base year) are available, the results of which will be presented within the Environmental Statement.

15.5.2 There are uncertainties inherent within all modelled road traffic data, including those on which the operational road user GHG emissions calculations presented within this Preliminary Environmental Information Report (PEIR) are based. Traffic model outputs have, however, been appropriately validated, as discussed within the Local Modal Validation Report (which will be included as part of the DCO application). The revised traffic data which will be assessed within the Environmental Statement are likely to be subject to fewer uncertainties as they will be derived from a more recent base year (i.e. 2019 as opposed to 2016).

15.5.3 The methodology used to estimate road user GHG emissions presented in this PEIR is considered the most appropriate; however, it is subject to uncertainty, not least regarding the assumed uptake of electric vehicles in future years. While the vehicle fleet projections used were those most recently published by the Department for Transport (July 2020), it is likely that these will be updated in the near future (e.g. to account for the forthcoming transport decarbonisation plan, which is due to be published in Spring 2021).

15.5.4 At this preliminary stage it has not been possible to estimate GHG emissions associated with a number of other sources, as the required data were either not available or were insufficiently developed. Within the Environmental Statement, changes in GHG emissions associated with the proposed scheme will also be estimated for each of the emission sources described in Table 15.2.

Table 15.2 Additional emission sources to be considered within the Environmental Statement

Emissions source	Emission estimation methodology	Data sources
Product stage (embodied carbon in construction materials)	Highways England Carbon Tool (v.2.3) (Highways England, 2019g)	Estimated types and quantities of materials/items (including mass haul and soil stabilisation assumptions)
Transport of construction materials to site		Estimated distances from suppliers to site
Energy consumption (on-site plant and machinery)		Estimated fuel and electricity consumption
Energy consumption (staff vehicles)		Estimated numbers of workers and distances travelled to/from site
Electricity, gas and water consumption (construction site compounds)		Estimated on-site electricity, gas and water consumption
Transportation, treatment and disposal of waste materials		Estimated waste type, quantities, disposal method and transportation distances
Maintenance activities		Assumptions regarding likely maintenance activities and frequencies
Replacement of assets at end of design life		Design life of permanent assets/structures to calculate number of planned replacement cycles within the 60-year appraisal period

Emissions source	Emission estimation methodology	Data sources
Land use change and forestry	Carbon storage by habitat: review of the evidence of the impacts of management decisions and condition of carbon stores and sources (NERR043) (Natural England, 2012) Woodland Carbon Code Carbon Calculation Spreadsheet (v2.3, May 2020)	Type and area of land use lost/gained Number of trees, type and planting/management plans.
Electricity consumption (operation)	Electricity emission factors (Department for Business, Energy and Industrial Strategy (BEIS), 2020a)	Anticipated electricity consumption (e.g. for lighting)

15.5.5 As GHG emissions have not been estimated for those sources described in Table 15.2, benchmarking of the performance of the proposed scheme (i.e. by comparing GHG emissions to those estimated for other highway projects), as required by DMRB LA 114 (Highways England, 2019f), has not been undertaken. Such a comparison will, however, be reported within the Environmental Statement where sufficient and appropriate data for comparable projects are available (e.g. by normalising estimated emissions to account for differences in size and scale between different projects).

Vulnerability to changes in climate

15.5.6 There is inherent uncertainty in the climate models which form the basis of the climate projections used to inform this assessment (i.e. the climate models used in the UK Climate Projections 2018 (UKCP18) datasets (Met Office, 2020)). However, the use of the UKCP18 High Emissions Receptor Concentration Pathway 8.5 (RCP8.5) projections dataset is likely to provide a more conservative estimate of future climate change, as it represents the highest modelled GHG emissions scenario.

15.5.7 Only one grid cell, for each of the UKCP18 datasets considered (ranging from 2.2km to 25km), was selected to describe the climatic conditions in the study area considered within this assessment. Therefore, it is assumed that climate conditions across the study area are adequately described by the selected grid cell, particularly as climate conditions are not expected to vary substantially over short distances (the length of the proposed scheme is approximately 24km) and that in many cases the majority of the proposed scheme falls into the grid cell used.

15.5.8 There is substantial uncertainty regarding the likelihood and consequence of climate change related impacts on the performance of UK road transport infrastructure. A qualitative approach has therefore been used, supported by professional judgement where relevant. As described in Section 15.4, it has not been possible to undertake a risk assessment of potential climate change

impacts on the proposed scheme (in line with DMRB LA 114) within this assessment, as embedded mitigation measures are still in the process of being developed. Such an assessment will be presented in the Environmental Statement once embedded mitigation has been finalised.

15.5.9 Where relevant, aspect-specific measures to mitigate the vulnerability of the proposed scheme to climate change are detailed in the corresponding chapters. For example, mitigation with regards to increased flood risk as a result of climate change is addressed in Chapter 14: Road drainage and the water environment.

15.5.10 The proposed scheme's vulnerability to climate change has been assessed on the basis that suitable design standards and robust engineering practices will be followed and the assumption that all relevant design standards are suitable for both current and future climatic conditions.

15.5.11 DMRB LA 114 Climate states that climate assessments should use the H++ climate scenarios to test the sensitivity of vulnerable safety-critical features, to ensure that such features would not be affected by more radical changes to the climate beyond that projected in the latest set of UK Climate Projections.

15.5.12 The H++ scenarios cover heat waves, cold snaps, low and high rainfall, droughts, floods and windstorms. However, of these climate related events, the greatest risks to safety critical features (e.g. structures) are considered likely to be those associated with flooding. The H++ scenarios were developed using a set of climate change projections which have since been superseded (i.e. UKCP09); however, the Met Office does not propose to update these scenarios using UKCP18 (Met Office, 2018a). While the H++ climate scenarios are still considered valid high-end scenarios, it is noted that the climate change allowances which have been considered within Chapter 14: Road drainage and the water environment, are very similar to those for H++. Where those allowances are below the appropriate H++ allowance for the watercourse, there is no realistic prospect of the additional flows causing significant flood risk to the proposed scheme. As such, an assessment of H++ scenarios is not proposed to be undertaken.

15.6 Study area

Greenhouse gas emissions

15.6.1 In line with DMRB LA 114 (Highways England, 2019f), different study areas need to be defined for different types of emission source. As such, the following study areas are defined for the emission sources considered within this assessment:

- GHG emissions resulting from operational road users – the study area comprises the road network included within the Traffic Reliability Area of the traffic model developed for the proposed scheme (as shown in Figure 6.1).

15.6.2 The following study areas are defined for the emissions sources which have not been considered within this PEIR, but which will be considered within the Environmental Statement:

- GHG emissions resulting from construction – this is the study area necessary to consider all of the GHG emissions associated with construction materials and their associated transport to site from the supplier. It also includes GHG emissions associated with construction activities carried out within the Order Limits, the distances that workers travel to and from the construction site and the transport and processing of waste off-site for reuse, recycling or treatment/disposal. As such, the study area is defined by the greatest extent of these activities, which assumes that some may occur at a national scale (i.e. within England).

- GHG emissions resulting from operation and maintenance – the study area is based on a similar extent as the construction phase (e.g. to include replacement of assets which may be delivered from suppliers located across England). It also includes the GHG emissions from the energy consumed within the Order Limits required to operate the proposed scheme.

Vulnerability to changes in climate

15.6.3 The study area for the proposed scheme's vulnerability to climate comprises the construction footprint of the proposed scheme, including compounds and temporary land take.

15.6.4 The proposed scheme provisional Order Limits are shown on Figure 1.1 (Appendix A).

15.7 Baseline conditions

Baseline sources

Greenhouse gas emissions

15.7.1 The following key sources of information have been used to define baseline and future baseline GHG emissions in the study area relevant to the proposed scheme:

- Carbon dioxide (CO_2) emissions at a UK and county level – UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005 to 2018 (BEIS, 2020b)

- A preliminary estimate of Do-Minimum (i.e. without the proposed scheme) road user GHG emissions for the base year (2016) and over a 60-year appraisal period after the proposed scheme opening year (2027), in line with DMRB LA 114

15.7.2 No information is currently available regarding Do-Minimum GHG emissions associated with the current and future operation and maintenance activities for the extents of the existing A12 and surrounding road network, which would be replaced by the proposed scheme. An estimate of future baseline GHG emissions from these activities will be made within the Environmental Statement using relevant assumptions.

Vulnerability to changes in climate

15.7.3 The following key sources of information have been used to define the baseline and future baseline climate in the study area relevant to the proposed scheme:

- Current climate data within the study area for the proposed scheme – HadUK-Grid regional observations dataset v1.0.1.0 for the 'climate normal' period of 1981-2010 (Met Office et al., 2019), for the 25km grid square centred on grid reference TL 87500 12500.
- Climate extreme indices – State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018b)
- Projected climate changes within the study area for the proposed scheme – UK Climate Projections 2018 (UKCP18) relative to the baseline period of 1981-2010 (Met Office, 2020), under the high emissions scenario (i.e. RCP8.5) and for a 50% probability of occurrence, for the 25km grid square centred on grid reference TL 87500 12500.
- Projected climate data within the study area for the proposed scheme – UKCP18 relative to the baseline period of 1981-2010 (Met Office, 2020), under the high emissions scenario (i.e. RCP8.5), for the 12km grid square centred on grid reference TL 82000 10000 and the 2.2km grid square centred on gird reference TL 82500, 12500.
- Geological hazards – British Geological Survey (BGS) GeoIndex (BGS, 2021a) and GeoClimate Open (BGS, 2021b) datasets.

Baseline conditions

Greenhouse gas emissions

15.7.4 Estimated operational road user GHG emissions across the study area defined in Section 15.6 for the modelled base year (2016) are shown in Table 15.3.

Table 15.3 Estimated baseline GHG emissions

Source	Baseline GHG emissions (tCO_2e)
	2016
Road users	1,075,963

15.7.5 The estimated road user emissions shown in Table 15.3 equate to approximately 31% and 1% of 2016 national estimates of road user GHG emissions within Essex (3,420ktCO_2e) and the UK (103,821ktCO_2e) respectively (BEIS, 2020b).

15.7.6 Within the Environmental Statement, baseline GHG emissions associated with the operation and maintenance of the existing A12 will also be reported.

Vulnerability to changes in climate

15.7.7 With regard to baseline climate impacts, DMRB LA 114 indicates that:

- the assessment of a project's vulnerability to climate change shall use published historical regional weather data to demonstrate the current climate impacts on a study area
- recent weather patterns and extreme weather events should be identified to provide an indication of how the scheme will account for climate change in the immediate future (i.e. during construction)
- historical events as a result of weather patterns and extreme weather events (i.e. landslides after heavy rainfall) shall be identified to provide an indication of past vulnerability

15.7.8 As such, baseline climate data for the East of England are summarised in Table 15.4, based on data for the most recent 'climate normal' period available from the Met Office (i.e. 1981–2010) (Met Office *et al*., 2019). These data have been compared to similar data for England as a whole, which indicate that:

- the climate in the East of England region is warmer compared to across England as a whole, throughout the year, with the most sizeable differences recorded during summertime
- the climate in the East of England region is drier compared to across England as a whole, throughout the year, with the greatest difference in precipitation being in wintertime

Table 15.4 Baseline climate data for England and the East of England region

Climate variable	Observed climate baseline (1981–2010)			
	Period	England	East of England	Difference
Daily maximum temperature (°C)	Annual	13.4	14.2	+0.8
	Winter	7.1	7.3	+0.2
	Spring	12.7	13.4	+0.7
	Summer	20.1	21.3	+1.2
	Autumn	13.9	14.6	+0.7
Daily minimum temperature (°C)	Annual	5.9	6.1	+0.2
	Winter	1.3	1.4	+0.1
	Spring	4.4	4.7	+0.3
	Summer	10.9	11.4	+0.5
	Autumn	6.8	7.1	+0.3

Climate variable	Observed climate baseline (1981–2010)			
	Period	England	East of England	Difference
Daily mean temperature (°C)	Annual	9.6	10.2	+0.6
	Winter	4.2	4.3	+0.1
	Spring	8.5	9.0	+0.5
	Summer	15.5	16.3	+0.8
	Autumn	10.3	10.9	+0.6
Mean accumulated precipitation (mm)	Annual	855	622	-233
	Winter	230	146	-84
	Spring	181	137	-44
	Summer	194	160	-34
	Autumn	250	179	-71

15.7.9 An overview of historical and more-recent extreme weather conditions recorded in the East of England is presented in Table 15.5, based on data contained within the State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018b). These data indicate that:

- maximum temperatures in the East of England region are higher than across England as a whole, and appear to be increasing
- the duration of ‘warm spells’ is shorter in the East of England region than across England as a whole (potentially as a result of coastal influences on meteorology), but they appear to be increasing
- the duration of ‘cold spells’ and number of ‘icing days’ are lower in the East of England region than across England as a whole, and appear to be decreasing
- rainfall from ‘extremely wet days’ is lower in the East of England region than across England as a whole, and appears to be decreasing
- maximum ‘five-day precipitation’ is lower in the East of England region than across England as a whole, and appears to be decreasing
- the ‘longest dry spell’ is longer in the East of England region than across England as a whole, but appears to be decreasing

Table 15.5 Summary of climate extremes for England and the East of England region

Climate variable	Period	England	East of England	Difference
Highest maximum temperature [a]	1981–2010	28.3	29.9	+1.6
	2008–2017	28.5	30.3	+1.8
	Change [b]	+0.2	+0.4	-
Warm spell duration index (days) [c]	1981–2010	10.0	8.8	-1.2
	2008–2017	15.0	13.2	-1.8
	Change [b]	+5.0	+4.4	-
Cold spell duration index (days) [d]	1981–2010	2.8	2.8	0.0
	2008–2017	2.0	1.0	-1.0
	Change [b]	-0.8	-1.8	-
Number of icing days [e]	1981–2010	2.5	2.0	-0.5
	2008–2017	1.9	1.0	-0.9
	Change [b]	-0.6	-1.0	-
Rainfall from extremely wet days (mm) [f]	1981–2010	69.3	56.8	-12.5
	2008–2017	72.0	53.2	-18.8
	Change [b]	+2.7	-3.6	-
Maximum five-day precipitation (mm) [g]	1981–2010	67.3	53.1	-14.2
	2008–2017	65.7	51.8	-13.9
	Change [b]	-1.6	-1.3	-
Longest dry spell (days) [h]	1981–2010	22.2	24.5	+2.3
	2008–2017	20.1	22.2	+2.1
	Change [b]	-2.1	-2.3	-

[a] Highest daily maximum temperature recorded during the month

[b] Difference in observed value between 2008–2017 and 1981–2010

[c] Count of days with at least six consecutive days when daily maximum temperature is above the 90th percentile centred on a five-day window for the base period of 1961–1990

[d] Count of days with at least six consecutive days when daily minimum temperature is below the 10th percentile centred on a five-day window for the base period of 1961–1990

[e] Number of days when the daily minimum temperature is below 0°C

[f] Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall

[g] Highest value of rainfall accumulated over five days

[h] Largest number of consecutive days with <1mm rainfall

15.7.10 Based on a preliminary Flood Risk Assessment, there are significant areas at risk of fluvial flooding near the proposed scheme in a 1% Annual Exceedance Probability (AEP) event. However, the A12 carriageway is outside of modelled fluvial flood extents in this event. Further details are in Section 14.7 of Chapter 14: Road drainage and the water environment.

15.7.11 A search of internet sources also indicates flooding events have occurred on the A12 near the proposed scheme, which appear to have affected road users. Historical flooding to the A12 is generally believed to be surface water flooding, with several areas predicted to be at risk of flooding according to the Environment Agency Risk of Flooding from Surface Water mapping (Environment Agency, 2021f).

15.7.12 Risks from groundwater, water infrastructure and sewer flooding are also reported in Chapter 14; however, these relate to the wider area in which the proposed scheme is located, rather than the A12 itself, and therefore do not indicate existing vulnerability.

15.7.13 Based on GeoIndex (BGS, 2021a), no historical landslide events are recorded near of the proposed scheme, and therefore no such past vulnerability has been identified at this stage.

15.7.14 No records were available at the time of writing regarding past incidences of subsidence within the footprint of the proposed scheme.

Future baseline

Greenhouse gas emissions

15.7.15 Preliminary estimates of Do-Minimum operational road user GHG emissions in the opening year (2027), design year (2042) and over a 60-year appraisal period after scheme opening (2027–2086) are shown in Table 15.6.

Table 15.6 Estimated future Do-Minimum GHG emissions

Source	Future baseline GHG emissions (tCO_2e)		
	Opening year (2027)	Design year (2042)	Appraisal period (2027–2086)
Road users	960,632	863,413	52,582,516

15.7.16 The preliminary estimates of road user emissions shown in Table 15.6 indicate that road user GHG emissions would decrease by approximately 10% between the modelled opening year (2027) and modelled design year (2042). This is despite the total number of vehicle kilometres travelled within the study area being modelled to increase by approximately 15% over this period. An overall decrease in road user GHG emissions occurs because of a substantial projected increase in the proportion of electric vehicles in the national vehicle fleet (which result in lower GHG emissions than conventionally fuelled vehicles), coupled with improvements in vehicle efficiency. This illustrates the overriding influence that national policy (e.g. future bans on the sale of conventionally fuelled cars and vans) is expected to have on road user GHG emissions in future years.

15.7.17 Do-Minimum road user GHG emissions are assumed to remain constant between 2042 and 2086 in the absence of traffic data beyond 2042, whereas in reality they are likely to decrease substantially over time due to increasing proportions of electric vehicles.

15.7.18 Within the Environmental Statement, baseline GHG emissions associated with the operation and maintenance of the existing A12 will also be reported.

Vulnerability to changes in climate

15.7.19 Current and projected future changes in climate, in terms of temperature and precipitation, are presented in Table 15.7. These data utilise the 25km spatial resolution UKCP18 probabilistic dataset for the grid cell centred at grid reference TL 87500 12500. The current climate conditions (i.e. observed baseline) refer to the most recent historic climate dataset of 1981–2010. The future climate conditions (i.e. climate projections) refer to projections made under the high emissions scenario (i.e. RCP8.5) with a 50% probability of occurrence for the 2030s (2020–2049), 2060s (2050–2079) and 2080s (2070–2099) respectively. These 30-year periods cover the lifespan of the proposed scheme (which is taken to be 60 years in accordance with DMRB LA 114).

Table 15.7 Projected changes in climate at the location of the proposed scheme

Climate metric	Observed baseline 1981–2010	Projected change (UKCP18 RCP8.5 (50% probability))		
		2030s (2020–2049)	2060s (2050–2079)	2080s (2070–2099)
Annual mean accumulated precipitation	564.0mm	0.2%	-2.1%	-1.1%
Winter mean accumulated precipitation	134.8mm	+6.8%	+13.9%	+21.0%
Summer mean accumulated precipitation	140.7mm	-12.6%	-26.8%	-35.4%
Annual mean temperature	10.5°C	+1.1°C	+2.5°C	+3.7°C
Mean winter minimum temperature	1.7°C	+0.9°C	+2.2°C	+3.2°C
Mean summer maximum temperature	21.7°C	+1.5°C	+3.5°C	+5.3°C

15.7.20 Under the climate scenario considered, annual mean accumulated precipitation at the location of the proposed scheme is projected to slightly decrease over time, and by the 2080s is projected to have decreased by 1.1% compared to the observed baseline. However, projected changes in seasonal precipitation by the 2080s, i.e. +21.0% during wintertime and -35.4% during summertime, indicate substantially wetter winters and substantially drier summers could occur.

15.7.21 All of the temperature related metrics considered indicate that there could be a steady increase in temperatures, with the largest increase occurring during summertime. Specifically, the annual mean, mean winter minimum and mean summer maximum temperatures are projected to increase by 3.7°C, 3.2°C and 5.3°C, respectively, by the 2080s compared to the observed baseline values.

15.7.22 Other climate variables, selected to represent more extreme conditions (i.e. the 10th and 90th percentiles of projected values) are presented in Table 15.8. These variables were derived utilising the regional (12km) and, where relevant, local (2.2km) spatial resolution UKCP18 high emissions scenario (i.e. RCP8.5) datasets for the grid squares centred at grid reference TL 82000 10000 and TL 82500 12500, respectively.

15.7.23 Daily projections for the period 2061–2080 were used to assess potential changes in more extreme daily temperature, precipitation and wind events. The 90th percentile of projected values has been used to represent the value above which any event happening within a day (e.g. a precipitation event) is likely to occur less frequently. For instance, for the period 2061–2080, maximum daily precipitation events greater than 6.7mm are likely to occur relatively infrequently. Similarly, the 10th percentile has been used to represent the value below which any event happening within a day is likely to occur less frequently. The corresponding metrics for the observed baseline period 1981–2010 (which is the baseline for the 12km and 2.2km projection datasets) are also presented for comparison.

Table 15.8 Projected changes in climate extremes at the location of the proposed scheme

Meteorological parameter	Observed baseline 1981–2010		Projected (RCP8.5) 2061–2080		Projected change	
	10th %ile	90th %ile	10th %ile	90th %ile	10th %ile	90th %ile
Daily precipitation (mm/day)	-	5.3 to 7.0	-	5.1 to 6.7	-	-0.2 to -0.3
Minimum daily temperature (°C)	-0.9 to 1.2	12.3 to 14.5	2.4 to 4.2	15.9 to 18.2	+3.3 to +3.0	+3.6 to +3.7
Maximum daily temperature (°C)	3.6 to 6.1	20.2 to 23.1	7.4 to 9.3	25.9 to 30.3	+3.8 to +3.2	+5.7 to +7.2
Daily temperature (°C)	1.6 to 3.8	16.0 to 18.6	4.9 to 6.7	20.6 to 23.8	+3.3 to +2.9	+4.6 to +5.2
Maximum daily wind gusts (m/s)	8.2 to 8.6	18.3 to 19.4	8.1 to 8.6	17.5 to 19.1	-0.1 to 0.0	-0.8 to -0.3

Note: Ranges are provided for each variable to account for differences in the outputs of the 12 ensembles (i.e. model runs) included within the UKCP18.

15.7.24 Under the climate scenario considered, the 90th percentile of daily precipitation values is projected to decrease slightly from 7.0mm/day during 1981–2010 to 6.7mm/day during 2061–2080 (upper limits used), indicating that more extreme precipitation events have the potential to occur slightly less frequently. However, it should be noted that when even less likely events are considered, i.e. in excess of the 90th percentile, precipitation intensity appears to increase between the two periods, suggesting that, while more extreme precipitation events could occur less frequently, very extreme precipitation events could be of higher intensity when they do occur. For instance, the 99th percentile of daily precipitation values is projected to increase by approximately 12% from 20.3mm/day to 22.7mm/day (upper limits used).

15.7.25 The 10th percentile of minimum daily temperatures is projected to increase from -0.9°C to 2.4°C (lower limits used), indicating that days with more extreme low temperatures have the potential to occur less frequently. The 90th percentile of maximum daily temperatures is projected to increase from 23.1°C to 30.3°C (upper limits used), indicating that days with more extreme high temperatures will potentially occur more frequently.

15.7.26 The intensity of the 90th percentile of maximum wind gusts is projected to decrease slightly from 19.4m/s to 19.1m/s, indicating that higher wind speeds will potentially occur less frequently.

15.7.27 Utilising the same dataset as for Table 15.8, a number of climate extreme indices for the study area were also calculated (see Table 15.9), which underpin the warmer and drier conditions identified above. For example, the number of annual air frost days (upper limit) during 2061–2080 will potentially be substantially lower than during 1981–2010, i.e. from up to 20 events to up to one event. Hot spells and heatwaves will potentially increase from up to seven events and up to five events per year during 1981–2010, to up to 57 events and up to 47 events per year, respectively, during 2061–2080. In addition, drought events and dry spells will potentially increase from up to two events to up to 11 events and from up to six events to up to 17 events, respectively. The annual number of days with wind gust events exceeding 45mph will potentially reduce slightly from up to 28 days to up to 25 days.

Table 15.9 Projected changes in climate extreme indices at the location of the proposed scheme

Climate extreme indices	Observed baseline 1981–2010	Projected (RCP8.5) 2061–2080
Annual number of days when mean temperature >25°C	0–1	3–23
Annual air frost days	5–20	0–1
Annual hot spells (days)	0–7	15–57
Annual heatwaves (days)	0–5	10–47
Annual heavy rain days	1–2	1–3

Climate extreme indices	Observed baseline 1981–2010	Projected (RCP8.5) 2061–2080
Annual drought events	1–2	1–11
Annual dry spells	6–17	15–37
Annual number of days when maximum wind gust >45mph	17–28	13–25

Note: Ranges are provided for each variable to account for differences in the outputs of the 12 ensembles (i.e. model runs) included within the UKCP18.

15.7.28 Future changes in climate have the potential to exacerbate or reduce the effects of the proposed scheme on the environment (i.e. to result in 'in-combination' effects). This issue has been considered within each of the relevant aspect chapters using aspect significance criteria, rather than within this chapter, as recommended within the Institute of Environmental Management and Assessment's (2020b) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation.

Value and sensitivity of receptors

15.7.29 In line with the DMRB LA 114 (Highways England, 2019f), the following receptors have been identified:

- With regard to GHG emissions:
  - UK carbon budgets (as a proxy for the global climate)
- With regard to the proposed scheme's vulnerability to climate change:
  - receptors associated with the construction process (including the construction workforce, plant and machinery)
  - the assets and their operation, maintenance and refurbishment (e.g. road pavement surfaces, structures, earthworks and drainage, technology assets, soft estate)
  - end-users (e.g. members of the public or commercial operators using the proposed scheme)

15.7.30 In the absence of specific guidance in DMRB LA 114 on the valuation of receptors with regard to climate impacts, all receptors are considered to be of equally high value.

15.8 Potential impacts

Construction

Greenhouse gas emissions

15.8.1 GHG emissions would be generated during the construction phase as a result of the following activities, in alignment with modules A1 to A5 of the 'before use' life cycle stage identified in Publicly Available Specification (PAS) 2080:2016 Carbon Management in Infrastructure (British Standards Institution, 2016):

- Embodied GHG emissions associated with the required raw materials (product stage (modules A1–A3))
- Transport of materials to the construction site (construction process stage (module A4))
- Transport of waste from the construction site and subsequent treatment (construction process stage (module A5))
- Transport of construction workers, on-site staff and visitors to and from the construction site (construction process stage (module A5))
- Operation of construction plant and on-site activities (construction process stage (module A5))
- On-site consumption of fuel, electricity and water (construction process stage (module A5))
- GHG emissions mobilised by vegetation losses or soil disturbance (construction process stage (module A5))

15.8.2 Substantial increases in GHG emissions during the construction phase could potentially impact the global climate by contributing to the cumulative impact GHG emissions have on climate change. Furthermore, the UK Government has set a number of legally binding carbon budgets over different time periods, which it is required to meet (see Section 15.3). Increases in GHG emissions, should they be of sufficient magnitude, could potentially impact on the ability of the Government to meet these carbon reduction targets, in combination with other GHG emissions from across the UK, including other infrastructure schemes.

15.8.3 As per paragraph 2.3 of DMRB LA 114 (Highways England, 2019f), GHG emissions associated with decommissioning of the proposed scheme (i.e. modules C1 to C4 of the 'end of life' life cycle stage identified in PAS 2080 (British Standards Institution, 2016)) are excluded from the assessment due to the length of the operational phase of the proposed scheme's assets (which is assumed to be greater than the 60-year appraisal period required by DMRB LA 114.

Vulnerability to changes in climate

15.8.4 As identified in Table 15.4, the East of England region appears to have experienced increased temperatures in recent years. Furthermore, the projected changes in climate variables over the relatively short term (2020–2049) shown in Table 15.7 suggest that further increases in temperature have the potential to occur (especially during summer) and that precipitation has the potential to increase during winter. Table 15.10 identifies climate related impacts on receptors during construction, including temporary works, which could potentially occur as a result of these changes.

Table 15.10 Potential impacts resulting from climate change during construction

Potential change in climate	Climate related hazard/opportunity	Impact receptor(s)	Potential impacts
Increased precipitation during winter months	Flooding of construction site, compounds, haul routes and/or excavations	Directly: Machinery and plant; materials; temporary facilities; earthworks Indirectly: Watercourses and adjacent land; construction workforce; Contractor; scheme operator	Damage to equipment, materials stored on-site and compound facilities. Machinery and plant damaged or trapped. Site roads become impassable. Contamination of water bodies through runoff. Adverse impacts on health, safety and welfare of construction workforce. Delays to construction programme and increased costs.
	Flooding of local road network and site access roads	Directly: Contractor Indirectly: Scheme operator	Disruption to supply of materials and goods required to support construction activities and associated delays to construction programme.
	Higher pore water pressure in embankments and earthworks, leading to instability and risk of failure	Directly: Structures; earthworks Indirectly: Machinery and plant; construction workforce; Contractor; scheme operator	Damage to equipment and compound facilities. Adverse impacts on health, safety and welfare of construction workforce. Delays to construction programme and increased costs.

Potential change in climate	Climate related hazard/opportunity	Impact receptor(s)	Potential impacts
Higher temperatures and lower rainfall during summer	Very high summer temperatures and increased number of hot spells	Directly: Construction workforce; machinery and plant	Increased risk of heat stress or sunstroke for outdoor construction workers. Risk of mechanical failure of equipment due to overheating.
	Fewer very cold days with freezing conditions	Directly: Construction workforce; machinery and plant Indirectly: Contractor; scheme operator	Reduced health, safety and welfare risks to construction workers associated with icy conditions or very cold temperatures. Conditions for some construction activities/ processes/equipment more likely to be favourable, benefiting construction programme.
	Increased desiccation of soils	Directly: Earthworks Indirectly: Machinery and plant; construction workforce; Contractor	Slope stability reduction and earthworks failure during or immediately after summer storm events falling on desiccated soils.
	Accelerated hardening of bitumen	Directly: Pavements Indirectly: Contractor; scheme operator	Inappropriate conditions to lay pavements (e.g. very hot weather) resulting in delays to construction programme.

Operation

Greenhouse gas emissions

15.8.5 GHG emissions during the operational phase of the proposed scheme would be associated with:

- maintenance and operation of the road infrastructure – through consumption of energy (e.g. through petrol or diesel combustion and use of electricity) and materials to support activities such as the repair and replacement of lighting and structures (including fencing) and highway resurfacing

- consumption of energy (e.g. through petrol and diesel combustion and use of electricity) by motorised vehicles using the road infrastructure – the proposed scheme has the potential to alter traffic volumes, composition and speeds on the local road network, both positively and negatively, which could act to alter the overall magnitude of road user GHG emissions
- ongoing changes in the emissions/sequestration balance within the scheme footprint associated with changes in land use, for example through changes in the spatial extents and management of carbon sinks such as woodland

15.8.6 These emissions have the potential to impact the global climate and, should they be of sufficient magnitude, the UK Government's ability to meet legally binding carbon budgets in combination with other GHG emissions from across the UK.

Vulnerability to changes in climate

15.8.7 As identified in Table 15.7, projected changes in climate over the longer term suggest that there could be substantial increases in temperature, especially during summer, and precipitation during winter in the area of the proposed scheme. Furthermore, Table 15.8 indicates that maximum daily temperatures have the potential to increase substantially over the lifespan of the proposed scheme, while Table 15.9 indicates that climate events such as hot spells, heatwaves, dry spells and droughts have the potential to occur more frequently.

15.8.8 Table 15.11 sets out how such changes could impact proposed scheme receptors during its operation, including infrastructure elements (e.g. structures, earthworks, drainage, road surfacing, lighting and signage, soft estate), road users, scheme operators and maintenance workers.

15.8.9 It should be noted that Chapter 14: Road drainage and the water environment, has identified that the risk of surface water and fluvial flooding is likely to increase as a result of climate change. This may impact the magnitude and frequency of flooding and, if unmitigated, result in additional areas of the proposed scheme becoming at risk of flooding in a 1% AEP event. As discussed in Chapter 14, mitigation has therefore been proposed to account for the increases in flood risk identified as a result of climate change.

Table 15.11 Potential impacts resulting from climate change during operation

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
Increased precipitation during winter months More extreme rainfall events	Road surface flooding, should drainage capacity be exceeded	Directly: Road users; pavements Indirectly: Scheme operator	Danger or delay/disruption to road users. Damage to road pavements. Increased management/maintenance requirements/costs.
	Rivers flooding roads and road infrastructure (e.g. bridges, underpasses)	Directly: Pavements; structures; road users Indirectly: Scheme operator	Danger or delay/disruption to road users. Damage to/accelerated degradation of scheme structures and assets. Increased management/maintenance requirements/costs.
	Culvert scouring	Directly: Drainage; structures Indirectly: Scheme operator	Culvert failure or increased maintenance requirements/costs.
	Bridge scouring	Directly: Structures Indirectly: Scheme operator	Bridge foundation failure or increased maintenance requirements/costs.
	Erosion at toe of embankments	Directly: Earthworks Indirectly: Scheme operator	Embankment failure or increased maintenance requirements/costs.
	Water ingress to cables and electrical equipment (e.g. signage)	Directly: Electrical infrastructure Indirectly: End users; scheme operator	Damage to equipment, which could result in danger or delay/disruption to road users. Increased maintenance requirements/costs.

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
	Rise in groundwater level	Directly: Structures; earthworks Indirectly: Scheme operator	Change in groundwater level affecting earth pressures for retaining walls causing damage to retaining walls and subsequent ground movement. Increased maintenance requirements/costs.
		Directly: End users; structures; pavement Indirectly: Scheme operator	Flooding of underbridges (particularly in winter), which could result in danger or delay/disruption to road users. Damage to/accelerated degradation of scheme structures and assets. Increased maintenance requirements/costs.
	Flooding of roads, hard shoulders, verges and access routes, etc.	Directly: Contractor Indirectly: Scheme operator; end users	Challenges for the maintenance regime (e.g. delays, failures).
	Increased debris and sediment runoff	Directly: Drainage Indirectly: Soft estate	Capacity reduction of sustainable drainage systems (SuDS) over time due to sediment build-up.
	Increased debris washing into drainage infrastructure (e.g. gullies and culverts)	Directly: Drainage Indirectly: End users; scheme operator	Blockages of drainage system, which could result in danger or delay/disruption to road users and increased maintenance requirements/costs.
	Increased number of heavy rain days	Directly: Pavements Indirectly: End users; scheme operator	Higher stripping rate of pavements leading to texture depth reduction, which could result in danger to road users and increased maintenance requirements/costs.

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
	Increased rainfall during winter	Directly: Pavements Indirectly: End users; scheme operator	Potholing, rutting and cracking from moisture entering and remaining in pavements (particularly in combination with frost formation) which could result in damage to road users' vehicles and increased maintenance requirements/costs.
	Higher pore water pressure in embankments and earthworks, leading to instability and risk of failure	Directly: Structures; earthworks Indirectly: End users; scheme operator	Delay/disruption to road users. Increased maintenance requirements/costs.
	Increased groundwater level changes	Directly: Earthworks	Variations in groundwater levels cause softening of embankment fill through capillary action and accelerated weathering effects, weakening embankments.
Lower rainfall during summer More frequent drought events and dry spells	Soil shrinkage and/or subsidence	Directly: Structures; earthworks Indirectly: Pavements; end users; scheme operator	Adverse impacts on foundations, including for bridges and other structures, which may result in increased maintenance requirements or failure.
	Reduced inflow into SuDS	Directly: Drainage; soft estate	Planting/seeding failure, reducing SuDS functional capacity.
	Increased desiccation of soils	Directly: Earthworks Indirectly: Pavements; end users	Slope stability reduction and earthworks failure during or immediately after summer storm events falling on desiccated soils.

Potential change in climate	Climate related hazard/opportunity	Impacted receptor(s)	Potential impacts
Increase in maximum summer temperatures and number/duration of hot days, hot spells and heatwaves	Heating and thermal expansion beyond the design capability of structures and assets	Directly: Structures	Damage or failure of structures or assets.
	Increased number of hot days and maximum temperatures	Directly: Pavements	Permanent deformation of asphalt (part of the paving mixture, i.e. flexible surfacing), particularly during prolonged hot weather conditions.
		Directly: Pavements Indirectly: End users	Surface rutting leading to water ponding in ruts. Reduced skid resistance due to fatting (accumulation of bituminous mix on the surface of the pavement).
	Acceleration of bitumen binder hardening	Directly: Pavements	Pavements cracking and fretting with age and traffic loads.
	Increased annual and summer mean temperature may lead to longer growing season	Directly: Pavements; structures	Stability impacts on structures and deformation of pavements due to overgrown tree roots.
		Directly: Soft estate; drainage	Additional maintenance needs for soft estate and SuDS, due to overgrown vegetation.
	Increased maximum (summer) temperatures may impact on performance of electrical equipment	Directly: Electrical equipment	Reduced efficiency and lifespan of LED luminaires etc.

15.9 Design, mitigation and enhancement measures

Embedded (design) mitigation

15.9.1 The environment team is working in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of alternatives, details the design alternatives that have been considered to date, including the environmental factors which have influenced the decision making.

15.9.2 The proposed scheme preliminary design is ongoing and will continue to be influenced by environmental factors to avoid or reduce effects where feasible. This process will be detailed in full in the Environmental Statement within the scheme description and assessment of alternatives chapters.

15.9.3 For example, as part of the process for evaluating GHG emissions associated with construction of the proposed scheme, processes have been embedded to evaluate these iteratively throughout the design process, thereby informing and identifying opportunities to reduce such emissions. These processes will inform design stages allowing GHG emissions to be considered in a timely manner, rather than at the end of the design process. The sharing of information is being promoted, along with the identification of innovations and engagement with suppliers across the project team to ensure that GHG emissions along the value chain have been considered.

Standard mitigation

15.9.4 Standard mitigation would occur as a matter of course due to legislative requirements or standard sector practices. Examples of standard mitigation for this aspect includes the following:

- Implementation of standard good practice construction measures (e.g. planning of site layouts and activities to minimise impacts of heavy rainfall).
- Implementation of a construction phase Travel Management Plan to minimise GHG emissions associated with the transportation of staff, construction workers, materials and waste to and from the construction site.
- Implementation of appropriate measures to reduce the vulnerability of construction activities associated with the proposed scheme to climate impacts. Such measures could include suitable management of site drainage and using weather forecasts to plan on-site activities.
- Implementation of an appropriate monitoring strategy to proactively identify potential climate related impacts (e.g. additional visual inspections of the proposed scheme’s assets after extreme weather events).

15.9.5 Standard mitigation will be included in a first iteration of the Environmental Management Plan which will be prepared for the Environmental Statement and DCO submission (refer to Chapter 5: Environmental assessment methodology).

Additional mitigation

15.9.6 No additional mitigation measures are envisaged to be required, at this stage, following the implementation of embedded and standard mitigation.

Enhancement

15.9.7 No opportunities for enhancement have been identified at this stage.

15.10 Assessment of likely significant effects

Construction

Greenhouse gas emissions

15.10.1 Construction phase GHG emissions have not been quantified at this stage but will be estimated going forwards and reported within the Environmental Statement. The magnitude of construction phase GHG emissions, particularly following the implementation of embedded and standard mitigation measures to avoid or minimise GHG emissions, is considered likely to be negligible in comparison to relevant UK carbon budgets. On this basis, construction phase GHG emissions are considered unlikely to have a material impact on the ability of the UK Government to meet its carbon reduction targets and are therefore considered **likely to be 'not significant'**, in line with DMRB LA 114 and the NNNPS.

Vulnerability to changes in climate

15.10.2 Following the application of embedded and standard mitigation measures to reduce the vulnerability of the proposed scheme, climate change related impacts are considered **unlikely to result in substantial disruption** during the construction phase.

Operation

Greenhouse gas emissions

15.10.3 At this stage, only GHG emissions associated with operational road users (i.e. emissions associated with the consumption of fuel and electricity by vehicles) have been considered. Furthermore, these estimates are preliminary as they are based on an early iteration of the traffic model for the proposed scheme.

15.10.4 Within the Environmental Statement, emissions associated with the maintenance and operation of the proposed scheme (i.e. emissions associated with the consumption of materials used during maintenance activities, including repair and replacement of proposed scheme assets, and electricity consumption for operational needs, e.g. signage, lighting) will also be considered.

15.10.5 Preliminary estimates of operational road user GHG emissions following the implementation of the proposed scheme in the opening year (2027), design year (2042) and over a 60-year appraisal period after scheme opening (2027–2086) are shown in Table 15.12.

Table 15.12 Estimated future Do-Something GHG emissions

Source	Do-Something GHG emissions (tCO_2e)		
	Opening year (2027)	Design year (2042)	Appraisal period (2027–2086)
Road users	982,630	886,008	53,933,442

15.10.6 The preliminary estimates of road user emissions shown in Table 15.12 indicate that the proposed scheme is estimated to result in a 2.3% and 2.6% increase in road user GHG emissions across the study area in the opening year and design year, respectively, compared to the Do-Minimum scenario shown in Table 15.6.

15.10.7 Preliminary estimates of the net change in operational road user GHG emissions (i.e. Do-Something minus Do-Minimum GHG emissions) within relevant carbon budget periods are shown in Table 15.3.

Table 15.13 Estimated net change in GHG emissions (Do-Something – Do-Minimum) with proposed scheme

Project Stage	Estimated total road user GHG emissions (tCO_2e) (Do-something scenario)	Net change in road user GHG emissions with proposed scheme (tCO_2e)	Carbon budget period	Carbon budget (tCO_2e)	Net change in road user GHG emissions with proposed scheme (as % of carbon budget)
Operation	982,630	+21,998	4th carbon budget (2023–2027)	1,950,000,000	0.001%
Operation	4,816,527	+110,587	5th carbon budget (2028–2032)	1,725,000,000	0.006%
Operation	4,655,490	+111,582	6th carbon budget (2033–2037)	965,000,000 [a]	0.012%

[a] Based on the sixth carbon budget recommendation of the Committee on Climate Change, which is yet to be formally adopted into UK law.

15.10.8 The results in Table 15.13 indicate that estimated changes in GHG emissions as a result of the proposed scheme are negligible in comparison to relevant UK carbon budgets. On this basis, operational phase GHG emissions are considered unlikely to have a material impact on the ability of the UK Government to meet its carbon reduction targets and are therefore **considered to be 'not significant'**, in line with DMRB LA 114 and the NNNPS.

Vulnerability to changes in climate

15.10.9 For the operational phase, potential hazards which have been identified, at this stage, include:

- various hazards related to increased rainfall and extreme rainfall events in winter (e.g. flooding road surfaces and underbridges, scouring and erosion of proposed scheme assets and foundations, damage to drainage and culverts, groundwater levels affecting earth pressures on structures such as retaining walls, increased maintenance requirements)
- various hazards associated with decreased rainfall and higher occurrence of dry spells (e.g. soil shrinkage impacting foundations, desiccation of soils affecting slope stability during or after heavy rainfall events)
- increased summer temperatures and heatwaves/hot spells (e.g. thermal expansion beyond design capability for structures and assets, degradation of pavements causing deformation of asphalt, pavements cracking, excessive growth causing stability impacts on structures from overgrown roots, increased maintenance requirements)

15.10.10 Embedded mitigation measures will be incorporated into the design, while materials will be chosen to comply with relevant highways design standards, guidance and good engineering practice. Additionally, the design will incorporate suitable climate change allowances in accordance with relevant Environment Agency guidance (e.g. in relation to the sizing and capacity of the drainage systems).

15.10.11 It is considered that the embedded mitigation measures, coupled with appropriate asset management during operation, including monitoring and inspections, would adequately address the potential climate change hazards identified. As a result, it is considered that the potential climate related hazards identified **would not result in a significant effect** during the operational phase.

16 Cumulative effects assessment

16.1 Topic introduction

16.1.1 This chapter sets out the preliminary cumulative effects assessment (CEA) completed for this Preliminary Environmental Information Report (PEIR). The CEA has been undertaken following the guidance outlined in the Planning Inspectorate's Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2019).

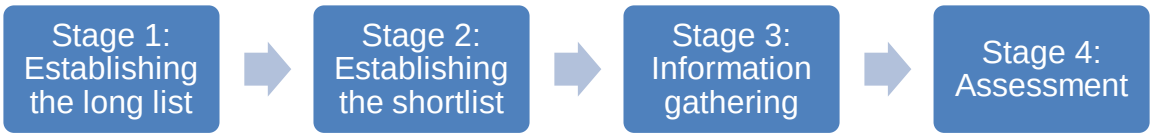
16.1.2 Cumulative effects result from incremental environmental impacts caused by other past, present, or reasonably foreseeable actions together with a scheme. Inter-project cumulative effects can be additive or interactive (synergistic) in nature. Cumulative effects can occur during both construction and operation of a scheme and it is these effects that are the focus of this chapter.

16.1.3 The combined (intra-project) effects of the proposed scheme and the interrelationship between other environmental aspects (e.g. between ecology and hydrology, population and health) upon a single resource/receptor will be reported within the individual environmental aspect chapters of the Environmental Statement, as required (see Chapter 5: Environmental assessment methodology, Section 5.7).

16.1.4 The CEA identifies 'other reasonably foreseeable development' that can potentially contribute to cumulative effects with the proposed scheme. To aid this process, local planning authorities (LPA) were consulted to assist with the identification of 'other reasonably foreseeable development'.

16.1.5 The four-stage process applied for this CEA is illustrated in Plate 16.1.

Plate 16.1 The CEA process is iterative and involves four stages



16.1.6 The focus of this CEA chapter for PEIR is to present how 'other existing development and/or approved development' have so far been identified to establish a long list (Stage 1) and how a preliminary shortlist has subsequently been derived (Stage 2). The CEA is currently at the information-gathering stage (Stage 3) whereby environmental information on shortlisted 'other existing development and/or approved development' is being obtained, where available. The full assessment of cumulative effects (Stage 4) will be reported in the Environmental Statement.

16.1.7 Stage 1 will be repeated when preparing for the Environmental Statement to capture new planning applications and other reasonably foreseeable developments which may come forward during the interim period.

16.1.8 This chapter is supported by Figure 16.1 (see Appendix A) and appendices:

- Figure 16.1 Shortlisted developments for CEA
- Appendix D1 Stage 2 establishing a shortlist of 'other existing development and/or approved development'
- Appendix D2 Example of the CEA matrix to be completed and reported in the Environmental Statement

16.2 Stakeholder engagement

16.2.1 The proposed CEA methodology, together with a copy of the preliminary Stage 1 long list of reasonably foreseeable development was provided in the Environmental Scoping Report (Highways England, 2020d) for formal consultation on the scope of the Environmental Impact Assessment (EIA) (see Chapter 5: Environmental assessment methodology).

16.2.2 The nine LPAs within the study area for cumulative effects and were consulted by the Planning Inspectorate in relation to the Environmental Scoping Report are:

- Babergh District Council
- Braintree District Council
- Chelmsford City Council
- Colchester Borough Council
- Essex County Council
- Maldon District Council
- Suffolk County Council
- Tendring District Council
- Uttlesford District Council

16.2.3 A summary of the relevant stakeholder feedback during the scoping consultation and key requirements from the Planning Inspectorate, as identified within the Scoping Opinion (Planning Inspectorate, 2021) relevant to cumulative effects, is outlined in Table 16.1.

Table 16.1 Key stakeholder feedback for Stage 1 cumulative effects aspect

Stakeholder	Comment	Response
Planning Inspectorate	Longfield Solar Farm is a Nationally Significant Infrastructure Project (NSIP) and is proposed to be located adjacent to the A12 and the proposed scheme where the construction phase and possible glint or glare during operation may result in impacts to road users.	Carried forward into Stage 3: Information gathering and will be included within Stage 4: Assessment of cumulative effects, which will be reported in the Environmental Statement.
Essex County Council	In relation to the Beaulieu Park development and Railway Station, the main construction works for the station are anticipated in 2023, with the station opening 2025 / 2026. Reference should be made to the committed Beaulieu Central, which has planning permission and will contain 62,000m^2 of commercial space including a hotel and a 40,000m^2 business park. This will be located near the new Railway Station.	There are 18 applications identified as being associated with this development. All applications have been carried forward into Stage 3: Information gathering. The applications will also be taken forward for Stage 4: Assessment of cumulative effects, which will be reported in the Environmental Statement.
Chelmsford City Council	Strategic Growth Site 8: North of Broomfield - for 450 new homes. Masterplan has now been approved by the City Council and a planning application is expected at the end of 2021.	Carried forward into Stage 3: Information gathering, and further investigation will be undertaken at the Environmental Statement as to whether this is progressed to Stage 4: Assessment of cumulative effects.
Chelmsford City Council	Strategic Growth Site 6: Chelmsford Garden Community (CGC) - the 3000 new homes in the adopted Chelmsford Local Plan should be classified as 'More than Likely' using Highway England's table to ascertain degrees of certainty for development proposals. A masterplan is due to be approved in 2021 for the CGC with planning applications expected in late 2021.	Carried forward into Stage 3: Information gathering and will be included within Stage 4: Assessment of cumulative effects, which will be reported in the Environmental Statement.
Essex County Council	Chelmsford North East Bypass (CNEB) - there are proposed improvements to J19 of the A12 resulting from the CNEB. It is likely the construction programme for the development could overlap with the construction programme for the proposed scheme starting in 2023.	CNEB (Phase 1) carried forward into Stage 3: Information gathering and will be included within Stage 4: Assessment of cumulative effects, which will be reported in the Environmental Statement.

Stakeholder	Comment	Response
Essex County Council	Essex County Council noted that the applicant must consider other large scheme proposals including, but not limited to, the proposed Bradwell B Nuclear Power station, the Chelmsford North East Bypass, the Lower Thames Crossing, Junction 28 of the M25, and many large-scale residential developments proposed across Essex. All these schemes in combination with the proposed scheme are likely to have many significant cumulative impacts on many aspects including the highway network across the County. Such cumulative impacts on the highway network and other topics areas therefore need to be investigated as referenced by the Applicant in Chapter 16 of the Scoping Submission.	Other large scheme proposals to be further investigated further as part of the Environmental Statement. With regards to Bradwell B, further investigation and discussion with the proposed scheme traffic modellers determined that this development would not be progressed to Stage 4: Assessment of cumulative effects. Bradwell B proposals are at an early stage and no specific timeline has been set out for the development, although it is anticipated to take between nine and 12 years to construct. It is understood that the Bradwell B transport strategy is not yet mature and that their Development Consent Order (DCO) is due for submission in 2024 or 2025. Assuming one year for consent and a ten-year construction programme, their peak of construction would be in the late 2020s, so it is not anticipated to coincide with construction of the proposed scheme. It is anticipated that Bradwell B will need to consider the proposed scheme as part of their assessment of cumulative effects.

16.2.4 Based on the responses to the Scoping Opinion, cross-cutting aspects of concern relating to major developments and potential cumulative effects included the assessment of effects associated with traffic, air quality and noise and vibration.

16.2.5 The full Scoping Opinion, together with the applicant's response regarding how and where comments have been addressed in the EIA and draft DCO, will be included within the Environmental Statement.

16.2.6 LPAs were contacted in February 2021 via email to consult on the preliminary shortlist of 'other existing development and/or approved development'.

16.2.7 Further details on the consultation with LPAs is provided in Section 16.4 of this chapter, where the Stage 2 process of deriving a shortlist is described.

16.3 Legislative and policy background

16.3.1 The requirements for the assessment of cumulative effects for NSIP under the Planning Act 2008 (as amended) are set out in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations').

16.3.2 In the EIA Regulations, Schedule 3 paragraph 1(b) refers to the selection criteria for screening Schedule 2 development, and states that *'The characteristics of development must be considered with particular regard to…(b) cumulation with other existing development and/or approved development'*. Schedule 3 paragraph 3(g), which relates to the types and characteristics of the potential impact, also requires *'(g) the cumulation of the impact with the impact of other existing and/or approved development'* to be taken into account.

16.3.3 In relation to the information for inclusion in an Environmental Statement, Schedule 4, paragraph 5 of the EIA Regulations requires *'A description of the likely significant effects of the development on the environment resulting from, inter alia: (e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources'* and *'The description of the likely significant effects on the factors specified in regulation 5(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.'*

16.3.4 The need to consider cumulative effects in planning and decision making is also set out in planning policy, in particular the National Policy Statement for National Networks (NNNPS). The NNNPS, under point 4.3, stipulates that '…*in considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:*

- *its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.'*

16.3.5 The NNNPS, under point 4.16, stipulates that 'When considering significant cumulative effects, any environmental statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been granted, as well as those already in existence)'. For the proposed scheme this would comprise 'other existing development and/or approved development' which is taken to include existing developments and existing plans and projects that are 'reasonably foreseeable'.

16.3.6 The NNNPS, under point 4.17, states that the Examining Authority should 'consider how significant cumulative effects and the interrelationship between effects might as a whole affect the environment, even though they may be acceptable when considered on an individual basis with mitigation measures in place'.

16.3.7 The NNNPS, under point 4.55, also stipulates that 'the effects of existing sources of pollution in and around the project are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits'.

16.3.8 The compliance with legislation and local planning policy in relation to cumulative effects will be provided and detailed in the Environmental Statement for the proposed scheme.

16.4 Assessment methodology

16.4.1 The detailed methodology for this CEA chapter has been presented in the Environmental Scoping Report (Highways England, 2020d), which can be found on the Planning Inspectorate's National Infrastructure Planning website: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf

16.4.2 Certain aspect chapters of this PEIR, such as air quality and noise which assess effects of operational vehicular emissions, are inherently cumulative assessments. This is because those aspects depend on traffic forecasts that consider the impacts of other developments and other highway projects. Therefore, the CEA chapter of the Environmental Statement will not report effects for aspects which relate to operational traffic.

16.4.3 Large-scale construction works, construction traffic on haul routes, plant and site compounds could have the potential for cumulative effects with other identified developments. As such, these will be assessed as part of the CEA to be reported in the Environmental Statement.

16.4.4 The four-stage process applied for this CEA and illustrated in Plate 16.1 is based on guidance in Advice Note Seventeen (Planning Inspectorate, 2019).

Stage 1: Establishing the long list

16.4.5 The long list of 'other existing development and/or approved development' was identified by determining the zone of influence (ZOI) for each environmental aspect and using this to form a study area within which to identify reasonably foreseeable development.

16.4.6 The criteria for determining the ZOIs are presented in Table 16.2.

Table 16.2 Criteria for determining the zone of influence for the CEA for each environmental aspect

Environmental aspect	Zone of influence	Reasoning
Air quality	Construction dust – within 200m of all construction activity. Construction traffic emissions – within 200m of Affected Road Network. Operational emissions – n/a	Based on relevant guidance, Design Manual for Roads and Bridges (DMRB) LA 105 Air quality (Highways England, 2019d).
Cultural heritage	Setting of designated heritage assets (construction and operation) – within 1km from provisional Order Limits. Designated and non-designated heritage assets and their settings (operation and construction) – 300m from provisional Order Limits.	Based on relevant guidance, DMRB LA 106 Cultural heritage assessment (Highways England, 2020k).
Landscape and visual	Construction and operation effects – 2km from provisional Order Limits.	Based on professional judgement and landscape and visual impact survey. 2km for scoping to set landscape context, potentially reducing to 1km for Environmental Statement following generation of Zone of Theoretical Visibility, agreement of representative viewpoints with relevant local authorities and field verification as views of the proposed scheme are unlikely to be significant beyond 1km due to distance and intervening features.
Biodiversity	General construction and operation effects – 2km from provisional Order Limits. European sites: • 2km for European sites. • 30km where bats are a qualifying feature of the European site. • Where there is a hydrological connectivity between the proposed scheme and the European sites. • Mobile species-specific distances (refer to Chapter 9: Biodiversity). • Protected and notable species (refer Chapter 9: Biodiversity).	Based on relevant guidance, DMRB LA 108 Biodiversity (Highways England, 2020m) and likely significant effects.

Environmental aspect	Zone of influence	Reasoning
Geology and soils	Construction and operational effects on geology and soil receptors – 250m from provisional Order Limits.	Based on relevant guidance and professional judgement (in the absence of a defined study area in DMRB LA 109 Geology and soils (Highways England, 2019e)). It is not considered likely that significant effects would arise beyond this distance.
Noise and vibration	Construction noise – 300m from provisional Order Limits. Construction vibration – 100m from provisional Order Limits. Operational noise – n/a. Operation vibration - scoped out.	Based on relevant guidance (DMRB LA 111 Noise and vibration (Highways England, 2020b)). Operational vibration scoped out in accordance with DMRB LA 111.
Population and health	Construction and operation land use and community health effects – 600m from provisional Order Limits. Construction and operation effects on physical activity opportunities – 10km from provisional Order Limits.	Based on DMRB LA 112 Population and Human Health (Highways England, 2020o), LA 111, LA 105 and professional judgement that likely significant effects on land use and population health from noise, air quality, visual intrusion and local disruption would be typically up to 600m. Based on Department for Transport guidance that cycle commutes are typically up to 10km, and therefore cumulative impacts from major developments and changes to cycling accessibility within this range are potentially significant to health and sustainable transport policy objectives.
Water environment	Groundwater, hydromorphology, Water Framework Directive (WFD) and water quality (operation and construction) – 1km from provisional Order Limits. Flood risk (operation and construction) – 2km from provisional Order Limits.	Based on professional judgement.

16.4.7 Stage 1 was undertaken as part of the scoping exercise. A preliminary long list of 'other existing development and/or approved development' was established and presented in the Environmental Scoping Report (Highways England, 2020d). The long list has not been included in this PEIR, due to the scale and level of detail, but will be updated and included in an appendix in the Environmental Statement.

16.4.8 The identification of the long list of 'other existing development and/or approved development' was based on a review of:

- Planning applications registered with the relevant LPAs (Town and Country Planning Act 1990) since January 2016
- Development allocations proposed in an approved or emerging (with at least a draft having been submitted to the Planning Inspectorate) Local Plan and/or Neighbourhood Plan
- NSIPs listed on the Planning Inspectorate's register of projects (Planning Act 2008)
- Development of transport systems authorised by Transport and Works Act Order (Transport and Works Act 1992)
- Hybrid bills currently before parliament
- Reserved matter applications and discharge of conditions

16.4.9 The preliminary long list has been reviewed further since its publication in the Environmental Scoping Report (Highways England, 2020d) to take account of feedback through the Scoping Opinion, as presented in Table 16.1. Subsequent reviews and updates will be undertaken to account for feedback as part of the pre-application statutory consultation and any additional planning applications or development allocations made during the interim period.

16.4.10 A cut-off point for adding new development applications to the long list will be required to allow sufficient time for completion of the CEA and compilation of the Environmental Statement prior to the submission of the DCO. This is likely to be two to three months following the completion of pre-application statutory consultation. A further update to the long list will be made during the pre-Examination period to allow for an up-to-date record of relevant 'other existing development and/or approved development' to be available should questions arise during the Examination.

16.4.11 The Stage 1 preliminary long list of 'other existing development and/or approved development' identified 372 records of planning applications and relevant development plan allocations. The information was captured and assessed using criteria provided in Matrix 1 of Appendix 1 from Advice Note Seventeen (Planning Inspectorate, 2019) as a basis. The Stage 1 preliminary long list and a review of consultation responses in the Scoping Opinion resulted in 279 applications being taken forward to Stage 2 shortlisting.

Stage 2: Establishing a shortlist

16.4.12 Consultation was undertaken in February 2021 on Stage 2 - Establishing a shortlist as per the guidance outlined in Advice Note Seventeen (Planning Inspectorate, 2019). An important part of the Stage 2 process is consultation, so that the shortlist of 'other existing development and/or approved development' identified for the CEA aspect is comprehensive and accurate. The developments identified in the preliminary shortlist have been categorised into Tier 1 to Tier 3 development stages based on Advice Note Seventeen with the level of available information decreasing between each respective tier. Tier 1 developments comprise those currently under construction or have a permitted or submitted planning application under the relevant planning regime. Tier 2 developments comprise those projects on the Planning Inspectorate's Programme of projects where a scoping report has been submitted, or projects that have requested a scoping opinion from the relevant LPA which is accompanied with a scoping report. Tier 3 comprise those developments identified in the relevant Development Plan (and emerging Development Plans) or for which a scoping or screening opinion has been sought from the Planning Inspectorate or relevant LPA.

16.4.13 Nine LPAs within the study area for cumulative effects were consulted by the Planning Inspectorate in relation to the Environmental Scoping Report (as stated in Section 16.2). Of these, the following six LPAs were issued a copy of the Stage 2 preliminary shortlist following the identification of applications and allocations within their administrative boundaries, with the remaining three responding in the Scoping Opinion as having no comment or input on the proposed scheme:

- Essex County Council
- Braintree District Council
- Chelmsford City Council
- Colchester Borough Council
- Maldon District Council
- Tendring District Council

16.4.14 Based on the responses received to the Stage 2 shortlisting consultation it was possible to confirm the status of the identified applications and allocations, including those subsequently withdrawn, those with no planning permission or where planning permission had been granted. Feedback provided by the LPAs also identified the status of construction activities, including whether identified developments had started construction, were under construction or had been completed. An estimated completion date was also provided by the respective LPAs for several of the developments identified in the shortlist which are currently under construction.

16.4.15 At the commencement of Stage 2, a total of 279 applications were identified as having potential for cumulative effects. Matrix 1 of Appendix 1 from Advice Note Seventeen (Planning Inspectorate, 2019) was adapted for Stage 2 to include criteria on the:

- scale and nature of development likely to have a significant effect
- overlap in temporal scope
- other aspects, such as construction traffic

16.4.16 Professional judgement was used to supplement the threshold criteria, with consideration to the inclusion and exclusion criteria presented in Table 16.3.

Table 16.3 CEA Stage 2 inclusion and exclusion criteria

Consideration	Criteria
Temporal scope	Other development with overlapping construction (2023-2027) and operational periods (2027-2042) to the proposed scheme will be considered further. Other development with temporal scopes outside these periods will not be shortlisted for the CEA.
Scale and nature of development	Development identified as Schedule 1 and 2 developments in the EIA Regulations will be considered further. Other developments not identified as Schedule 1 or 2 will not be shortlisted for the CEA unless, after reviewing it against criteria in Schedule 3 of the EIA Regulations, it is considered that it has characteristics by which there is a likelihood of significant effects when considered in combination with other development and/or development phases.
Sensitivity of the receiving environment	Where there are potential source-pathway-receptor linkages between other developments and the proposed scheme, cumulative effects will be considered further. Other developments with no clear source-pathway-receptor linkage will not be shortlisted for the CEA.

16.4.17 Only developments deemed likely to have significant cumulative effects have been shortlisted for further assessment in Stages 3 and 4 of the CEA, rather than every development with a foreseeable potential interaction. Justification has been provided in the matrix to assist in providing a clear record of 'other existing development and/or approved development' considered and the decision-making process taken with respect to including and excluding development from further assessment.

16.4.18 Following consultation with the LPAs and completion of the Stage 2 shortlisting process the number of 'other existing development and/or approved development' was reduced to 113, which were then taken forward to Stage 3 information gathering. Figure 16.1 indicates where the 113 shortlisted developments are located.

16.4.19 The preliminary Stage 2 shortlisting matrix is provided in Appendix D1.

Stage 3: Information gathering

16.4.20 The CEA has relied on the gathering of environmental information from a range of sources published as part of planning application submissions or planning documentation for the 'other existing developments and/or approved developments'. In addition, where an environmental assessment has not been undertaken, such as for allocations in Local Development Plans, then published Strategic Environmental Assessments and Sustainability Appraisals have been relied on for additional supporting information. Specific information has been obtained from the following sources:

- Consultation with LPAs on the Stage 2 short list
- Planning application documentation and supporting environmental assessments obtained from LPAs planning portals
- Local Development Plans prepared by the respective LPAs
- Strategic Environmental Assessments / Sustainability Appraisals, including the North Essex Section One Local Plan Sustainability Appraisal (2020), Chelmsford Sustainability Appraisal Report (2018) and the post adoption Sustainability Appraisal of the Chelmsford Local Plan (2020)
- The Planning Inspectorate's website, including EIA documents prepared for NSIPs: https://infrastructure.planninginspectorate.gov.uk/

16.4.21 Stage 3 information gathering is a process for capturing information on the design and construction of a proposed development. Criteria include:

- proposed design and location
- construction, operation, and decommissioning
- baseline data and effects arising from 'other existing development and/or approved development'

16.4.22 Information was gathered on the 113 'other existing development and/or approved development'. Of these 84 were identified as having potential for construction and operational cumulative effects and 29 identified as having potential for operation-only cumulative effects. All 113 'other existing development and/or approved development' will be taken forward to Stage 4 detailed assessment. The preliminary Stage 3 information gathering will be provided to each of the relevant environmental aspects to inform the detailed assessment of potential cumulative effects.

16.4.23 In advance of the publication of the Environmental Statement, additional environmental information will be gathered for any further applications added to the shortlist as part of the review identified above.

Stage 4: Assessment

16.4.24 The Stage 4 process will involve a detailed assessment of cumulative effects with the 'other existing developments and/or approved developments' identified on the finalised shortlist matrix.

16.4.25 This detailed assessment will be completed for the Environmental Statement using Matrix 2 from Advice Note Seventeen (Planning Inspectorate, 2019) to record the results of this assessment process (refer to Appendix D2 for an example template of Matrix 2). The competence of the EIA practitioner and other assessors involved in the preparation of the CEA (i.e. in terms of their suitable experience, qualifications, and professional memberships) will also be set out in the Environmental Statement.

Assessment of significance

16.4.26 DMRB LA 104 (Highways England, 2020c) states that the significance of effect should be determined by the extent to which the impacts can be accommodated by the resource.

16.4.27 For the detailed assessment of cumulative effects to be undertaken at Stage 4 as part of the Environmental Statement, the value of a resource and magnitude of impact will be determined according to the criteria set out within the respective environmental aspect chapters. The significance of effect will then be carried forward from the environmental aspect chapters to identify the significance of cumulative effects with other identified developments on the shortlist. Where an effect is moderate or above (adverse or beneficial), it will be deemed to be 'significant'. Effects will be identified as short-term or long-term, permanent or temporary, and adverse or beneficial as set out within the respective environmental aspect chapters. Mitigation measures will be considered at the detailed assessment stage, with the resulting residual significance of effects identified.

16.4.28 Typical descriptors of significance are outlined in Table 16.4 and are based on the criteria detailed in DMRB LA 104. These descriptors have been supplemented with additional criteria for each level of significance to provide the further differentiation and are based on professional judgement.

Table 16.4 Determining significance of cumulative effects

Significance	Effect
Very large (adverse or beneficial)	Effects at this level are a material consideration in the decision-making process. Where the balance of the effects of the proposed scheme or combined effects of the proposed scheme in association with 'other existing development and/or approved development' upon an individual or collection of environmental receptors would be very highly significant (adverse or beneficial). Effects would be permanent and far reaching, affecting the integrity of receptors or resources of very high value.

Significance	Effect
Large (adverse or beneficial)	Effects at this level are likely to be a material consideration in the decision-making process. Where the balance of the effects of the proposed scheme or combined effects of the proposed scheme in association with 'other existing development and/or approved development' upon an individual or collection of environmental receptors would be highly significant (adverse or beneficial). Effects would be: • permanent and far reaching, affecting the integrity of receptors or resources of high value • noticeable permanent effects on a receptor of very high value
Moderate (adverse or beneficial)	Effects at this level can be a material consideration decision-making factors. Where the balance of the effects of the proposed scheme or combined effects of the proposed scheme in association with 'other existing development and/or approved development' upon an individual or collection of environmental receptors would be significant (adverse or beneficial). Effects would be: • permanent and far reaching, affecting the integrity of receptors or resources of medium value • localised and/or temporary for receptors of high or very high value
Slight (adverse or beneficial)	Effects at this level are not a material consideration in the decision-making process. Where the balance of the effects of the proposed scheme or combined effects of the proposed scheme in association with 'other existing development and/or approved development' upon an individual or collection of environmental receptors would be noteworthy but not significant (adverse or beneficial). Effects would be: • permanent and far reaching, affecting the integrity of receptors or resources of low value • localised and/or temporary for receptors of medium value
Neutral	No effects, or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. Where the beneficial or adverse effects of the proposed scheme or the combined effects of the proposed scheme in association with 'other existing development and/or approved development' would balance.

16.4.29 Table 16.4 significance descriptors have also been aligned with the considerations included within Advice Note Seventeen (Planning Inspectorate, 2019), which outline that the CEA will also give due consideration to the following factors when determining significance:

- the duration of effect, i.e. whether it is temporary or permanent
- the extent of effect, i.e. the geographical area of an effect
- the type of effect, e.g. whether additive (loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (two impacts combine to affect a species not affected by an individual impact in isolation)
- the frequency of the effect
- the 'value' and 'resilience' of the receptor affected
- the likely success of any mitigation required

16.5 Assessment assumptions and limitations

16.5.1 The following assumptions were made for the Stage 2 shortlisting process:

- EIA threshold criteria based on the Schedule 2 screening criteria in the EIA Regulations (under no. 10, Infrastructure Projects):
  - greater than 150 residential dwellings
  - greater than 1ha for non-dwelling urban development
  - area of land required exceeds 5ha overall
- That a medium site (100+ dwellings) would construct 50 dwellings per year
- The timing of discharged pre-commencement planning conditions has been used as an indicator as to whether there has been or would be sufficient time for the development's construction to be completed prior to construction starting on the proposed A12 scheme. It has been assumed that construction would normally start within two years of discharging all pre-commencement planning conditions.

16.5.2 These assumptions were consulted on as part of the consultation exercise for the shortlist with LPAs as described in Section 16.4.

16.5.3 As part of the preliminary Stage 3 information-gathering exercise, differences in what LPAs report and include on their planning portals were identified. There has been a reliance on the relevant LPAs to advise on the details of the developments included in the Stage 2 shortlist matrix and also to provide links to supporting documentation and details relating to these identified developments. Feedback from LPAs has supported the preliminary Stage 3 information-gathering exercise.

16.5.4 Only planning applications submitted since January 2016 have been considered on the basis that it is likely that older submissions will have been completed prior to the proposed scheme construction start of works and are therefore unlikely to give rise to cumulative effects. The exception is for some identified reserved matters applications, which indicate large-scale planning applications pre-dating 2016, that have yet to commence construction.

16.5.5 Any gaps or uncertainties encountered, including the availability of third-party environmental information on shortlisted developments, will be noted in the Environmental Statement.

16.6 Assessment of likely significant effects

16.6.1 At this preliminary stage, consideration has been given to providing a high-level understanding of likely significant cumulative effects and where there is likely to be a need for mitigation.

16.6.2 For a development of this nature, typical cumulative impacts could include the incremental loss of high-quality agricultural land where the proposed scheme, in combination with several other developments, occupies greenfield land.

16.6.3 Should several developments be under construction at the same time, the impacts of various construction sites with their associated traffic, construction plant, lighting, noise, dust, and other factors could combine to affect the amenity of a local community or environmental receptor.

16.6.4 There is also the potential for a combination of effects associated with increased development, such as land use change, increased lighting, and new structures, which could contribute to a general urbanising effect of the countryside along the A12 corridor. This would ultimately change the character of the local environment.

16.6.5 Figure 16.1 indicates clusters of shortlisted applications in areas between Marks Tey and Colchester, around Witham, and Chelmsford, with the most notable of these associated with the development proposals for Beaulieu Park off junction 19 of the A12 on the fringes of Chelmsford and Boreham. This is a significant mixed-use development including the provision of residential dwellings, a business park, retail use, hotel, leisure, education and community uses, new railway station and radial distributor road. This clustering, visible on Figure 16.1, indicates there is development pressure in those areas which may result in cumulative effects. The most likely cumulative effects are those on biodiversity; heritage; geology and soils; landscape and visual; and population and health receptors since they are all within the relevant ZOIs for these aspects. There is also potential for cumulative effects of construction noise and air quality in these locations.

16.6.6 The scale of proposed development illustrated on Figure 16.1 also indicates a likely cumulative effect of land use change from rural to more urbanised development.

16.6.7 A further potential cumulative effect is where there could be a concentration of construction workers associated with the various proposed developments in a particular area. This may result in the generation of pressure on local facilities and services, for example, hotels and other accommodation.

16.6.8 These issues will be assessed using available information and the results will be reported in the forthcoming Environmental Statement.

16.7 Mitigation

16.7.1 Once the likely significant cumulative impacts on receptors have been identified and assessed, measures to avoid, prevent, reduce, or offset significant cumulative effects will be identified and described in the Environmental Statement.

16.7.2 While the measures identified for the aspects reported in other chapters of this PEIR would help to reduce the contribution of the proposed scheme to cumulative effects, there may be a requirement for additional mitigation as well as collaboration and co-operation with third-party developers, to further mitigate cumulative effects.

16.7.3 For example, initial discussions have already taken place between the design team working on the development of the design and planning of the proposed scheme and the team working on the Longfield Solar Farm application (ID 186 of Appendix D1). This is helping to gain a better understanding of the timescales and phasing of each development, where workers may be accommodated, and how construction sites would be accessed.

16.7.4 If appropriate, and subject to the cooperation of third parties, there may be opportunities for holistic mitigation strategies.

16.7.5 Options for mitigation may relate to detailed programming and phasing of construction activities to avoid or reduce the likelihood of overlapping construction activities in a specific locality. Other considerations may relate to where construction workers would be accommodated, to help distribute the impacts on accommodation across a larger area, reducing the scale of impacts in any given location.

17 Summary

17.1 Summary of likely significant effects

17.1.1 Table 17.1 provides a summary of the potential residual significant environmental effects associated with the proposed scheme's construction and operation. Mitigation measures have been developed for this preliminary assessment to avoid or reduce environmental effects. Consideration of these mitigation measures has been taken into account when determining the significance of effects.

17.1.2 The conclusions presented in Table 17.1 are preliminary, and subject to the ongoing EIA process, which includes further surveys, studies, and mitigation development. The final results of the environmental assessment will be reported in the upcoming Environmental Statement.

Table 17.1 Summary of preliminary assessment of likely significant effects

Aspect	Summary of significant (residual) environmental effects	
	Construction	**Operation**
Air quality	No significant effects on human health or ecology receptors, or UK Government monitoring points for compliance with EU Limit Values for air quality.	No significant effects on human health receptors or UK Government monitoring points for compliance with EU Limit Values for air quality. Potential for significant adverse effects on biodiversity sites from nitrogen deposition (subject to further assessment).
Cultural heritage	Likely significant adverse effects on 13 historic buildings and structures and two archaeological remains.	Likely significant adverse effects on the settings of six listed buildings.
Landscape and visual	Likely significant adverse effects on the landscape and receptors with views of construction activities (e.g. movement of construction machinery, excavation and earthworks; the presence of compounds, haul roads and stockpiled soil and materials; and loss of vegetation).	Likely significant adverse effects on areas of landscape that would be directly affected by new junctions and the offline bypasses, for visual receptors that are in very close proximity to the proposed scheme, and where the presence of major new infrastructure would significantly change the character of the view.
Biodiversity	Likely significant adverse effects on two potential veteran trees, a number of ancient hedgerows, and woodland habitat; and likely significant beneficial effects on water vole and great created newt.	Likely significant adverse effects from air quality on Whetmead LNR and LWS, Perry's Wood LWS and potential veteran trees.

Aspect	Summary of significant (residual) environmental effects	
	Construction	**Operation**
Geology and soils	Significant adverse effects on soils from loss of agricultural land and likely significant effects on groundwater and surface waters from contamination.	No significant effects identified.
Material assets and waste	No significant effects identified.	No significant effects identified.
Noise and vibration	Likely significant adverse effects on receptors in close proximity to construction activities such as pilling and demolition, construction of new junctions and bridges, and night-time working.	Likely significant adverse effects for approximately 63 residential dwellings, and significant beneficial effects for approximately 225 residential dwellings.
Population and health	No significant effects on land use and accessibility identified (although it is noted there would be a small permanent loss of property and land which would have large significance for the individual households concerned). Effects on human health at population level have been assessed as neutral. However, it is noted for some individuals there may be negative impacts on wellbeing associated with construction.	No significant effects on overall land use and accessibility resources identified. There would be likely positive human health effects on community severance, access to services, active travel and road safety; and uncertain (subject to further assessment) effects from air quality and noise and on access to greenspace.
Road drainage and the water environment	No significant effects identified.	Likely significant adverse water quality effects for a small number of watercourses due to drainage outfalls (mitigation currently under development). Likely significant adverse hydromorphology effects for one watercourse.
Climate	No significant effects identified.	No significant effects identified.
Cumulative effects assessment	Cumulative effects will be assessed and reported within the Environmental Statement.	

17.2 Next steps of the EIA

17.2.1 Scheme design development, further surveys, modelling, and assessment will continue throughout summer 2021. Stakeholders will continue to be consulted on the likely significant effects and proposed mitigation.

17.2.2 The results of the EIA will be reported within an Environmental Statement. An outline structure of the Environmental Statement is provided in Table 17.2.

17.2.3 The Environmental Statement, as well as other environmental reports such as the Environmental Management Plan, Habitats Regulations Assessment, Flood Risk Assessment, and Water Framework Directive compliance assessment, will form part of the DCO application.

Table 17.2 Outline structure of the Environmental Statement

Subject	Description
Non-Technical Summary (NTS)	A summary of the EIA using non-technical language. The NTS will summarise the scheme description, alternatives considered, the likely significant effects, the proposed mitigation and monitoring requirements and opportunities for enhancements.
Chapter 1. Introduction	A brief introduction to the scheme, legislative and policy framework, competent expertise used to undertake the EIA, and the purpose and structure of the Environmental Statement.
Chapter 2. The scheme	Description of the scheme location, the need for the scheme, scheme objectives and baseline scenario. A scheme description will be provided comprising information on the site, design and physical characteristics of the development. The scheme description will describe both the construction and operation of the scheme, as well as long term management and a statement of whether the EIA is to consider decommissioning of the scheme.
Chapter 3. Assessment of alternatives	Description of the main alternatives considered during the design and development of the scheme, and the justification for the choice of the preferred option, including a comparison of environmental effects.
Chapter 4. Consultation	Summary of consultation undertaken throughout the design development.
Chapter 5. Environmental assessment methodology	This chapter will set out the scope of the EIA, including a summary of how this has been influenced by statutory consultation. The general assessment approach will be detailed including the guidance and methodologies to be used, general assessment criteria and terminology to be used, and the approach to mitigation, enhancement and monitoring.
Chapter 6. Air quality	Chapters 6-15 will assess the potential significant effects from the proposed scheme. Each of the specialist chapters will include the following: • competent expert evidence • legislative and policy framework • assessment methodology • assessment assumptions and limitations • study area
Chapter 7. Cultural heritage	
Chapter 8. Landscape and visual	
Chapter 9. Biodiversity	
Chapter 10. Geology and soils	

Subject	Description
Chapter 11. Material assets and waste	• baseline conditions • potential impacts • design, mitigation and enhancement measures • assessment of likely significant effects • monitoring requirements
Chapter 12. Noise and vibration	
Chapter 13. Population and health	
Chapter 14. Road drainage and the water environment	
Chapter 15. Climate	
Chapter 16. Cumulative effects assessment	This chapter will assess the cumulative effects of other major developments which could overlap with the proposed scheme.
Chapter 17. Summary	Summary of the residual effects (highlighting where significant residual effects are predicted), and a summary of mitigation measures and monitoring requirements. This will form the basis of a commitments schedule to be included within the EMP.
Technical appendices and figures (including location, design and constraints plans).	

Acronyms

Abbreviation	Term
µg	Microgram
AADT	Annual Average Daily Traffic
ACM	Asbestos-Containing Material
ADMS	Atmospheric Dispersion Modelling System
AEP	Annual Exceedance Probability
ALC	Agricultural Land Classification
APIS	Air Pollution Information System
AQMA	Air quality management area
AQO	Air quality objective
ARN	Affected road network
AURN	Automatic Urban and Rural Network
AWP	Aggregates Working Party
BAP	Biodiversity Action Plan
BEIS	Department for Business, Energy and Industrial Strategy
bgl	Below ground level
BGS	British Geological Survey
BMV	Best and most versatile
BoCC	Bird of Conservation Concern
BOCN	Barn Owl Conservation Network
BPM	Best Practicable Means
BRE	Building Research Establishment
BS	British Standard
BSI	British Standards Institution
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTO	British Trust for Ornithology
CBBGC	Colchester Braintree Borders Garden Community
CCTV	Closed-circuit television
C&D	Construction and Demolition

Abbreviation	Term
CD&E	Construction, Demolition and Excavation
CEA	Cumulative Effects Assessment
CGC	Chelmsford Garden Community
CIRIA	Construction Industry Research Information Association
CITB	Construction Industry Training Board
CL:AIRE	Contaminated Land: Applications in Real Environments
CLR11	Model Procedures for Management of Land Contamination
CNEB	Chelmsford North East Bypass
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoCP	Code of Construction Practice
COPD	Chronic Obstructive Pulmonary Disease
CPRE	Campaign to Protect Rural England
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
DBA	Desk-based assessment
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DfRE	Design for Resource Efficiency
DfT	Department for Transport
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DoWCoP	CL:AIRE Definition of Waste, Development Industry Code of Practice
DS	Do-Something
DQRA	Detailed Quantitative Risk Assessment
EAV	External Aspect Verification
ECC	Essex County Council
eDNA	Environmental DNA

Abbreviation	Term
EEAWP	East of England Aggregate Working Party
EFC	Essex Field Club
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPSM	European Protected Species Mitigation
EQS	Environmental Quality Standards
ERL	Essex Red Data List
EU	European Union
EWTBRC	Essex Wildlife Trust Biological Record Centre
FRA	Flood Risk Assessment
GAC	Generic Assessment Criteria
GCN	Great crested newt
GEML	Great Eastern Main Line
GHG	Greenhouse gas
GI	Ground Investigation
GIR	Ground Investigation Report
GLVIA3	Guidelines for Landscape and Visual Impact Assessment
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWP	Global-warming potential
HADDMS	Highways Agency Drainage Data Management System
HADECS	Highways Agency Detection Enforcement Camera System
HDV	Heavy Duty Vehicle (i.e. Heavy Goods Vehicles and buses)
HER	Historic Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Goods Vehicle
HLT	Historic landscape type
HRA	Habitats Regulations Assessment
HSI	Habitat Suitability Index
IAQM	Institute of Air Quality Management

Abbreviation	Term
IAS	International Aviation and Shipping
IEMA	Institute of Environmental Management and Assessment
INNS	Invasive Non-Native plant and animal Species
ISMP	Invasive Species Management Plan
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
Kt	Kilotonne
KSI	Killed or Seriously Injured
LAA	Local Aggregates Assessment
LAQM.TG(16)	Local Air Quality Management: Technical Guidance (TG16)
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LCRM	Land Contamination: Risk Management
LED	Light-emitting diode
LEL	Lower Explosive Limit
LEMP	Landscape and Ecological Management Plan
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LOAEL	Lowest Observed Adverse Effect Level
LPA	Local Planning Authority
LTT	Long-term trend
LVIA	Landscape and visual impact assessment
LWS	Local Wildlife Site
MAGIC	Multi Agency Geographic Information for the Countryside
mAOD	Metres above ordnance datum
M-BAT	Metal Bioavailability Assessment Tool
mbgl	Metres below ground level
MCA	Mineral Consultation Area

Abbreviation	Term
MMP	Materials Management Plan
MPA	Minerals Planning Authority
MSA	Mineral safeguarding area
Mt	Million tonnes
Mtpa	Million tonnes per annum
N	Nitrogen
NCN	National Cycle Network
NERC	Natural Environment and Rural Communities Act 2006
NGR	National Grid Reference
NIA	Noise Important Area
NNNPS	National Networks National Policy Statement
NNR	National Nature Reserve
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOMIS	National Online Manpower Information System (only 'NOMIS' is now used)
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPSE	Noise Policy Statement for England
NRR	National Risk Register
NSIP	Nationally Significant Infrastructure Project
NTS	Non-Technical Summary
NVZ	Nitrate vulnerable zone
OAR	Options Assessment Report
ONS	Office for National Statistics
PAH	Polycyclic Aromatic Hydrocarbons
PAS	Publicly Available Specification
PBDE	Polybrominated diphenyl ethers
PCF	Project Control Framework
PCM	Pollution Climate Mapping (model)

Abbreviation	Term
PEIR	Preliminary Environmental Information Report
PFOS	Perfluorooctane sulphonate
PM_{10}	Particulate matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
PRA	Preferred Route Announcement
PRoW	Public right of way
PSSR	Preliminary Sources Study Report
PSYM	Predictive System for Multimetrics
PWS	Private water supply
RAMS	Recreational Disturbance Avoidance and Mitigation Strategy
RBMP	River Basin Management Plan
RCP	Receptor Concentration Pathway
RDWE	Road drainage and the water environment
REAC	Register of Environmental Actions and Commitments
RDB3	Red Data Book 3
RIGS	Regionally Important Geological Sites
RIS	Road Investment Strategy
RoFSW	Risk of Flooding from Surface Water
RSP	Responsible Sourcing Plan
RST	Runoff Specific Thresholds
SAC	Special Area of Conservation
SAR	Standardised Admissions Ratio
SELEP	South East Local Enterprise Partnership
SEPA	Scottish Environment Protection Agency
SFRA	Strategic Flood Risk Assessment
SIR	Standardised Incidence Ratio
SMR	Standardised Mortality Ratio
SNRHW	Stable Non-Reactive Hazardous Waste
SOAEL	Significant Observed Adverse Effect Level

Abbreviation	Term
SoCC	Statement of Community Consultation
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source protection zone
SPZ1	Inner Groundwater Source Protection Zone
SRN	Strategic road network
SSSI	Site of Special Scientific Interest
SuDS	Sustainable drainage system
SVD	Stopped Vehicle Detection
SVOC	Semi-Volatile Organic Compounds
SWMP	Surface Water Management Plan
TAG	Transport Analysis Guidance
tCO_2e	Tonnes of carbon dioxide equivalent
tpa	Tonnes per annum
TPH	Total Petroleum Hydrocarbons
TRA	Traffic Reliability Area
TraC	Transitional and coastal (water body)
TRO	Traffic Regulation Order
UK	United Kingdom
UKCP	UK Climate Projections
UKTAG	UK Technical Advisory Group on the Water Framework Directive
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UXO	Unexploded Ordnance
VOC	Volatile Organic Compounds
WCA	Waste Consultation Area
WCH	Walkers, cyclists and horse riders
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WHO	World Health Organization

Abbreviation	Term
WHS	Wallingford HydroSolutions
WPA	Waste planning authority
WQAR	Water Quality Assessment Report
WRAP	Waste and Resources Action Programme
WSI	Written Scheme of Investigation
ZOI	Zone of Influence
ZTV	Zone of theoretical visibility

Glossary

Term	Definition
Absolute noise level	Absolute noise level is used to describe the predicted noise level, usually in terms of $L_{A10,18h}$, at a given receptor or area.
Active travel	Travelling to specific destinations (e.g. work or school) by active modes such as walking or cycling.
Additional mitigation	Requires further activity (after consideration of embedded and standard mitigation) in order to achieve the anticipated outcome. It will be described in the aspect chapters of the Environmental Statement and secured through the Register of Environmental Actions and Commitments (REAC) and the DCO.
Additive (cumulative effects)	Where similar types of impact from a scheme or different developments affect a receptor at the same time and in a similar way e.g. loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss overall.
Affected Road Network (ARN)	All roads that trigger the traffic screening criteria from DMRB LA 105 and adjoining roads within 200m.
Aggregates	Minerals which are used primarily to support the construction industry including soft sand, sand and gravel, and crushed rock.
Aggregate apportionment	The 'National and Sub-National Guidelines for Aggregates Provision in England 2005-2020' (Department for Communities and Local Government, 2009) set out how much aggregate should be provided for in each of the English sub-national areas. The apportionment targets set out in the Essex Minerals Local Plan (ECC, 2014) ensure that district, borough, and city planning authorities with mineral resources, plan for and protect identified mineral resources.
Air quality objective (AQO)	The threshold below which harmful effects from pollutant exposure are not expected, set out within the Air Quality Standards Regulations 2010.
Air quality management area (AQMA)	An area declared by a local authority which has been determined will exceed the relevant air quality strategy objective.
Air quality threshold	Generic term to represent the relevant pollutant averaging period and concentration value described by the air quality strategy objectives or EU Limit Values.
Agricultural Land Classification (ALC)	The Agricultural Land Classification system forms part of the planning system in England and Wales. It classifies agricultural land in five categories according to versatility and suitability for growing crops.
Ancient Woodland Inventory site	The ancient woodland inventory identifies over 52,000 ancient woodland sites in the UK. Ancient woodland in England is defined as woodland that has existed since 1600 or before.

Term	Definition
Annual Exceedance Probability (AEP)	Annual Exceedance Probability (AEP) refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which may be calculated to have a 1% chance to occur in any one year, is described as a 1% AEP event.
Arboriculturist	Person who has, through relevant education, training and experience, gained expertise in the field of trees in relation to construction (BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations).
Arboricultural impact assessment	An assessment of the effect of the proposed scheme on existing trees.
Archaeological geophysical survey	Survey using non-intrusive and non-destructive techniques to determine the presence or absence of anomalies likely to be caused by archaeological features, structures or deposits. Geophysical survey determines the presence of anomalies of archaeological potential through measurement of one or more physical properties of the subsurface.
Archaeological watching brief	A formal programme of archaeological observation and investigation conducted during any operation carried out for non-archaeological reasons.
Aspect	This refers to an environmental topic (e.g. air quality, biodiversity, noise).
Atmospheric dispersion modelling	The mathematical computation of the dispersal of emissions as they travel through the ambient atmosphere.
A-weighting (dB(A))	In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the mid-range frequencies.
Backfilling	Backfilling means a recovery operation where waste is used in excavated areas (such as underground mines, gravel pits) for the purpose of slope reclamation or safety or for engineering purposes in landscaping and where the waste is substituting other non-waste materials which would have had to be used for the purpose.
Background concentration	The ambient pollutant concentration from multiple sources.
Barn owl nest	A site used by barn owls for nesting and raising of young, legally protected when in use for nesting.
Barn owl roost	A site used by a barn owl to roost/rest but not nest.
Baseline	In EIA, ‘baseline conditions’ are the environmental conditions in existence before the occurrence of an impact from a development, i.e. they are the existing conditions that would be affected.
Baseline (in context of landscape and visual)	Work to provide an outline understanding of landscape and visual conditions before or without implementation of the project, requiring a mix of desk study consultation and field work. (DMRB LA 107)

Term	Definition
Bat roost	A bat's home.
Bed substrate	The material that rests at the bottom of a stream and along the channel margins.
Best and Most Versatile (BMV)	This is the land which is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non-food uses such as biomass, fibres and pharmaceuticals.
Best overall environmental outcome	A departure from the waste hierarchy which delivers better overall environmental outcomes.
Best Practicable Means (BPM)	Measures to reduce noise that have regard to the current state of technical knowledge.
Bill of quantities	A document containing details on the volumes of excavated arisings from, and materials required for, a development. Also 'Schedule of Rates'.
Borrow pit	A temporary mineral working to supply material for a specific construction project.
Carbon budgets	A carbon budget, defined in accordance with the Climate Change Act 2008, places a restriction on the total amount of greenhouse gases the UK can emit over a defined five-year period.
Carbon dioxide equivalent (CO_2e)	Carbon dioxide equivalent (abbreviated as CO_2e) is a metric used to compare the emissions of various greenhouse gases, based on their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of CO_2 with the same GWP. For example, the GWP for methane (CH_4) is 25, and for nitrous oxide (N_2O) it is 298. This means that an emission of 1 tonne of CH_4 is equivalent to an emission of 25 tonnes of CO_2 and an emission of 1 tonne of N_2O is equivalent to 298 tonnes of CO_2.
Carbon emissions	Shorthand for emissions of any of the seven GHGs that contribute to climate change.
Characteristics (in relation to landscape and visual)	Elements or combination of elements, which make a particular contribution to distinctive character. (DMRB LA 107)
Circular economy	A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which we keep resources in use for as long as possible; extract the maximum value from resources while in use; recover and regenerate products and materials at the end of life; and keep products, components and materials at their highest utility and value at all times.
Climate	Long-term weather conditions prevailing over a region.

Term	Definition
Climate extreme indices	With regard to climate change, extreme weather events and climate events are often referred to collectively as climate extremes. The World Climate Research Programme (WCRP) and World Meteorological Organization (WMO) expert team on climate change detection and indices (ETCCDI) coordinate, organise and collaborate on climate extremes, indices and climate change detection. This team have defined a set of 27 core indices (the 'ETCCDI' indices) which can be derived from land surface observations of daily temperature and precipitation.
Climate scenario	UKCP18 uses emissions scenarios, called Representative Concentration Pathways (RCPs). RCPs specify the concentrations of greenhouse gases that would result in target amounts of radiative forcing at the top of the atmosphere by 2100, relative to pre-industrial levels. Four forcing levels have been set: 2.6, 4.5, 6.0 and 8.5 W/m^2. These create four RCPs that are used in UKCP18: RCP2.6, RCP4.5, RCP6.0 and RCP8.5.
Cold spell duration index	Count of days with at least six consecutive days when daily minimum temperature is below the 10^{th} percentile.
Confined aquifer	An aquifer which is not exposed to the surface due to the presence of an overlying low permeability unit. Groundwater within a confined aquifer is contained at pressure.
Conservation area	An area designated under Section 69 of the Planning (Listed Building and Conservation Areas) Act 1990 as being an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.
Construction, demolition and excavation waste	Arisings and waste from the demolition of buildings and structures, site preparation and clearance, remediation, excavation and construction activities.
Construction materials	Primary, recycled or secondary, and renewable sources of materials required for constructing a project.
Correlation coefficient	The linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.
Couch	A site regularly used by otters as a resting place, often above ground.
Cumulative effects	Effects upon the environment that result from the incremental impact of an action when added to other past, present, or reasonably foreseeable actions. Each impact by itself may not be significant but can become a significant effect when combined with other impacts.

Term	Definition
Decibel	The unit of measurement used for sound pressure levels and noise levels quoted in decibels (dB). The decibel scale is logarithmic rather than linear; the threshold of hearing is zero decibels, while at the other extreme, the threshold of pain is about 130 decibels. These limits are seldom experienced and typical levels lie within the range of 30dB(A) (a quiet night-time level in a bedroom) to 90dB(A) (at the kerbside of a busy road).
Den	A polecat's resting place.
Department for Transport (DfT)	The Government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved.
Design Manual for Roads and Bridges (DMRB)	Provides standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
Design year	Term used to describe the situation 15 years after scheme opening.
Designated Funds	Funding available from Highways England in order to make project-related improvements covering four funding streams: safety and congestion, environment and wellbeing, users and communities and innovation and modernisation. Enhancements delivered using Designated Funds are separate from the scheme for which development consent is being sought.
Desire line	Line likely to be taken by walkers, cyclists or horse riders finding the shortest route between two points.
Desk-based assessment (DBA)	A document produced to assess the overall heritage resources of a defined area. These are primarily performed without the aid of archaeological field investigations through the use of Historic Environment Records and archive materials.
Detailed quantitative risk assessment (in relation to geology and soils)	A detailed quantitative risk assessment involves detailed or supplementary investigation to confirm contaminant linkages and to identify or develop site-specific assessment criteria.
Development Consent Order (DCO)	Introduced by the Planning Act in 2008, a DCO is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP).
Dewatering	Dewatering refers to the removal of groundwater and/or surface water from a location to facilitate construction.
Diffusion tube	A passive pollution monitoring device.
Discharge	The volume of flow passing a point in a given time period.
Disposal	Any operation which is not recovery, even where the operation has as a secondary consequence the reclamation of substances or energy.

Term	Definition
District level licence	District level licences are granted and authorised by Natural England to permit developments that affect great crested newt *Triturus cristatus* and involve habitat creation and mitigation being carried out at the local authority level, providing an alternative to the standard EPSM licensing process.
DNA	Deoxyribonucleic acid - a molecule that determines the genetic makeup of all living organisms.
Do-Minimum (DM)	A future year scenario including other committed developments and infrastructure schemes, but not the proposed scheme.
Do-Something (DS)	A future year scenario including other committed developments and infrastructure schemes together with the proposed scheme.
Earthworks	Engineering works created through the processing of parts of the earth's surface involving quantities of soil or unformed rock.
Effect	Term used to express the consequence of an impact. The significance of effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Embodied carbon	Carbon (GHG) emissions associated with energy consumption and chemical processes during the extraction, transport and/or manufacture of construction materials or products.
Emission factors	The emission rate of a pollutant attributable to a specific activity.
End of first life	The point at which an asset is no longer useful in the capacity for which it was originally intended.
Enhancement	A beneficial measure that is over and above what is required to mitigate the adverse effects of a scheme. Enhancements do not factor into the assessment of effects.
Entrainment effects	The mechanical forcing (by wind) of pollutants to a receptor.
Embedded mitigation	Intrinsic part of design evolution (e.g. reducing height of an embankment to reduce visual impact), taking into account guidance provided in DMRB GG 103 and LD 117–119 (Highways England 2019b; 2020f–h). This will form part of the proposed scheme description in the Environmental Statement.
Environment Agency	Established under the Environment Act 1995, it is a Non-Departmental Public Body of Defra. The Environment Agency is the leading public body for protecting and improving the environment in England and Wales. It is responsible for wide-ranging matters, including the management of all forms of flood risk, water resources, water quality, waste regulation, pollution control, inland fisheries, recreation, conservation and navigation of inland waterways.

Term	Definition
Environmental Impact Assessment (EIA)	A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement.
Environmental Management Plan (EMP)	A site-specific plan (or set of plans) developed to ensure that appropriate environmental management practices are followed during the construction and operation phases of a scheme. An initial EMP will be included in the DCO application. This will then be updated before construction starts, and again after completion of works before the scheme becomes operational.
Environmental Statement	A document produced in accordance with the EIA Directive, as transposed into UK law by the EIA Regulations, to report the results of an EIA.
Essential mitigation	Mitigation critical for the delivery of a scheme which can be acquired through statutory powers. For the purpose of the proposed scheme, both standard and additional mitigation are considered essential mitigation.
EU Limit Value	Legally binding threshold for individual pollutants, as prescribed in the European Commission Ambient Air Quality Directive (2008/50/EC).
European protected species mitigation (EPSM) licence	The licence issued that permits an activity affecting a European protected species, that would otherwise constitute an offence under the relevant legislation.
Examining Authority	The person(s) appointed by the Secretary of State to assess the Development Consent Order application and make a recommendation to the Secretary of State.
Features (in relation to landscape and visual)	Particularly prominent, 'eye-catching' elements or characteristic components (i.e. tree clumps, church towers, or wooded skylines). (DMRB LA 107)
First study area (material assets and waste)	Project footprint (including temporary land take) for which consent is being sought. The area within which construction materials will be consumed (used or deployed), and waste generated (including temporary compounds and storage areas etc.).
Floodplain	A floodplain is flat or nearly flat land adjacent to a stream or river, stretching from the banks of its channel to the base of the enclosing valley walls and (under natural conditions) experiences periods of flooding.
Flood risk	The exposure, vulnerability and hazard associated with flooding.
Flood zone	Flood zones refer to the probability of river and sea flooding, ignoring the presence of defences. Flood zone 3 shows the area that could be affected by a 1 in 100 year (1% chance) flood event. Flood zone 2 shows the area that could be affected by a 1 in 1,000 (0.1% chance) flood event. Flood zone 1 shows areas that are very unlikely to experience a flood (<0.1% chance).

Term	Definition
Flow dynamics	The manner in which flow behaves, e.g. turbulent flows, non-energetic and laminar flows.
Fluvial geomorphology	The scientific study of the form and function of rivers and the interaction between streams and the landscape around them.
Form	A hare's resting place.
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record.
Geology	The physical structure, substance and history of the earth (rocks and minerals).
Ghost licence	An EPSM licence that is written, prepared and agreed prior to a Development Consent Order (DCO) being granted but which cannot be officially granted until the DCO planning consent has been given.
Greenhouse gases (GHGs)	A gaseous compound that absorbs infrared radiation and traps heat in the atmosphere. Greenhouse gases are usually expressed in terms of carbon dioxide equivalent (CO_2e).
Green infrastructure	Networks of green spaces and watercourses and water bodies that connect rural areas, villages, towns and cities. (GLVIA3)
Greenspace	Any area of vegetated land, urban or rural. This can include public or private parks and gardens, amenity greenspace, sports pitches, allotments, green corridors such as canals and green cycleways, as well as the natural and semi-natural environment such as woodland and fields.
Ground gas	Gases such as carbon dioxide and methane, which are generated within the ground and/or within landfills, commonly from the breakdown of vegetative matter.
Ground Investigation (GI)	Ground investigations are a means of determining the condition of the ground, ideally before beginning construction works.
Ground Investigation Report (GIR)	A Ground Investigation Report gives the designer's interpretation or judgement of the ground conditions as they pertain to the planned works and an assessment of the ground risks.
Groundwater dependent terrestrial ecosystem (GWDTE)	Groundwater dependent terrestrial ecosystems are wetlands which critically depend on groundwater flows and chemistries.
H++	Defined as plausible 'high-end' climate change scenarios, which are typically extreme climate change scenarios on the margins or outside of the 10^{th} to 90^{th} percentile range presented in the 2009 UK climate change projections (also known as 'UKCP09').

Term	Definition
Habitats Regulations Assessment (HRA)	A Habitats Regulations Assessment refers to the several distinct stages of assessment which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended) if a plan or project may affect the protected features of a habitats site, before a decision can be made on whether to authorise it.
Haul road	Temporary roads used during the construction phase to transport materials, equipment, and the workforce within the Order Limits.
Hazardous waste	Defined in line with Article 3(2) of the Waste Framework Directive (Council Directive 2008/98/EC) as waste which displays one or more of the hazardous properties listed in Annex III of the Directive[22].
Health inequalities	The unfair and avoidable differences in exposure to health risk factors and to health status, health across the population, and between different groups within society. Note that where these are unfair and avoidable differences, these are also known as health inequities.
Heritage assets	The historic environment assets such as archaeological remains, historic buildings and historic landscapes which have archaeological, architectural, artistic or historic value.
Hibernacula	A habitat feature where reptiles and amphibians may hibernate.
Highways England	Highways England is the public body that operates, maintains and improves England's motorways and major A roads.
Historic Environment Record (HER)	Information services that seek to provide access to comprehensive and dynamic resources relating to the historic environment of a defined geographic area for public benefit and use.
Historic Landscape Characterisation	A formal process of the study of the historic landscape, using an array of sources including historic maps, archaeological data and aerial photographs. Historic Landscape Characterisation identifies and describes the essential characteristics of the land being studied. The studied areas are recorded chiefly in GIS format as polygons.
Holt	An otter's den/home, usually a tunnel system.
In-combination climate effects	When a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact.

[22] The UK left the European Union on the 31 December 2020. The UK government is committed to maintaining environmental standards and international obligations from 1 January 2021, and existing EU environmental laws will continue to operate in UK law.

Term	Definition
Inert waste	Waste which meets one or more of the following criteria: • that does not undergo any significant physical, chemical or biological transformations; • that does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and • where its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater. See Directive 1999/31/EC and Council Decision 2003/33/EC.
Institute of Environmental Management and Assessment (IEMA)	A professional body for environmental managers and EIA professionals.
Interfluve	A region between the valleys of adjacent watercourses.
Intra-project cumulative effects	The combined action of a number of different environmental aspect specific effects upon a single resource/receptor (also referred to as interrelationship of effects).
Inter-project cumulative effects	The combined action of a number of different projects, in combination with the project being assessed, on a single resource or receptor.
Invasive Non-Native Species (INNS)	Species that have been released either deliberately or accidentally outside of their natural range, where they have become established and cause adverse ecological, environmental, or economic impacts.
Key construction material	Construction materials which, by weight, constitute the majority of material required to deliver the scheme.
L_{A10}	The A-weighted sound level, in dB, that is exceeded 10% of the time.
$L_{A10,18h}$	The L_{A10} noise level, in dB, that is exceeded 10% of the time between 06:00 and 24:00.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the level of a notional steady sound, which at a given position and over a defined period of time, would have the same A-weighted acoustic energy as the fluctuating noise.
L_{den}	A noise index to take into account day, evening and night-time periods in one single figure, with evening and night periods being weighted to account for increased sensitivity.
L_{night}	The equivalent continuous sound level $L_{Aeq,8h}$ for the period 23:00 to 07:00 hours.
Land bank	The stock land with planning permissions but where minerals development has yet to take place.

Term	Definition
Landfill capacity	The known, forecast or estimated remaining landfill void space, either regionally or nationally. Landfill capacity is generally measured in cubic metres.
Landscape	An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. (GLVIA3)
Landscape and visual impact assessment (LVIA)	A tool used to identify and assess the likely significance of the effects of change resulting from development both on the landscape as an environmental resource in its own right and on people's views and visual amenity. (GLVIA3)
Landscape architect	Competent expert to mean: 1) Chartered Member of the Landscape Institute; or 2) member of a recognised equivalent landscape professional body. (DMRB LA 107)
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse. (GLVIA3)
Landscape character area (LCA)	These are single unique areas which are the discrete geographical areas of a particular landscape type. (GLVIA3)
Landscape character assessment	The process of identifying and describing variation in character of the landscape, and using this information to assist in managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make landscapes distinctive. (GLVIA3)
Landscape character type	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes. (GLVIA3)
Landscape component	Interplay of physical, natural and cultural factors of our surroundings. (DMRB LA 107)
Landscape effects	Effects on the landscape as a resource in its own right. (GLVIA3)
Landscape elements	Individual parts which make up the landscape, such as, for example, trees, hedges and buildings. (GLVIA3)
Landscape quality (or condition)	A measure of the physical state of the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and the condition of individual elements. (GLVIA3)
Landscape receptors	Defined aspects of the landscape resource that have the potential to be affected by a proposal. (GLVIA3)
Landscape resource	Natural and physical attribute (i.e. soils, vegetation). (DMRB LA 107)

Term	Definition
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a whole variety of reasons. (GLVIA3)
Leaching	When soil loses water-soluble nutrients due to excessive rain or irrigation.
Life cycle stage	PAS 2080:2016 proposes a modular approach for the quantification of infrastructure related GHG emissions over a number of stages over the 'life cycle' of a project, namely 'before use (A)', 'use (B)' and 'end of life (C)'. These stages are further disaggregated into modules (e.g. product stage (A1–A3) and construction process stage (A4–A5)).
Limits of deviation	Limits of deviation provide an envelope of development, as opposed to specific dimensions, and are used to allow design flexibility. These will be defined in the DCO and set the maximum extents of elements of the scheme.
Listed building	A building or structure designated under Section 1 of the Planning (Listed Building and Conservation Areas) Act 1990 as being of special architectural or historic interest.
Local Biodiversity Action Plan (LBAP)	Local Biodiversity Action Plans set the focus for conservation of locally valued species and habitats.
Local Nature Reserve (LNR)	Sites that are designated by the local authority under Section 21 of the National Parks and Access to the Countryside Act 1949 for nature conservation, which have wildlife or geological features that are of special interest locally.
Local Wildlife Site (LWS)	Local Wildlife Sites are non-statutory designated sites that have been identified and selected for their 'substantive nature conservation value'.
Long-term (in relation to noise and vibration assessment)	15 years after the scheme has opened to traffic.
Long Term Trend (LTT) adjustment factor	Adjustment factor applied to raw modelled NOx concentrations to account for over-optimism in the future uptake of low polluting vehicles by Defra tools.
Longest dry spell	Highest number of consecutive days with <1mm rainfall.
Lowest Observed Adverse Effect Level (LOAEL)	The level above which adverse effects on health and quality of life can be detected.
Low noise road surface	A surface that, when compared with traditional surfacing, has properties to reduce the noise from the tyre / road interface.
Macrophyte	An aquatic plant large enough to be seen with the naked eye.
Magnitude	The scale, size or degree of change (impact) to the environment from an action upon it.

Term	Definition
Main river	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. N.B. A main river designation is not an indication of size, although it is often the case that they are larger than ordinary watercourses.
Material impact	An event/outcome that is a key decision-making consideration.
Matter	This relates to sub-topics of an environmental aspect (e.g. designated sites, protected species).
Maximum five-day precipitation	Highest value of rainfall accumulated over five days.
Meandering channel	A single channel that follows a winding course, with a sinuosity ratio typically over 1.5.
Mental health	A state of wellbeing in which the individual realises his or her own abilities, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (WHO, 2018).
Mineral area of search	A broad area within which mineral sites are sought for development.
Mineral consultation area	Geographical area, based on a Mineral Safeguarding Area, where the district or borough council should consult the mineral planning authority for any proposals for non-minerals development.
Mineral planning authority	The mineral planning authority is the county council in two-tier parts of the country, or the unitary authority, or the national park authority, responsible for minerals development planning and control.
Mineral preferred area	Areas of known resources where planning permission might reasonably be anticipated providing the proposals are environmentally acceptable, or appropriate conditions can be applied to mitigate adverse impacts.
Mineral resource	Natural concentrations of minerals in or on the Earth's crust that are or may become of economic interest because they are present in such form, quality and quantity that there is the potential for eventual economic extraction. Generally, a mineral resource is known to exist within the boundaries outlined by BGS geological mapping.
Mineral safeguarding sites	Operational extraction sites or mineral sites specifically identified and allocated in strategic planning documents as those that will be mined or extracted.
Mineral specific sites	Areas with viable mineral resources where the landowners are willing to allow mineral development, and where granting of planning permission may be more likely than in a preferred area.

Term	Definition
Mineral safeguarding area	An area designated by a mineral planning authority which covers known deposits of minerals which are desired to be safeguarded from unnecessary sterilisation by non-mineral development. Mineral Safeguarding Areas are different from mineral safeguarding sites, defined above, as Government guidance is clear that there is no presumption that resources defined in Mineral Safeguarding Areas will be worked.
Minimum critical load	A quantitative estimate of exposure to a pollutant, below which significant harmful effects on specified sensitive elements of the environment are not expected to occur.
Mitigation	The action of reducing the severity and magnitude of change (impact) to the environment. Measures to avoid, reduce, remedy or compensate for significant adverse effects.
Municipal waste	Municipal waste covers household waste and waste similar in nature and composition to household waste.
National Networks National Policy Statement (NNNPS)	The NNNPS sets out '*the need for, and the Government's policies to deliver development of nationally significant infrastructure projects on the national road and rail networks'*.
National Network of Sites	SPA, SAC, and Ramsar Sites which were formerly collectively known as Natura 2000 sites but are now known as the National Network of Sites since the UK's exit from the European Union.
National Policy Statement (NPS)	National Policy Statements (NPS) are produced by Government. They give reasons for the policy set out in the statement and must include an explanation of how the policy takes account of Government policy relating to the mitigation of, and adaptation to, climate change.
Nationally Significant Infrastructure Project (NSIP)	Major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, and major road projects, as set out in the Planning Act 2008. See entry for Development Consent Order.
Natural England	A public body responsible for ensuring that England's natural environment is protected and improved.
Natural resources	Any physical, tangible and valued element of the natural environment (e.g. soil, land, water and biodiversity).
Net zero	Net zero means any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage.
Nitrogen deposition	The transfer of reactive nitrogen from the atmosphere to the biosphere.
Noise barrier	A purpose-built structure to reduce the passage of noise from the source to receiver. These are traditionally wooden but the use of other materials (e.g. plastic) is becoming more common.

Term	Definition
Noise modelling	The prediction of noise levels using specialist software to provide a 3D representation of the project and nearby noise-sensitive receptors.
Noise monitoring	Measurement of noise levels.
Noise Policy Statement for England	The document in which the Government sets out its vision and aims for noise policy in England.
Noise-sensitive receptor	Receptors which are potentially sensitive to noise. Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national or statutorily designated sites, public rights of way and cultural heritage assets.
NOMIS	NOMIS is a service provided by the ONS, providing free access to detailed and up-to-date UK labour market statistics from official sources.
Non-hazardous waste	Waste that is classified as neither inert nor hazardous.
Offline (in relation to a road project)	Where the new route of a road does not follow the alignment of an existing road.
Online (in relation to a road project)	Where the new route of a road follows the alignment of an existing road.
Opening year	The first year of operation.
Order Limits	The spatial boundaries of the proposed scheme. For the PEIR, the Order Limits are provisional as they have not been finalised.
Ordinary watercourse	All watercourses that are not designated as main rivers, and which are the responsibility of local authorities or, where they exist, Internal Drainage Boards. Note that being designated as an ordinary watercourse does not imply a 'small' river, although it is often the case that ordinary watercourses are smaller than main rivers.
PAS 2080	PAS 2080:2016 'Carbon Management in Infrastructure' specifies requirements for the management of whole-life carbon in infrastructure.
Peat resource	Existing or potential peat extraction sites.
Permitted reserves	Sites where planning permission has been granted for development but where extraction has still to take place or is not yet completed. It may cover the whole or part of a site.
Photomontage	A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs. (GLVIA3)

Term	Definition
Planning Inspectorate	The Planning Inspectorate for England and Wales is an executive agency of the Ministry of Housing, Communities and Local Government with responsibility to make decisions and provide recommendations and advice on a range of land use planning-related issues including operating the planning process for Nationally Significant Infrastructure Projects.
Planform	The birds-eye view of the channel and the form of the channel from that perspective.
Pollution Climate Mapping (PCM) model	Government's national air quality modelling used to assess and report on compliance with the Ambient Air Quality Directive to the European Commission.
Pools and riffles	Periodic undulations in bed elevation where relatively shallow, coarse-grained riffles are separated by deeper pools.
Population health	The health outcomes of a group of individuals, including the distribution of such outcomes within the group.
Pore water pressure	The pressure exerted on its surroundings by water held in pore spaces in rock or soil, an increase in which can result in a decrease in the shear strength of a slope material, reducing slope stability.
Preliminary Environmental Information Report (PEIR)	Report produced for statutory consultation for schemes consented through the Planning Act 2008. The purpose of the PEIR is to provide environmental information to enable consultees to understand the likely significant environmental effects of the proposed scheme, and measures proposed to mitigate such effects, to help inform their consultation responses.
Preliminary Sources Study Report (PSSR)	A combination of desk study and site reconnaissance, the purpose of which is to develop an initial conceptual site model.
Preparing for re-use	Checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.
Prevention (material assets and waste)	Measures taken before a substance, material or product has become waste, that reduce: • the quantity of waste, including through the re-use of products or the extension of the life span of products • the adverse impacts of the generated waste on the environment and human health • the content of harmful substances in materials and products
Primary materials	Physical substances from non-renewables sources, i.e. those that cannot or will not be replaced in short (non-geological) periods of time. Also referred to as 'virgin' materials.
Principal aquifer	Deposits that have high intergranular and/or fracture permeability meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Term	Definition
Principles of net self-sufficiency and proximity	The principles of self-sufficiency and proximity (commonly referred to as the 'proximity principle') are set out in the Waste Framework Directive. Local planning authorities are required, under regulation 18 of the Waste (England and Wales) Regulations 2011 which transposed the Directive, to have regard to these requirements when exercising their planning functions relating to waste management. The principles of self-sufficiency and proximity, whereby local planning authorities are required to move towards developing their own waste disposal facilities wherever practical to become self-sufficient in waste management capacity; and the principle that wastes should be disposed of as close to the source of waste as possible. Materials that can be reclaimed or recycled are not included under this principle. Though this should be the aim, there is no expectation that each local planning authority should deal solely with its own waste to meet the requirements of the proximity and self-sufficiency principles. Nor does the proximity principle require using the absolute closest facility to the exclusion of all other considerations.
Prior extraction	There are varying degrees of prior extraction, including the following: • Large scale extraction: Where the full mineral resource, or a significant proportion of it, is extracted. Large scale extraction would typically occur as separate activity to the non-minerals development and would include restoration of the land to make it suitable for future non-minerals development. However, in line with national policy there would be no presumption that the mineral will be worked in full. • Medium to smaller-scale extraction: Where there is no opportunity for a more comprehensive extraction of the mineral resources present, prior extraction would be undertaken as an integral part of the non-minerals development (such as during site preparation). The material would then either be processed and used on site or exported to a suitable minerals operator for processing in order that it can be used to supply other development projects. • Incidental extraction: Where any minerals that are incidentally extracted during site preparation would be processed and used on site (e.g. from excavating the road box, foundations, drainage works etc). This is typically the minimum level of prior extraction that the MPA would seek as part of any non-minerals development in an MSA.
Priority habitats	Priority habitats are the habitats of conservation priority which are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
Priority species	Priority species are species of conservation priority which are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
Project Air Quality Action Plan	The section of the air quality assessment where the proposed viable mitigation measures are set out and assessed.

Term	Definition
Protected and notable species	Species of plant and animal protected by legislation, and species of conservation importance such as priority species or species of principal importance.
Public health	The art and science of preventing disease, prolonging life and promoting health through the organised efforts of society (Acheson, 1988).
Public right of way (PRoW)	A widely known right to cross private land is known as a 'right of way'. If this is a right granted to everyone it is a 'public right of way'.
Q_{95}	The flow that is exceeded 95% of the time and usually taken as an indication of low flows.
Qualifying feature	In the PCM compliance risk assessment, qualifying features include public access (e.g. footpath) and sensitive receptors (e.g. residential properties, schools etc) within 15m of the running lane / kerbside, but are not within 25m of a junction.
Rainfall from extremely wet days	Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall.
Ramsar site	A wetland of international importance that has been designated under the Ramsar Convention 1971.
RCP8.5	RCP8.5 refers to the concentration of carbon that delivers global warming at an average of 8.5 watts per square meter across the planet. The RCP8.5 pathway delivers a temperature increase of about 4.3°C by 2100, relative to pre-industrial temperatures.
Receptor	The 'receptor' is the existing environmental feature usually associated with population, fauna or flora that would be affected by an impact of a development – for instance, the population of a protected species, or a specific archaeological site, or the occupants of a residential property.
Reach	A length of river along which the channel controls are sufficiently uniform to allow a fairly consistent morphological structure to be maintained.
Realignment (of a watercourse)	The artificial straightening of a river channel to accommodate structures, flood control or navigation.
Recovery (material assets and waste)	Any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the study areas or wider economy.
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Recycling includes the reprocessing of organic material but does not include energy recovery and reprocessing into materials that are to be used as fuels or for backfilling operations.
Recycled aggregates	Aggregates that are typically derived from reprocessing materials previously used in construction, such as road planings, railway ballast, crushed concrete or masonry from construction and demolition activities.

Term	Definition
Region (material assets and waste)	The defined geographical areas or physical extents of the second study area. For the purposes of the material assets and waste aspect, the recommended physical extent is the former East of England Planning Region.
Regionally Important Geological Sites (RIGS)	Regionally important geological sites are sites of regional and local importance for their geology that have not been designated a Site of Special Scientific Interest.
Register of Environmental Actions and Commitments (REAC)	Itemised schedule of environmental mitigation. Sets out the intended purpose of the mitigation, as well as how it will be delivered, who is responsible for implementing it, when it will be implemented, and success criteria (including monitoring requirements). The REAC forms part of the EMP.
Registered park and garden	Gardens, grounds and other planned open spaces with historical significance. Registration is a 'material consideration' in the planning process.
Refugia	Habitat features where an animal may take refuge.
Representative worst-case receptor	A sensitive receptor location that is considered to show the largest increase in pollutant concentration as a result of the proposed scheme, compared to other sensitive locations in the vicinity.
Residual effect	The predicted consequential change on the environment from the impacts of a development after mitigation.
Rest water level	The natural groundwater level measured in a borehole or piezometer.
Re-use (material assets and waste)	Any operation by which products or components that are not waste are used again for the same purpose.
Riparian zone	The corridor of land which runs along the banks of a river channel. If vegetated, it is known as the vegetated riparian zone.
River network	The streams, rivers, lakes and other water bodies that form a particular drainage basin.
Runoff	The movement of water above and below the surface.
Scheduled monument	Scheduled monuments are protected by law designated under the Ancient Monuments and Archaeological Areas Act 1979 and are, by definition, of national importance.
Scoping	The process of identifying the issues to be addressed in the Environmental Impact Assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered unlikely to be significant.
Secondary A aquifer	Deposits that comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers or wetland ecosystems.

Term	Definition
Secondary B aquifer	Deposits with mainly lower permeability layers that may store and yield limited amounts of groundwater.
Secondary undifferentiated aquifer	Deposits where it is not possible to apply either a secondary A or B definition because of the variable characteristics of the rock type.
Secondary materials and aggregates	Useful by-products from manufacturing or industrial processes. Secondary aggregates are typically by-products of industrial and other processes. These can be subdivided into manufactured and natural aggregates, depending on their source and can include materials such as pulverised fuel ash, ground granulated blast-furnace slag, furnace bottom ash, incinerator bottom ash, recycled glass etc. Both secondary and recycled aggregates offer appropriate engineering specifications to allow them to replace primary aggregates.
Second study area (material assets and waste)	• Feasible sources and availability of construction materials required to construct the main elements of the proposed scheme. • Suitable recovery and waste management infrastructure that could accept arisings and waste generated by the proposed scheme.
Sector-removal (background concentrations)	The removal of major road contributions to the Defra background mapping data concentrations.
Sediment transport dynamics	The manner in which sediment is eroded, transported and deposited along a watercourse.
Sensitivity	Term applied to specific receptors, combining judgements of the susceptibility of the receptor to specific type of change proposed and the value related to that receptor.
Sett	A badger's home, usually consisting of a network of tunnels with multiple entrances.
Setting (in relation to cultural heritage)	The setting of an asset is the surroundings in which a place is experienced, while embracing an understanding of perceptible evidence of the past in the present landscape.
Setting (in relation to landscape and visual)	Contribution of the surroundings to the appearance of an area or feature and the interrelationship of the area or feature to the wider context and sense of place. (DMRB LA 107)
Sense of place	The essential character and spirit of an area (genius loci - spirit of the place). (DMRB LA 107)
Shared-use path	Shared footway/cycleway usually segregated from roads.
Short-term (in relation to noise and vibration assessment)	When the scheme opens to traffic.

Term	Definition
Significance	A measure of the importance, or gravity, of the environmental effect, defined by significance criteria specific to the environmental aspect.
Significant Observed Adverse Effect Level (SOAEL)	The level above which significant adverse effects on health and quality of life occur.
Sinuosity	The degree in which a channel meanders. A sinuous channel generally has a sinuosity ratio between 0 and 1.5. Straight channels have a ration less than 1.1.
Site arisings	Construction, demolition, excavation and other arisings generated from within a project boundary, during both construction, and operation and maintenance phases.
Site of Special Scientific Interest (SSSI)	Site designated as being of special interest for its flora, fauna or geological or physiographical features and protected under the Wildlife and Countryside Act 1981.
Snuffle hole	Small holes in the ground made by badgers as they forage for food such as earthworms.
Social capital	The networks of relationships among people who live and work in a particular society, enabling that society to function effectively.
Soilscapes	Soilscapes is a web application which conveys a summary of the broad regional differences in the soil landscapes of England and Wales.
Soil resource plan	A soil resource plan shows the areas and type of topsoil and subsoil to be stripped, haul routes, the methods to be used, and the location, type and management of each soil stockpile.
Source-pathway-receptor	The ‘source-pathway-receptor’ model defines those receptors considered to be at risk. The term ‘source’ describes the origin of potential effects (e.g. construction activities) and the term ‘pathway’ describes the means (e.g. through air, water or ground) by which the effect reaches the receiving sensitive ‘receptor’ (e.g. terrestrial habitats / species, human receptors etc.). If the source, pathway or receptor is absent, no link exists and thus there will be no potential for an impact to occur.
Source protection zone (SPZ)	Zones around groundwater sources used for potable supply or food processing, including wells, boreholes and springs, which show the level of risk to the source from contamination.
Special Area of Conservation (SAC)	An area which has been identified as being important for a range of vulnerable habitats, plant and animal species within the EU and is designated under the Habitats Directive.
Special Protection Area (SPA)	A site designated under the Birds Directive due to its international importance for the breeding, feeding, wintering, or the migration of, rare and vulnerable species of birds.

Term	Definition
Species of Principal Importance	Species of principal importance are species protected under section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
Speed band	A range of categories for which outputs from the traffic model are grouped into to describe their emissions.
Spraint	The dung of an otter.
Stable non-reactive hazardous waste	Hazardous waste, the leaching behaviour of which will not change adversely in the long term, under landfill design conditions or foreseeable accidents: • in the waste alone (for example, by biodegradation) • under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) • by the impact of other wastes (including waste products such as leachate and gas)
Standardised admissions ratio (SAR)	The SAR is a health measure that allows a comparison of hospital admissions data between areas, while accounting for differences in population structures (i.e. age profile) between those areas. It is calculated by using admissions data from a standard population to estimate the number of admissions expected in the study population. The estimate is then compared with the actual (observed) number of admissions and multiplied by 100 to yield the SAR. If the observed admissions are the same as the expected admissions the SAR will be 100. An SAR greater than 100 indicates that admissions are higher than would be expected for the age structure in the study population. An SAR less than 100 indicates it is lower than expected.
Standardised incidence ratio (SIR)	The SIR is a health measure that allows a comparison of incidence of diseases between areas, while accounting for differences in population structures (i.e. age profile) between those areas. It is calculated from mortality data using the same approach as for the SAR.
Standardised mortality ratio (SMR)	The SMR is a health measure that allows a comparison of mortality data between areas, while accounting for differences in population structures (i.e. age profile) between those areas. It is calculated from mortality data using the same approach as for the SAR.
Standard mitigation	Mitigation required regardless of the EIA because it is generally imposed through legislative requirements or standard sector practices (e.g. implementing considerate contractor practices to reduce nuisance from site work). These measures would be captured in an Environmental Management Plan (EMP).

Term	Definition
Sterilise	Substantially constrain or prevent existing and potential future use and extraction of mineral resources, typically by constructing infrastructure over or adjacent to a deposit. In the absence of any further guidance, this has been interpreted to mean that the proposed scheme would need to sterilise an entire minerals site placing their future use at risk or rendering them inaccessible for current or future use. This approach is considered consistent with Materials and Waste in Environmental Impact Assessment - Guidance for a Proportionate Approach (Institute of Environmental Management & Assessment (IEMA), 2020a) that also focuses on impacts to allocated minerals sites in their entirety.
Strava Global Heatmap	A web-based source of information activities undertaken by users of the Strava fitness app (www.strava.com). The heatmap shows 'heat' made by aggregated, public activities over the last two years. The heatmap is updated monthly.
Strip, map and sample excavation	Stripping the full depth of topsoil in a specifically defined area of archaeological potential, to maximise visibility of potential archaeological remains. Following topsoil removal, any archaeological features identified are recorded in plan, and this is then used to agree a programme of sample excavation and recording in consultation with the relevant archaeological regulator.
Sub-region (material assets and waste)	The defined geographical areas or physical extents of the County of Essex and the unitary authorities of Southend-on-Sea and Thurrock.
Superficial deposits	Superficial deposits (previously called ‘drift’) are the youngest geological deposits formed during the most recent period of geological time. Most of these superficial deposits are unconsolidated sediments, such as gravel, sand, silt and clay.
Susceptibility (in relation to landscape and visual)	The ability of a defined landscape or visual receptor to accommodate the specific proposed development without undue negative consequences. (GLVIA3)
Synergistic (in relation to cumulative effects)	Where different types of impact affect a receptor and interact to increase their combined significance e.g. two discharges combine to have an effect on a species not affected by discharges in isolation.
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.
Traffic Reliability Area (TRA)	The TRA is the area covered by the traffic model that the competent expert for traffic has identified as reliable for inclusion in an environmental assessment.
Tree Preservation Order	A Tree Preservation Order is an order made by a local planning authority in England to protect specific trees, groups of trees or woodlands in the interests of amenity.
Tranquillity	A state of calm and quietude associated with peace, considered to be a significant asset of landscape. (GLVIA3)

Term	Definition
Trial trenching	The excavation of a pattern of linear trenches to determine the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts and their research potential, within a specified area. If such archaeological remains are present, trial trenching aims to define their character, extent, quality and state of preservation, reports on them and enables an assessment of their significance in a local, regional, national or international context as appropriate. Trial trenching may be conducted 'blind' or to test the results of non-intrusive investigations like geophysical surveys.
UKCP18	The UK Climate Projections 2018 (UKCP18) are a set of UK climate projection tools designed to help decision-makers assess their risk exposure to climate change. The UKCP18 project uses cutting-edge climate science to provide climate change projections out to 2100. UKCP18 provides probabilistic projections over land and a set of high-resolution, spatially coherent future climate projections for the UK at 12km scale. The 12km climate model has been further downscaled to 2.2km scale – a level previously only used for short-term weather forecasts, allowing realistic simulation of high impact events such as localised heavy rainfall in summer.
Unconfined aquifer	An aquifer which is exposed to the surface with no other overlying units.
Unproductive strata	Deposits which are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them.
Verification (including adjustment factor)	A comparison of the modelled results versus monitoring results at relevant locations to enable the adjustment of model outputs (by applying an adjustment factor), minimising the inherent uncertainties associated with dispersion modelling.
Veteran tree	A tree that by recognised criteria shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned.
Visual receptors	Individuals and/or defined groups of people who have the potential to be affected by a proposal. (GLVIA3)
Vulnerability (climate)	The degree to which a system/asset is exposed and resilient to adverse effects of climate change.

Term	Definition
Walkers, cyclists and horse riders (WCH)	Users that include: • pedestrians – including mobility impaired and vulnerable pedestrians • cyclists – including mobility impaired and vulnerable cyclists • equestrians – including mobility impaired and vulnerable equestrians Other users considered as part of this group include (but are not limited to): • scooter riders (non-motorised) • cyclists with electrically assisted pedal cycles (where these conform to Department for Transport or other relevant regional regulations and where they can legally be used) • users of powered wheelchairs (where these conform to Department for Transport regulations and where they can legally be used)
Warm spell duration index	Count of days with at least six consecutive days when daily maximum temperature is above the 90th percentile.
Waste	Defined in line with Article 3(1) of the Waste Framework Directive (Council Directive 2008/98/EC) as: 'any substance or object which the holder discards or intends or is required to discard'. Waste is commonly split into the following classifications: inert, hazardous, and non-hazardous (the latter being waste classified as neither inert nor hazardous).
Waste classification	As part of the waste duty of care, waste holders must classify their waste: before it is collected, disposed of or recovered; to identify the controls that apply to the movement of the waste; to complete waste documents and records; to identify suitably authorised waste management options; and to prevent harm to people and the environment. Technical Guidance WM3 'Waste Classification - Guidance on the classification and assessment of waste' provides guidance on waste classification in the UK. It is a comprehensive reference manual for anyone involved in producing, managing and regulating waste. Appendix A of WM3 includes the waste classification codes, also referred to as LoW (List of Waste) or EWC (European Waste Catalogue) codes.
Waste consultation area	Geographical area, based on existing waste infrastructure sites, where the district or borough council should consult the mineral planning authority for any proposals for non-minerals development.

Term	Definition
Waste holder	The duty of care applies to anyone who imports, produces, carries, keeps, treats, disposes of, or is a dealer or broker that has control of, controlled waste (commonly referred to as a 'waste holder'). Waste holders include the following: • waste producer – any person whose activities produce waste. It also includes permitted operations or exempt facilities that produce waste as part of their activities. If you carry out a waste operation that changes the nature or composition of the waste, you are regarded as a producer of the waste. Waste producers play a key role under the duty of care requirements as they are in the best position to identify the nature and characteristics of the waste. • waste carrier – any person who normally and regularly collects, carries or transports waste in the course of any business or with a view to profit, including those that produce and transport their own waste. • waste dealer – any person, business or organisation that buys waste with the aim of subsequently selling it, including in circumstances where the dealer does not take physical possession of the waste. • waste broker – any person, business or organisation that arranges waste transportation and management of waste on behalf of another party, such as organisations contracting out waste collection services. • waste manager – any person involved in the collection, transport, recovery or disposal of controlled waste, including the supervision of these operations, the aftercare of disposal sites and actions taken as a dealer or broker.
Waste infrastructure	Facilities that handle, treat or prepare for re-use, recycle and dispose (landfill) of waste.
Waste planning authority	The mineral planning authority is the county council in two-tier parts of the country, the unitary authority, or the national park authority responsible for planning control of waste development planning and control.
Water Framework Directive (WFD)	The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is an EU directive which commits EU member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore). The Directive has been transposed into UK legislation via The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2017, which is now the retained legislation following Brexit.
Wider determinant of health	Personal, social, economic and environmental factors which determine the health status of individuals and communities.
Zone of Influence (ZOI)	This is established for each environmental aspect considered within the Environmental Statement in order to establish the relevant 'other existing development and/or approved development' to be considered within the cumulative effects assessment.

Term	Definition
Zone of Theoretical Visibility (ZTV)	Map produced (usually digitally) to specific criteria to illustrate the area(s) from which a project can theoretically be visual. (DMRB LA 107)

References

Acheson, E. D. (1988). On the state of the public health [the fourth Duncan lecture]. Public Health, 102(5), 431–437.

AECOM (2016a). Braintree and Witham Surface Water Management Plan (SWMP) and modelling outputs. Provided January 2021 by Essex County Council.

AECOM (2016b). Braintree District Council Level 1 Strategic Flood Risk Assessment (SFRA) Update. Available at: https://www.braintree.gov.uk/downloads/file/1616/bdc-level-1-sfra-final. Accessed January 2021.

AECOM (2016c). Colchester Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) Update. Available at: https://www.colchester.gov.uk/local-plan/evidence-base-emerging-local-plan-2017-33/. Accessed January 2021.

AECOM (2017). Colchester Borough Council Level 2 Strategic Flood Risk Assessment (SFRA) Update. Available at: https://www.colchester.gov.uk/local-plan/evidence-base-emerging-local-plan-2017-33/. Accessed January 2021.

Anciaes P R, Jones P, and Mindell J S (2016). Community Severance: Where Is It Found and at What Cost? Transport Reviews, 36:3, 293-317, DOI: 10.1080/01441647.2015.1077286.

Babergh and Mid-Suffolk District Councils (2020). 2020 Air Quality Annual Status Report.

Barton, H and Grant, M (2006). A health map for the local human habitat. The Journal for the Royal Society for the Promotion of Health, 126 (6). pp. 252-253. ISSN 1466-4240.

Bat Conservation Trust (2018). Guidance Note 08/18 Bats and artificial lighting in the UK.

BPP Consulting (2015). Essex & Southend on Sea Waste Local Plan - Waste Capacity Gap Update. Available at: https://assets.ctfassets.net/knkzaf64jx5x/2UMYSwNRKjbgxb7ZatwA9k/552235f765e76856c971f4f68a2b03d7/SD_20_-_Topic_Paper_1_WCG_Update_Dec_2015.pdf. Accessed January 2021.

Braintree District Council (2005). Braintree District Local Plan Review 2005.

Braintree District Council (2011). Braintree District Core Strategy 2011 – 2026.

Braintree District Council (2017). Braintree District Council Local Plan: Publication Draft June 2017. Available at: https://www.braintree.gov.uk/planning-building-control/emerging-local-plan/2. Accessed March 2021

Braintree District Council (2019). 2019 Air Quality Annual Status Report.

Braintree District Council (2020). Planning Application Summary 06/01143/OUT. Available at: https://publicaccess.braintree.gov.uk/online-applications/caseDetails.do?caseType=Application&keyVal=J06F0DBFO7000. Accessed February 2021.

Brentwood Borough Council (2020). 2020 Air Quality Annual Status Report.

British Geological Survey (n.d.). Minerals Information Online. Available at: https://www.bgs.ac.uk/mineralsuk/maps/maps.html. Accessed January 2021.

British Geological Survey (2019a). Geology of Britain Viewer. Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html?. Accessed January 2021.

British Geological Survey (2019b). Mineral Planning Factsheet Construction Aggregates. Available at: https://www2.bgs.ac.uk/mineralsuk/download/planning_factsheets/mpf_aggregates.pdf. Accessed January 2021.

British Geological Survey (2020). Susceptibility to Groundwater Flooding dataset. Accessed January 2021.

British Geological Survey (2021a). GeoIndex Onshore. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html. Accessed January 2021.

British Geological Survey (BGS) (2021b). GeoClimate Open. Available at: https://www.bgs.ac.uk/datasets/geoclimateukcp18-open/. Accessed February 2021.

British Standards Institution (2003). BS 7445-1:2003 Description and Measurement of Environmental Noise - Guide to Quantities and Procedures.

British Standards Institution (2009). BS 8902:2009 Responsible Sourcing Sector Certification Schemes for Construction Products.

British Standards Institution (2011). BS 3247: Specification for salt for spreading on highways for winter maintenance.

British Standards Institution (2012). British Standard: 5837:2012 Trees in relation to design, demolition and construction – Recommendations.

British Standards Institution (2013). BS 8582: Code of practice for surface water management for development sites.

British Standards Institution (2014a). BS 5228-1:2009 + A1:2014 Code of practice for Noise and Vibration Control on Construction and Open Sites Part 1 – Noise.

British Standards Institution (2014b). BS 5228-2:2009 + A1:2014 Code of practice for Noise and Vibration Control on Construction and Open Sites Part 2 – Vibration.

British Standards Institute (2016). PAS 2080:2016: Carbon Management in Infrastructure.

British Standards Institution (2020). BS 5489-1:2020: Design of Road Lighting. Lighting of Roads and Public Amenity Areas. Code of Practice.

Building Research Establishment (BRE) (2014). BES 6001 – The Framework Standard for Responsible Sourcing. Available at: https://www.bregroup.com/services/standards/responsible-sourcing/. Accessed January 2021.

Cambridge Environmental Research Consultants (2020). Atmospheric Dispersion Modelling System (ADMS-Roads) version 5.0.

Campaign to Protect Rural England (2007). Tranquillity Map England.

Campaign to Protect Rural England (2019). England's Light Pollution and Dark Skies.

Cave B, Fothergill J, Pyper R, Gibson G, and Saunders P (2017). Health in Environmental Impact Assessment: A Primer for a Proportionate Approach. Available at: https://www.iema.net/document-download/33596. Accessed January 2021.

Centre for Ecology and Hydrology (2020). Air Pollution Information System. Available at: http://www.apis.ac.uk/. Accessed March 2021.

Chelmsford City Council (2018). Chelmsford Pre-Submission Local Plan: Sustainability Appraisal Report. Prepared by Amec Foster Wheeler Environment and Infrastructure LT. Available at: https://www.chelmsford.gov.uk/_resources/assets/inline/full/0/1143549.pdf. Accessed February 2021.

Chelmsford City Council (2020a). Chelmsford Local Plan – Our Planning Strategy 2013 to 2036. https://www.chelmsford.gov.uk/_resources/assets/inline/full/0/4671682.pdf. Accessed February 2021.

Chelmsford City Council (2020b). 2020 Air Quality Annual Status Report.

Chelmsford City Council (2020c). Chelmsford Local Plan and Adopted Policies Map 2013 – 2036.

Chris Blandford Associates (2003). Essex Landscape Character Assessment.

Chris Blandford Associates (2005). Colchester Borough Landscape Character Assessment.

Chris Blandford Associates (2006). Braintree, Brentwood, Chelmsford, Maldon and Uttlesford Landscape Character Assessments.

CIRIA (2000a). Environmental handbook for building and civil engineering projects. Part 1: design and specification (C512).

CIRIA (2000b). Environmental handbook for building and civil engineering projects. Part 2: construction (C528).

CIRIA (2000c). Environmental handbook for building and civil engineering projects. Part 3: demolition and site clearance (C529).

CIRIA (2001). Control of water pollution from construction sites. Guidance for consultants and contractors (C532).

CIRIA (2006). Control of water pollution from linear construction projects. Site guide (C649).

CIRIA (2015a). The SuDS Manual (C753).

CIRIA (2015b). Environmental good practice on site guide (fourth edition) (C741).

CIRIA (2016a). Groundwater control: design and practice, second edition (C750).

CIRIA (2016b). River Weirs Guide (C763).

CIRIA (2019). Culvert, screen and outfall manual (C786).

CL:AIRE (2011). The Definition of Waste: Development Industry Code of Practice. Available at: https://www.claire.co.uk/projects-and-initiatives/dow-cop. Accessed January 2021.

Colchester Borough Council (2010). Proposals Maps.

Colchester Borough Council (2014a). Local Development Framework. Core Strategy. Adopted December 2008. Selected policies revised 2014.

Colchester Borough Council (2014b). Local Development Framework. Development Policies. Adopted October 2010. Selected policies revised 2014.

Colchester Borough Council (2017). Colchester Emerging Local Plan 2017 – 2033 (Publication Draft 2017). Available at: https://www.colchester.gov.uk/info/cbc-article/?catid=emerging-local-plan&id=KA-02211. Accessed July 2020.

Colchester Borough Council (2019). 2019 Air Quality Annual Status Report.

Colchester Borough Council (2020). 2020 Air Quality Annual Status Report.

Committee on Climate Change (2020). The Sixth Carbon Budget. The UK's path to Net Zero.

Cranfield University (2020). LandIS Soilscapes, Available at: http://www.landis.org.uk/soilscapes. Accessed January 2021.

Crown Estates (2020). Marine Aggregates Capability and Portfolio Document 2020. Available at: https://www.thecrownestate.co.uk/media/3634/2020-capability-portfolio-report.pdf. Accessed January 2021.

Cycling UK (2019). Cycling statistics. Available at: https://www.cyclinguk.org/statistics. Accessed July 2020.

Department for Business, Energy and Industrial Strategy (BEIS) (2020a). Green Book Supplementary Guidance: Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal. Data Table 1. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal. Accessed February 2021.

Department for Business, Energy and Industrial Strategy (BEIS) (2020b). UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005 to 2018. Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018. Accessed January 2021.

Department for Communities and Local Government (2012). Technical Guidance to the National Planning Policy Framework.

Department for Environment, Food and Rural Affairs (Defra) (2006). Air Quality and Social Deprivation in the UK: an environmental inequalities analysis. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/0701110944_AQinequalitiesFNL_AEAT_0506.pdf. Accessed March 2021.

Department for Environment, Food and Rural Affairs (Defra) (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf. Accessed January 2021.

Department for Environment, Food and Rural Affairs (Defra) (2015). Non-statutory technical standards for sustainable drainage systems. Available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards. Accessed March 2021.

Department for Environment, Food and Rural Affairs (Defra) (2018). Local Air Quality Management: Technical Guidance Note (TG16) (LAQM.TG(16)).

Department for Environment, Food and Rural Affairs (Defra) (2020a). NO_X to NO_2 Calculator v8.1; and NO_2 Adjustment for NOx Sector Removal Tool v8.0. Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html. Accessed September 2020.

Department for Environment, Food and Rural Affairs (Defra) (2020b). Background Mapping data for local authorities (2018 reference year). Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018. Accessed February 2021.

Department for Environment, Food and Rural Affairs (Defra) (2020c). 2020 NO_2 Pollution Climate Mapping projections data (2018 reference year). Available at: https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data. Accessed July 2020.

Department for Environment, Food and Rural Affairs (Defra) (2020d). UK Statistics on Waste - Statistical Notice (March 2020). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874265/UK_Statistics_on_Waste_statistical_notice_March_2020_accessible_FINAL_rev_v0.5.pdf. Accessed January 2021.

Department for Environment, Food and Rural Affairs (Defra) (2021). Magic Map Application. Available at: https://magic.defra.gov.uk/MagicMap.aspx. Accessed March 2021.

Department for Transport (2014). National Policy Statement for National Networks. Available at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks. Accessed January 2021.

Department for Transport (2015). Road Investment Strategy: for the 2015/16–2019/20 Road Period (RIS1). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf. Accessed February 2021.

Department for Transport (2017). Local Cycling and Walking Infrastructure Plans. London: Department for Transport, p.8.

Department for Transport (2020a). Road Investment Strategy 2 (RIS2): 2020 to 2025. Available at: https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025. Accessed February 2021.

Department for Transport (2020b). TAG Data Book. Available at: https://www.gov.uk/government/publications/tag-data-book. Accessed February 2021.

Department for Transport (2021). Transport Analysis Guidance. Available at: https://www.gov.uk/guidance/transport-analysis-guidance-tag. Assessed February 2021.

Department of Transport/Welsh Office (1988). Calculation of Road Traffic Noise.

Dyson-Bruce, L. and Bennett, A. (2013). The Essex Historic Landscape Characterisation Project. Available at: https://archaeologydataservice.ac.uk/archives/view/essex_hlc_2013/downloads.cfm. Accessed February 2021.

East Midland Aggregates Working Party (2017). Annual Monitoring Report 2017 - incorporating data from January – December 2017. Available at: https://www.nottinghamshire.gov.uk/media/2890566/emawp-annual-report-2017-final.pdf. Accessed January 2021.

East of England Aggregates Working Party (EEAWP) (2019). Annual Monitoring Report 2018 Data. Available at: https://centralbedfordshire.box.com/s/cobqx14c6ip41dl464ctok4i3erkx4zb. Accessed January 2021.

Environment Agency (2004). Model Procedures for the Management of Contaminated Land. Contaminated Land Report 11 (CLR11).

Environment Agency (2010). Water Framework Directive Assessment Essex and South Suffolk SMP2.

Environment Agency (2013). End of Waste Criteria for the Production of Aggregates from Inert Waste. Available at: https://www.gov.uk/government/publications/quality-protocol-production-of-aggregates-from-inert-waste. Accessed January 2021.

Environment Agency (2017). Essex Abstraction Licensing Strategy. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/636594/ALS_2017_Essex.pdf. Accessed February 2021.

Environment Agency (2018). Anglian River Basin Management Plan. Available at: https://www.gov.uk/government/publications/anglian-river-basin-district-river-basin-management-plan. Accessed March 2021.

Environment Agency *et al* (2018). Waste Classification, Guidance on the Classification and Assessment of Waste (Edition v1.1), Technical Guidance WM3. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/719394/Waste-classification-technical-guidance-WM3.pdf. Accessed January 2021.

Environment Agency (2020a). 2019 Waste Data Interrogator. Available at: https://data.gov.uk/dataset/d409b2ba-796c-4436-82c7-eb1831a9ef25/2019-waste-data-interrogator. Accessed January 2021.

Environment Agency (2020b). 2019 Remaining Landfill Capacity - Version 2. Available at: https://data.gov.uk/dataset/237825cb-dc10-4c53-8446-1bcd35614c12/remaining-landfill-capacity. Accessed January 2021.

Environment Agency (2020c). Flood Risk Assessments: Climate Change Allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. Accessed March 2021.

Environment Agency (2020d). Risk of Flooding from Reservoirs – Maximum Flood Extent (Web Mapping Service). Available at: https://data.gov.uk/dataset/44b9df6e-c1d4-40e9-98eb-bb3698ecb076/risk-of-flooding-from-reservoirs-maximum-flood-extent-web-mapping-service. Accessed March 2021.

Environment Agency (2020e). Statutory Main River Map. Available at: https://data.gov.uk/dataset/4ae8ba46-f9a4-47d0-8d93-0f93eb494540/statutory-main-river-map. Accessed January 2021.

Environment Agency (2021a). Detailed River Network Map. Provided January 2021.

Environment Agency (2021b). Catchment Data Explorer. Available at: https://environment.data.gov.uk/catchment-planning/. Accessed January 2021.

Environment Agency (2021c). Flood Map for Planning. Available at: https://flood-map-for-planning.service.gov.uk/. Accessed January 2021.

Environment Agency (2021d). Historic Flood Map. Available at: https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map. Accessed January 2021.

Environment Agency (2021e). Long term flood risk information. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map. Accessed January 2021.

Environment Agency (2021f). Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance datasets. Available at: https://data.gov.uk/dataset/b391e876-4571-44f9-85c5-3485ddf6333a/risk-of-flooding-from-surface-water-depth-0-1-percent-annual-chance. Accessed January 2021.

Environment Agency (2021g). Water Quality Archive. Available at: https://environment.data.gov.uk/water-quality/view/landing. Accessed March 2021.

Epping Forest District Council (2020). 2020 Air Quality Annual Status Report.

Essex County Council (n.d.). Minerals Local Plan Minerals Policies Map. Available at: https://images.ctfassets.net/knkzaf64jx5x/3kRWyM7PIyxdi1ccSCRb3Z/8b8c8d6e33e65d4673e5bdf376b185aa/policies-map.jpg. Accessed January 2021.

Essex County Council (2011). Essex Transport Strategy: the Local Transport Plan for Essex. Available at: https://www.essexhighways.org/uploads/docs/essex_ltp.pdf. Accessed January 2021.

Essex County Council (2014). Essex Minerals Local Plan.

Essex County Council (2017a). Minerals and Waste Development Framework Authority Monitoring Report 2016 to 2017. Available at: https://www.essex.gov.uk/minerals-waste-planning-policy/authority-monitoring-report. Accessed January 2021.

Essex County Council (2017b). Essex and Southend-on-Sea Waste Local Plan. Available at: https://www.essex.gov.uk/minerals-waste-planning-policy/waste-local-plan. Accessed January 2021.

Essex County Council (2018a). Minerals and Waste Development Framework Authority Monitoring Report 2017 to 2018. Available at: https://assets.ctfassets.net/knkzaf64jx5x/238RLlgKDGTr8EwwQvB1n5/b2a1c96fc85aff4af3e96461bde1822a/Authority_Monitoring_Report_2017-18.pdf. Accessed January 2021.

Essex County Council (2018b). Essex Joint Health And Wellbeing Strategy 2018-2022. Available at: https://data.essex.gov.uk/dataset/e6k09/essex-joint-health-and-wellbeing-strategy-20182022. Accessed July 2020.

Essex County Council (2019a). Consultation Response Letter - Minerals and Waste Safeguarding Implications of Proposed A12 Modifications. 01.12.2019.

Essex County Council (2019b). Essex Joint Strategic Needs Assessment and Area Profiles. Available at: https://data.essex.gov.uk/dataset/exwyd/essex-jsna-and-district-profile-reports-2019. Accessed July 2020.

Essex County Council (2020a). Essex Green Infrastructure Strategy.

Essex County Council (2020b). Greater Essex Local Aggregates Assessment 2020 (Covering the Calendar Year 2019). Available at: https://assets.ctfassets.net/knkzaf64jx5x/2bxPoGcohUGH3UOwX904mi/07c13c112f506dad336e55b9ff0730f2/GE_LAA_October_2020.pdf. Accessed January 2021.

Essex County Council (2020c). Sustainable Drainage Systems Design Guide. Available at: https://www.essexdesignguide.co.uk/. Accessed March 2021.

Essex County Council, Public Health Intelligence Research and Insight (2019). Joint Strategic Needs Assessment. Available at: https://data.essex.gov.uk/download/exwyd/wfy/Essex%20JSNA%202019%20FINAL.docx. Accessed March 2021.

Essex Highways (n.d.) Highways Information Map. Available at: https://www.essexhighways.org/interactive-maps-and-live-travel-information/highways-information-map. Accessed January 2021.

Essex Highways (2009). Essex County Council Rights of Way Improvement Plan. Available at: https://www.essexhighways.org/uploads/docs/final-rowip.pdf. Accessed July 2020

Essex Highways (2017). Chelmsford Cycling Action Plan. Essex County Council. Available at: https://www.essexhighways.org/uploads/files/Getting%20Around/Cycling/Chelmsford-CAP.pdf. Accessed July 2020

Essex Highways (2018). Braintree District Cycling Action Plan. Essex County Council. Available at: https://www.essexhighways.org/uploads/files/Getting%20Around/Cycling/Braintree-District-Cycling-Action-Plan.pdf. Accessed July 2020

European Union (n.d.). Forest Law Enforcement Governance and Trade. Available at: http://www.euflegt.efi.int/what-is-flegt. Accessed January 2021.

Extrium (2019). England Noise Map Viewer. http://www.extrium.co.uk/noiseviewer.html. Accessed January 2021.

GeoEssex (2020). Sites of Special Scientific Interest and Local Geological Sites Information. Available at: http://www.geoessex.org.uk/sites/. Accessed January 2021.

Glenigan; CITB; Department for Business, Energy and Industrial Strategy; and Constructing Excellence (2018). UK Industry Performance Report 2018 – Based on the UK Construction Industry Key Performance Indicators. Available at: https://constructingexcellence.org.uk/kpi-reports/. Accessed January 2021.

Google Earth (2021). Chelmsford to Marks Tey, United Kingdom. SIO, NOAA, U.S. Navy, NGA, GEBCO. Available at: http://www.google.com/earth/index.html. Accessed January 2021.

Groundsure (2018). Groundsure report specifically for junction 24 to junction 25, Groundsure reference: Enviro-A12-A_250, dated 19 July 2018, HAGDMS No. 30508).

Harlow Council (2020). 2020 Air Quality Annual Status Report.

Headland Archaeology (2020a). A12 Chelmsford to A120, Essex: Geophysical Survey Phase 1.

Headland Archaeology (2020b). A12 Chelmsford to A120, Essex: Geophysical Survey Phase 2.

Highways Agency (2013). A12/A120 Route Based Strategy. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/364194/FINAL_A12_RBS__with_figures_.pdf. Accessed January 2021.

Highways England Water Risk Assessment Tool (HEWRAT) v2.0.4 and HEWRAT Help Guide v2.0 (available from www.haddms.co.uk).

Highways England (2015). East of England Route Strategy. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416730/East_of_England.pdf. Accessed January 2021.

Highways England (2016). A12 Chelmsford to A120 widening: Options Assessment Report. Available at: https://highwaysengland.co.uk/A12. Accessed January 2021.

Highways England (2017a). A12 Chelmsford to A120 widening: Scheme Assessment Report. Available at: https://highwaysengland.citizenspace.com/he/a12-chelmsford-to-a120-widening-scheme-23-to-25/results/a12chelmsfordtoa120widening-schemeassessmentreport.pdf. Accessed January 2021.

Highways England (2017b). Sustainable Development Strategy an Action Plan. Available at: https://www.gov.uk/government/publications/highways-england-sustainable-development-strategy. Accessed January 2021.

Highways England (2018). The Road to Good Design. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672822/Good_road_design_Jan_18.pdf. Accessed February 2021.

Highways England (2019a). Design Manual for Roads and Bridges, GG 142 Walking, Cycling and Horse-riding Assessment and Review.

Highways England (2019b). Design Manual for Roads and Bridges, GG 103 Introduction and General Requirements for Sustainable Development and Design.

Highways England (2019c). Design Manual for Roads and Bridges, LA 110 Material Assets and Waste.

Highways England (2019d). Design Manual for Roads and Bridges, LA 105 Air Quality.

Highways England (2019e). Design Manual for Roads and Bridges LA 109, Geology and Soils.

Highways England (2019f). Design Manual for Roads and Bridges, LA 114 Climate. Revision 0.

Highways England (2019g). Highways England Carbon Tool (v2.3). Available at: https://www.gov.uk/government/publications/carbon-tool. Accessed February 2021.

Highways England (2020a). Design Manual for Roads and Bridges, LA 113 Road Drainage and the Water Environment. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2.

Highways England (2020c). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020d). A12 Chelmsford to A120 Widening Scheme: Environmental Scoping Report. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000006-A12%20-%20Environmental%20Scoping%20Report.pdf. Accessed January 2021.

Highways England (2020e). A12 Chelmsford to A120 Widening Scheme: Scheme Assessment Report Addendum. Available at: https://highwaysengland.citizenspace.com/he/a12-chelmsford-to-a120-widening-scheme-23-to-25/results/a12chelmsfordtoa120widening-schemeassessmentreportaddendum.pdf. Accessed January 2021.

Highways England (2020f). Design Manual for Roads and Bridges, LD 117 Landscape Design.

Highways England (2020g). Design Manual for Roads and Bridges, LD 118 Biodiversity Design.

Highways England (2020h). Design Manual for Roads and Bridges, LD 119 Roadside Environmental Mitigation and Enhancement.

Highways England (2020i). Design Manual for Roads and Bridges, LA 120 Environmental Management Plans. Revision 1.

Highways England (2020j). Highways England Speed Banded Emission Factors for use with IAN185/13 v3.1.

Highways England (2020k). Design Manual for Roads and Bridges, LA 106 Cultural Heritage Assessment. Revision 1.

Highways England (2020l). Design Manual for Roads and Bridges, LA 107 Landscape and Visual Effects.

Highways England (2020m). Design Manual for Roads and Bridges, LA 108 Biodiversity.

Highways England (2020n). Design Manual for Roads and Bridges, LA 115 Habitats Regulations Assessment.

Highways England (2020o). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1.

Highways England (2020p). Design Manual for Roads and Bridges, CG 501 Design of Highway Drainage Systems. Revision 2.

Highways England (2021a). A12 Chelmsford to A120 Scheme Preliminary Flood Risk Assessment.

Highways England (2021b). A12 Chelmsford to A120 Scheme Water Framework Directive Preliminary Assessment.

Highways England (2021c). A12 Chelmsford to A120 Scheme Water Quality Assessment Report (WQAR).

Highways England (2021d). Highways Agency Drainage Data Management System (HADDMS). Available at: http://www.haddms.com/. Accessed March 2021

Historic England (2017). Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets. Second Edition.

Historic England (2021). The National Heritage List for England. Available at: https://historicengland.org.uk/listing/the-list. Accessed March 2021.

Hoke M K, and Boen C E (2021). The health impacts of eviction: Evidence from the national longitudinal study of adolescent to adult health, Social Science & Medicine, Volume 273, 2021, 113742, ISSN 0277-9536.

Institute of Air Quality Management (IAQM) (2016). Guidance on the assessment of dust from demolition and construction. Version 1.1.

Institute of Air Quality Management (IAQM) (2017). Land-Use Planning & Development Control: Planning for Air Quality.

Institute of Environmental Management and Assessment (IEMA) (2015). IEMA Environmental Impact Assessment Guide to Shaping Quality Development.

Institute of Environmental Management and Assessment (IEMA) (2020a). IEMA Guide to: Materials and Waste in Environmental Impact Assessment – Guidance for a Proportionate Approach. Available at: https://www.iema.net/knowledge/policy-horizon/circular-economy/materials-and-waste-in-eia. Accessed January 2021.

Institute of Environmental Management and Assessment (IEMA) (2020b). Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation.

Institution of Lighting Professionals (2018). Guidance Note 8 Bats and Artificial Lighting.

Institution of Lighting Professionals (2020). Guidance Note 1 for the Reduction of Obtrusive Light.

International Association for Impact Assessment and European Public Health Association (2020). Human Health: Ensuring a high level of protection. Available at: https://ec.europa.eu/health/ph_overview/Documents/key07_en.pdf. Accessed January 2021.

Jacobs (2017). A12 to A120 Preliminary Sources Study Report (PSSR) Version P01, HAGDMS number 29472, dated June 2017.

Jacobs (2018). A12 Chelmsford to A120 Junctions 19 to 25: Cultural Heritage Desk Based Assessment.

Jacobs (2020a). A12 Chelmsford to A120, Phase 1 Habitat Survey.

Jacobs (2020b). Drainage CCTV survey.

JBA Consulting (2018). Chelmsford City Council Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA). Available at: https://www.chelmsford.gov.uk/planning-and-building-control/planning-policy-and-new-local-plan/new-local-plan/evidence-base/. Accessed January 2021.

Joffe M and Mindell J (2002). A framework for the evidence base to support Health Impact Assessment. Journal of Epidemiology and Community Health 2002;56:132–138.

Landmark (2016). Envirocheck report for the A12 between junctions 19 and 25. Reference 87509587_1_1, dated 25 May 2016.

Landscape Institute (2019). Visual Representation of Development Proposals Technical Guidance Note 06/19.

Landscape Institute and Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment, Third Edition. Oxon: Routledge.

London Borough of Havering (2019). Havering Air Quality Annual Status Report for 2018.

Lovelace R, Goodman A, Aldred R, Berkoff N, Abbas A, Woodcock J (2017). The Propensity to Cycle Tool: An open Source Online System for Sustainable Transport Planning. Journal of Transport and Land Use. 10:1, 505–528, DOI: 10.5198/jtlu.2016.862.

Maldon District Council *et al*. (2008). Mid-Essex Level 1 Strategic Flood Risk Assessment (SFRA). Appendix D Maldon Supplementary Report. Available at: https://www.maldon.gov.uk/info/20048/planning_policy/8110/evidence_base. Accessed January 2021.

Maldon District Council (2017). Maldon District Approved Local Development Plan 2014 – 2029. Available at: http://www.maldon.gov.uk/download/downloads/id/14807/approved_maldon_district_local_development_plan_2014-2029.pdf. Accessed July 2020.

Maldon District Council (2020). 2020 Air Quality Annual Status Report.

Marmot, M (2010). Fair society, healthy lives: the Marmot Review: strategic review of health inequalities in England post-2010. ISBN 9780956487001.

Mayou R, Bryant B (2001). Outcome in consecutive emergency department attenders following road traffic accidents. Br J Psych 2001;179:528-34.

Met Office (2018a). UKCP18 Guidance: UKCP18 for UKCP09 users. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance-ukcp18-for-ukcp09-users.pdf. Accessed February 2021.

Met Office (2018b). State of the UK Climate 2017: Supplementary Report on Climate Extremes.

Met Office; Hollis, D.; McCarthy, M.; Kendon, M.; Legg, T.; Simpson, I. (2019). HadUK-Grid Climate Observations by Administrative Regions over the UK, v1.0.1.0 (1862-2018). Centre for Environmental Data Analysis, 14 November 2019.

Met Office (2020). UK Climate Projections. Available at: https://ukclimateprojections-ui.metoffice.gov.uk/products. Accessed January 2020.

Mindell J S, and Karlsen S (2012). Community Severance and Health: What Do We Actually Know? Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 89, No. 2. DOI:10.1007/s11524-011-9637-7.

Mineral Products Association (2020). Profile of the UK Mineral Products Industry 2020 Edition. Available at: https://www.mineralproducts.org/Homepage-Promotions/Profile-of-the-UK-Mineral-Products-Industry.aspx. Accessed January 2021.

Ministry of Housing, Communities and Local Government (2009). National and Regional Guidelines for Aggregates Provision in England 2005 to 2020. Available at: https://www.gov.uk/government/publications/national-and-regional-guidelines-for-aggregates-provision-in-england-2005-to-2020. Accessed January 2021.

Ministry of Housing (2019). Communities & Local Government, National Planning Policy Framework (NPPF). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf. Accessed March 2021.

National Library of Scotland (2021). Historic maps. Available at: http://maps.nls.uk/geo/explore/side-by-side/#zoom=5&lat=56.0737&lon=-3.3408&layers=1&right=BingHyb. Accessed February 2021.

National Mental Wellbeing Impact Assessment Collaborative (England) (2011). Mental Well-being Impact Assessment: A toolkit for well-being. Available at: https://q.health.org.uk/document/mental-wellbeing-impact-assessment-a-toolkit-for-wellbeing/. Accessed January 2021.

Natural England (2012). Natural England Research Report NERR043. Carbon Storage by Habitat: Review of the Evidence of the Impacts of Management Decisions and Condition of Carbon Stores and Sources.

Natural England (2013). National Character Area 111 Northern Thames Basin.

Natural England (2014). National Character Area 86 South Suffolk and North Essex Clayland.

Natural England (2020a). Open Data Geoportal. Available at: https://naturalengland-defra.opendata.arcgis.com/. Accessed February 2021.

Natural England (2020b). Ancient Woodland (England). Available at: https://naturalengland-defra.opendata.arcgis.com/datasets/a14064ca50e242c4a92d020764a6d9df_0. Accessed February 2021.

Natural England (2020c). Great Crested Newts eDNA Pond Surveys for District Level Licensing (England). Available at: https://naturalengland-defra.opendata.arcgis.com/datasets/great-crested-newts-edna-pond-surveys-for-district-level-licensing-england. Accessed February 2021.

Natural England (2020d). Provisional Agricultural Land Classification (ALC) (England). Available at: https://naturalengland-defra.opendata.arcgis.com/datasets/5d2477d8d04b41d4bbc9a8742f858f4d_0. Accessed January 2021.

Natural England (2020e). Agricultural Land Classification (ALC) Grades - Post 1988 Survey (polygons). Available at: https://data.gov.uk/dataset/c002ceea-d650-4408-b302-939e9b88eb0b/agricultural-land-classification-alc-grades-post-1988-survey-polygons. Accessed January 2021.

North Essex Authorities (2020). North Essex Section One Local Plan Sustainability Appraisal: Proposed Main Modifications. Prepared by LUC. Available at: https://www.braintree.gov.uk/downloads/file/2559/sd001c-north-essex-section-1-local-plan-sa-proposed-main-modifications-august-2020. Accessed February 2021.

Office for National Statistics (ONS) (2020a). Household Projections for England. 2018-based: Principal Projection. Table 425. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland. Accessed March 2021.

Office for National Statistics (ONS) (2020b). UK Environmental Accounts: 2020. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2020. Accessed March 2021.

Ordnance Survey (n.d.). National Cycle Network. Available at: https://osmaps.ordnancesurvey.co.uk/52.51041,-2.26883,7. Accessed January 2021.

Ordnance Survey (2018). OS Open Greenspace Technical Specification.

Ordnance Survey (2021a). Standard OS map. Available at: https://osmaps.ordnancesurvey.co.uk/. Accessed January 2021.

Ordnance Survey (2021b). OS Open Rivers dataset. Available at: https://www.ordnancesurvey.co.uk/business-government/products/open-map-rivers. Accessed January 2021.

Place Services (2021). A12 Road Widening Scheme Between Boreham & Marks Tey: Aerial Investigation and Mapping Report.

Planning Inspectorate (n.d.). EIA documents prepared for NSIPs. Available at: https://infrastructure.planninginspectorate.gov.uk/. Accessed February 2021.

Planning Inspectorate (2015). Advice Note Two: The Role of Local Authorities in the Development Consent Process.

Planning Inspectorate (2017a). Advice Note Eighteen: The Water Framework Directive.

Planning Inspectorate (2017b). Habitats Regulations Assessment Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Bristol: The Planning Inspectorate.

Planning Inspectorate (2018). Advice Note Nine: Rochdale Envelope.

Planning Inspectorate (2019). Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects.

Planning Inspectorate (2020). Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping.

Planning Inspectorate (2021). Scoping Opinion: A12 Chelmsford to A120 Widening Scheme. Case Reference TR010060. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-000016-CHLM%20-%20Scoping%20Opinion.pdf. Accessed March 2021.

Pond Action (2002). A Guide to Monitoring the Ecological Quality of Ponds and Canals Using PSYM. Solihull: Environment Agency and Oxford: 200 (now Ponds Conservation Trust: Policy & Research).

Public Health England (n.d.). Public Health Profiles. Available at: https://fingertips.phe.org.uk. Accessed July 2020.

Public Health England (2018). Health matters: air pollution. Available at: https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution#:~:text=Air%20pollution%20has%20a%20significant,%C2%A38%20to%2020%20billion. Accessed March 2021.

RICS (2017). Whole Life Carbon Assessment for the Built Environment 1st edition, November, 2017. Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf. Accessed February 2021.

Scott Wilson (2007). Mid-Essex Level 1 Strategic Flood Risk Assessment. Available at: https://cbccrmdata.blob.core.windows.net/noteattachment/Mid%20Essex%20Strategic%20Flood%20Risk%20Assessment%20Main%20Report%20October%202007.pdf. Accessed January 2021.

Scottish Environment Protection Agency (SEPA) (2010). Engineering in the water environment: good practice guide – River crossings (second edition). Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf. Accessed January 2021.

Scottish Environment Protection Agency (SEPA) (2019). Engineering in the Water Environment: Good Practice Guide – Intakes and outfalls (second edition). Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf. Accessed January 2021.

Sealey, P.R. (2007). A Late Iron Age Warrior Burial from Kelvedon, Essex. East Anglian Archaeology 118.

South West Aggregates Working Party (2018). Annual Report 2018. Available at: https://www.cornwall.gov.uk/media/0mhnhvqe/south-west-aggregates-working-party-annual-report-2018.pdf. Accessed January 2021.

Strava Global Heatmap (n.d.). Available at: https://www.strava.com/heatmap. Accessed July 2020.

UK Technical Advisory Group on the Water Framework Directive (UKTAG) (2005). Draft Protocol for Determining "Significant Damage" to a "Groundwater Dependent Terrestrial Ecosystem". Released December 2005. Available at: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Determining%20significant%20damage%20to%20a%20groundwater%20dependent%20terrestrial%20ecosystem_Draft_011205.pdf. Accessed January 2021.

UK Woodland Carbon Code (2020). Woodland Carbon Code Carbon Calculation Spreadsheet (v2.3, May 2020). Available at: https://woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration. Accessed February 2021.

United Nations Framework Convention on Climate Change (2016). Paris Agreement. Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. Accessed January 2021.

Uttlesford District Council (2020). 2020 Air Quality Annual Status Report.

Vásquez-Vera H, Palència L, Magna I, Mena C, Neira J, Borrell C (2017). The threat of home eviction and its effects on health through the equity lens: A systematic review. Soc Sci Med. 2017 Feb;175:199-208. DOI: 10.1016/j.socscimed.2017.01.010. Epub 2017 Jan 9. PMID: 28107704.

Wallingford HydroSolutions (2020). Q95 data.

Waste and Resources Action Programme (WRAP) (2008). Net Waste Tool – Data. Available at: http://nwtool.wrap.org.uk/Reports/WRAP%20NW%20Tool%20-%20Data%20download.xls. Accessed January 2021.

Waste and Resources Action Programme (WRAP) (2009). Construction Procurement Guidance: Delivering Higher Recycled Content in Construction Projects. Available at: https://www.ciria.org//Resources/REK/Guidance/Delivering_higher_recycled_content_in_construction_projects.aspx. Accessed January 2021.

Waste and Resources Action Programme (WRAP) (2013). Resource Efficiency Benchmarks for Construction Projects. No longer available online.

Wenban-Smith (2020). A12 Chelmsford to A120 Junctions 19 to 25: Palaeolithic Desk Based Assessment.

Woodland Trust (2020). Ancient Tree Inventory. Available at: https://ati.woodlandtrust.org.uk/. Accessed February 2021.

World Health Organization (1948). World Health Organization Constitution. Available at: https://www.who.int/about/who-we-are/constitution. Accessed March 2021.

World Health Organization Occupational and Environmental Health Team (2006). WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: global update 2005: summary of risk assessment. Available at: https://apps.who.int/iris/handle/10665/69477. Accessed July 2020.

World Health Organization (2011). Burden of Disease from Environmental Noise. World Health Organization, Copenhagen.

World Health Organization Europe (2018a). Environmental Noise Guidelines for the European Region. Available at: https://www.euro.who.int/en/health-topics/environment-and-health/noise/publications/who-environmental-noise-guidelines-for-the-european-region-2018. Accessed July 2020.

World Health Organization (2018b). Mental health: strengthening our response. Available at: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response. Accessed March 2021.

Zetica (no date). Zetica's Regional Unexploded Bomb Risk Map for Essex. Available at: https://zeticauxo.com/downloads-and-resources/risk-maps/. Accessed January 2021.

Zetica (2018). Unexploded Ordnance (UXO) Desk Study and Risk Assessment for the A12 Scheme. Zetica Doc. No. P7265-17-R1/Revision B dated January 2018).

Appendix A Figures

A.1.1 The figures that support this PEIR are listed below. Figures have been arranged by chapter and uploaded to the Highways England consultation webpage. Figures can be found alongside the PEIR report at https://highwaysengland.co.uk/A12:

- Figure 1.1 Scheme Location Plan
- Figure 2.1 Preliminary Environmental Masterplan
- Figure 2.2 Temporary Working Areas, Side Roads and Structures
- Figure 6.1 Air Quality Assessment Study Area
- Figure 6.2 Air Quality Baseline Conditions
- Figure 6.3 Background NO_2 Concentrations
- Figure 6.4 Construction Dust Assessment – Sensitive Receptors
- Figure 6.5 Modelled NO_2 Concentrations in the Peak Construction Year (2025) Do Something Scenario for Human Health Receptors
- Figure 6.6 Modelled Change in NO_2 Between the Peak Construction Year (2025) Do Minimum and Do Something Scenarios for Human Health Receptors
- Figure 6.7 Modelled Ecology Receptors
- Figure 6.8 Modelled Compliance Risk Assessment Receptors
- Figure 6.9 Modelled NO_2 Concentrations in the Opening Year (2027) Do Something Scenario for Human Health Receptors
- Figure 6.10 Modelled Change in NO_2 Between the Opening Year (2027) Do Minimum and Do Something Scenarios for Human Health Receptors
- Figure 7.1 Cultural Heritage Archaeological Remains
- Figure 7.2 Cultural Heritage Built Heritage and Historic Landscape
- Figure 8.1 Key Landscape Constraints
- Figure 8.2 Local Landscape Character Areas
- Figure 8.3 Zone of Theoretical Visibility and Viewpoints
- Figure 9.1 Biodiversity Designated Sites
- Figure 9.2 Biodiversity Important Habitats
- Figure 9.3 Biodiversity Preliminary Results for Protected Species Surveys

- Figure 10.1 Geology and Soils Land Contamination Constraints Plan
- Figure 11.1 Minerals and Waste Infrastructure and Designations
- Figure 12.1 Noise Study Areas, Noise Important Areas, and Proposed Noise Monitoring Locations
- Figure 12.2 Noise Sensitive Receptors
- Figure 12.3 Do-Minimum 2027 Opening Year Noise Contours and Existing Noise Barriers
- Figure 12.4 Do-Something 2027 Opening Year Noise Contours and Existing and Proposed Noise Barriers
- Figure 12.5 Do-Minimum v Do-Something 2027 Opening Year Noise Change
- Figure 13.1 Population and Health Context
- Figure 13.2 Human Health Baseline and Impacts
- Figure 13.3 Communities, Land Use and Accessibility Impacts
- Figure 14.1 Key Water Environment Features
- Figure 14.2 Aquifer Designations
- Figure 14.3 Potential Groundwater Receptors
- Figure 14.4 Existing Fluvial Flood Risk
- Figure 14.5 Existing Surface Water Flood Risk
- Figure 14.6 Existing Groundwater Flood Risk
- Figure 14.7 Change in Flood Risk for 1% AEP Plus 65% Climate Change Event
- Figure 16.1 Shortlisted Developments for CEA

Appendix B Legislation and policy

B.1 Consenting regime

Planning Act 2008

B.1.1 The Planning Act 2008 is the legislative instrument for determining Nationally Significant Infrastructure Projects (NSIP) in a streamlined decision process (Development Consent Orders (DCO)). The Planning Act and DCO process were introduced by the UK government with the intention of reducing the amount of time taken to approve major new infrastructure projects.

B.1.2 In addition to the Planning Act 2008, the following legislation is relevant to the consenting of the A12 Chelmsford to A120 widening scheme (the 'proposed scheme').

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

B.1.3 These regulations are secondary legislation to complement the Planning Act 2008. This provides details about consultees, publicising a proposal, application procedures and forms to prepare and submit a DCO application.

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

B.1.4 These regulations are secondary legislation to complement the Planning Act 2008. This provides the details and requirements as to when and how to carry out an Environmental Impact Assessment (EIA) to support a DCO application.

The Infrastructure Planning (Publication and Notification of Applications etc.) (Coronavirus) (Amendment) Regulations 2020

B.1.5 These regulations are secondary legislation to complement the Planning Act 2008. This provides amendments to the Infrastructure Planning Regulations in regard to publicising, notifying and sharing information on websites maintained by the applicant and/or Examining Authority instead of physical locations only.

B.2 Legislation for environmental aspects

B.2.1 This section lists the key retained European Union (EU) legislation by the United Kingdom (UK) government and national legislation relevant to the protection of the environment. The legislation is split by the aspect headings used within the Preliminary Environmental Information Report (PEIR).

B.2.2 Table B.1 lists the key legislation for each environmental aspect. There is overlap between geology and soils, and material assets and waste; these two aspects have therefore been combined. Some legislation crosscuts over more than one aspect area, but for simplicity, the table identifies the key legislation for each aspect and minimises repetition.

B.2.3 The UK is no longer a member of the EU. EU legislation as it applied to the UK on 31 December 2020 is now part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies, and is published on legislation.gov.uk. This retained legislation is being kept up to date on legislation.gov.uk in the same way as other forms of domestic legislation. Table B.1 lists the retained legislation relating to applicable EU Directives.

Table B.1 Legislation relevant for environmental topics

Receptor	Legislation
Air quality	• The Air Quality Standards Regulations 2010 • Environment Act 1995, Part IV • Air Quality (England) (Amendment) Regulations 2000/2002
Cultural heritage	• European Convention on the Protection of Archaeological Heritage (Revised), 2001 • Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2002) • Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013)
Landscape and visual	• European Landscape Convention, 2000 • Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000 (CROW) and the Natural Environmental and Rural Communities Act 2006 (NERC) • The National Parks and Access to the Countryside Act 1949
Biodiversity	• The Conservation of Habitats and Species Regulations 2017 (as amended) • Wildlife and Countryside Act 1981 (as amended) • Natural Environment and Rural Communities Act 2006 (NERC) • Countryside and Rights of Way Act 2000 (CROW) (as amended) • Protection of Badgers Act 1992 • Wild Mammals (Protection) Act 1996 • Animal Welfare Act 2006 • The Hedgerows Regulations 1997 • The Eels (England and Wales) Regulations 2009 • Salmon and Freshwater Fisheries Act 1975 (as amended) • The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
Geology and soils, and material assets and waste	• Environmental Protection Act (EPA) 1990 • Environmental Permitting (England and Wales) Regulations 2010 • Control of Pollution (Applications, Appeals and Registers) Regulations 1996 • Environmental Protection Act (1990) amended 1995 and 2012 • Environment Act (1995)

Receptor	Legislation
Noise and vibration	• Land Compensation Act 1973 • The Noise Insulation Regulations 1975 (as amended 1988) • Control of Pollution Act 1974 (CoPA) • The Highways Noise Payments and Movable Homes (England) Regulations 2000 (as amended 2001) • The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009) • Environmental Protection Act, 1990
Population and health	• The Localism Act 2011
Road drainage and the water environment	• The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2017 • The Urban Waste Water Treatment (England and Wales) Regulations 1994 • Flood Risk Regulations (2009) • Environmental Permitting (England and Wales) Regulations 2010 • The Nitrate Pollution Prevention Regulations 2015 • Control of Pollution (Applications, Appeals and Registers) Regulations 1996 • Environmental Protection Act 1990 • Water Resources Act 1991 • Land Drainage Act 1991 • Environment Act (1995) • Water Act 2003 • Flood and Water Management Act 2010 and Commencement Orders • Ditches and Watercourses Act 1989 • Anti-Pollution Works Regulations 1999 • Environmental Damage (Prevention and Remediation) Regulations 2009 • Salmon and Freshwater Fisheries Act 1975 (as amended) • Eels (England and Wales) Regulations 2009
Climate	• Climate Change Act 2008 • The Climate Change Act 2008 (2050 Target Amendment) Order 2019

B.3 National policy context

Introduction

B.3.1 There are numerous national policy and strategy documents that are relevant to the proposed scheme. The Planning Act 2008 specifies that each type of NSIP must be determined in line with the relevant National Policy Statement (NPS). For road schemes such as the proposed scheme, the key document is the National Networks National Policy Statement (NNNPS). The Secretary of State must decide the application in accordance with any relevant NPS.

B.3.2 The National Planning Policy Framework (NPPF) is also capable of being 'important and relevant'.

B.3.3 There are also national transport strategies and plans along with environmental strategies. Details of these are set out below.

National Networks National Policy Statement

B.3.4 An application for development consent is to be decided in accordance with the relevant NPS. Paragraph 1.2 of the NNNPS states that:

'the Secretary of State must decide an application for a national networks nationally significant infrastructure project in accordance with this NPS unless he/she is satisfied that to do so would:

- *lead to the UK being in breach of its international obligations;*
- *be unlawful;*
- *lead to the Secretary of State being in breach of any duty imposed by or under any legislation;*
- *result in adverse impacts of the development outweighing its benefits;*
- *be contrary to legislation about how decisions are taken.'*

B.3.5 Chapter 2 of the NNNPS sets out the Government's vision and strategic objectives for the national networks:

'The Government will deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- *Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.*
- *Networks which support and improve journey quality, reliability, and safety.*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy.*
- *Networks which join up our communities and link effectively to each other.'*

B.3.6 The need for transport infrastructure in general is acknowledged in paragraph 2.2 of the NNNPS, which states:

'There is a critical need to improve the national networks to address road congestion and crowding on the railways to provide safe, expeditious and resilient networks that better support social and economic activity; and to provide a transport network that is capable of stimulating and supporting economic growth. Improvements may also be required to address the impact of the national networks on quality of life and environmental factors.'

B.3.7 The proposed scheme has been developed to support the socioeconomic development of the region, through the improved connectivity and reliability of the strategic network to connect different communities and business. This approach is permitted under paragraph 2.6 of the NNNPS, which states:

'There is also a need for development on the national networks to support national and local economic growth and regeneration, particularly in the most disadvantaged areas. Improved and new transport links can facilitate economic growth by bringing businesses closer to their workers, their markets and each other. This can help rebalance the economy.'

B.3.8 Paragraph 2.10 of the NNNPS states: *'The Government has therefore concluded that at a strategic level there is a compelling need for development of the national networks – both as individual networks and as an integrated system. The Examining Authority and the Secretary of State should therefore start their assessment of applications for infrastructure covered by this NPS on that basis.'* However, each scheme must demonstrate the specific need for any proposals on a case-by-case basis.

B.3.9 Section 3 of the NNNPS sets out the wider Government policy on national networks; this includes policies on minimising social and environmental impacts and improving quality of life. In delivering new schemes, the Government expects applicants to '*avoid and mitigate environmental and social impacts in line with the principles set out in the NPPF and the Government's planning guidance. Applicants should also provide evidence that they have considered reasonable opportunities to deliver environmental and social benefits as part of schemes.*'

B.3.10 The key considerations for a range of environmental aspects are set out in Chapter 5 of the NNNPS. Aspects covered are as follows:

- Air quality
- Carbon emissions
- Biodiversity and ecological conservation (includes geological conservation)
- Waste management
- Civil and military aviation and defence interests
- Dust, odour, artificial light, smoke, steam
- Flood risk
- Land instability
- The historic environment
- Landscape and visual impacts
- Land use including open space, green infrastructure, and green belt
- Noise and vibration
- Water quality and resources

B.3.11 An NNNPS Accordance Table will set out how the development aligns with the NNNPS policies for these aspects and will be submitted with the proposed scheme's DCO application.

B.3.12 In considering the proposed scheme, particularly when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State will account for:

- its potential benefits, including the facilitation of economic development, including job creation, housing, environmental improvement, and any long-term or wider benefits.
- its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

National Planning Policy Framework

B.3.13 The NPPF (2019) is also of relevance to the proposed scheme. Paragraph 1.18 of the NNNPS states, '*The NPPF is also likely to be an important and relevant consideration in decisions on nationally significant infrastructure projects, but only to the extent relevant to that project.'* However, paragraph 1.19 goes on to say, '*the NPPF makes clear that it is not intended to contain specific policies for NSIPs where quite particular considerations can apply. The National Networks NPS will assume that function and provide transport policy which will guide individual development brought under it.*'

B.3.14 The overarching policy contained in the NPPF is a presumption in favour of sustainable development. It states:

'Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- *An economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.*
- *A social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being.*
- *An environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'*

B.3.15 It includes guidance regarding sustainable transport and environmental protection.

National Infrastructure Delivery Plan 2016-2021

B.3.16 The National Infrastructure Delivery Plan 2016-2021 shows that the Government is clear about the economic importance of investment in highways infrastructure, especially in areas where congestion is a problem. Chapter 3 of the Delivery Plan covering roads states:

'*A reliable and high-performing road network helps improve productivity, but over decades, the quality of the network has declined and congestion, noise and poor air quality have become problems at certain hotspots. Poor or missing links mean cities which are close together do less business with one another. The government is committed to addressing these challenges by building a better network with smarter roads that use technology and modern road building techniques. In this way it can ensure the country has a road network that drives, instead of constrains, growth*.'

Other relevant national transport policy documents

B.3.17 The following national policy documents are of relevance to the proposed scheme:

- Department for Transport single departmental plan (2019)
- Department for Transport Road Traffic Forecast (2018)
- HM Treasury Investing in Britain's Future (2013)
- Department for Transport Action for Roads: A Network for the 21st Century (2013)
- Department for Transport Business Plan 2012-2015 (2012)

Key national environmental policy documents

B.3.18 The following environmental policy documents are of relevance to the proposed scheme:

- Clean Air Strategy 2019 (Department for Environment, Food and Rural Affairs (Defra), 2019)
- Biodiversity 2020: A strategy for England's wildlife and ecosystem services (Defra, 2020)
- Noise Policy Statement for England (Defra, 2010)
- Strategy for Sustainable Construction (HM Government and Strategic Forum for Construction, 2008)
- Healthy Lives, Healthy People: Our Strategy for Public Health in England (HM Government, 2011)

- Healthy Lives, Healthy People: A Call to Action on Obesity in England (HM Government, 2011)
- UK Climate Change Risk Assessment 2017 (HM Government, 2017) (due to be updated in summer 2021)
- Safeguarding our Soils: A Strategy for England (Defra, 2009)

B.4 Local planning policy

Introduction

B.4.1 Local planning policy can be important and relevant to the consideration of a DCO application as it may inform the Local Impact Report produced by local authorities during the DCO examination process.

B.4.2 Planning policies set out in emerging plans are also important, though until the plans are adopted, they hold limited weight in planning decisions. Given the programme for adoption for the relevant local plans, it is reasonable to assume that some or all the emerging local plans will have been adopted prior to submission of the DCO application.

B.4.3 It is acknowledged that the list of policies is only relevant at the time of writing. Emerging plans will be monitored, and policies added as they are adopted, so that the Environmental Statement and other planning documents are up to date at the point that the DCO application is submitted. The policies they replace will be removed, as appropriate.

B.4.4 Details of the local planning policy documents prepared by each local authority are detailed below. In addition to these documents, the Essex and Southend-on-Sea Minerals Plan and the Essex Waste Local Plan are extant policy for each authority area and are considered separately in the below sub-sections.

B.4.5 Several policies in each local planning authority are overarching, in that they may apply to wider sustainability, the use of resources and the protection of the environment in a broader sense. Many of these policies relate to sustainable development requirements. To save repetition throughout each specific topic, each of these overarching policies has been identified in introductory tables for each of the four local planning authorities, referred to as ‘multi-disciplinary’.

North Essex Authorities’ Shared Strategic Section 1 Plan

B.4.6 The local councils of Braintree District Council, Colchester Borough Council and Tendering District Council have worked together to produce a single Shared Strategic Section 1 Plan that sets out strategic cross-boundary policies for North Essex. These include policies on infrastructure, environment, employment and housing numbers. During examination, the Examining Authority advised that Section 1 of the Local Plan should adopt major modifications by removing strategic housing locations (garden communities) from the plan. The housing allocations will instead be delivered through Section 2 of the authorities’ Local Plans, produced individually by each local authority. The main modifications were accepted by the local authorities in summer 2020, leading to Section 1 of the Local Plan being declared sound by the Examining

Authority in December 2020. Section 1 of the Local Plan has been adopted by Colchester and Braintree.

Braintree District Council

B.4.7 The current development plan documents of relevance to Braintree District comprise:

- Local Plan Review (2005), saved policies
- North Essex Authorities' Shared Strategic Section 1 Plan (2021)
- Braintree Publication Draft Local Plan Section 2 (June 2017) (emerging)
- Essex Minerals Local Plan 2014
- Essex and Southend-on-Sea Waste Local Plan (July 2017)
- Supplementary Planning Documents (SPD)

B.4.8 Braintree District Council has several masterplans which relate to four strategic growth locations, and two key regeneration areas, identified within the now superseded Core Strategy. Two of the masterplans are located on the outskirts of Witham near the A12. This includes the 'South West Witham, north of Hatfield Road (Lodge Farm)' masterplan for which a planning application has now been approved (15/00430/OUT) and a reserved matters application (18/01912/REM); and the 'Land North-East of Witham (in Rivenhall Parish) off Forest Road' masterplan for which a planning application has also now been approved (15/00799/OUT and 17/01092/FUL). There is currently a pending application (20/02060/OUT) for phase 4 of the masterplan.

B.4.9 There are six SPDs relating to affordable housing, external artificial lighting, open space, parking standards, urban place and an Essex design guide. The guidance in these SPDs would not significantly affect material considerations of the proposed scheme.

B.4.10 There are also several neighbourhood plans and conservation areas currently being prepared. Of relevance to the proposed scheme are the following elements:

- Feering – the neighbourhood plan Regulation 14 consultation was carried on 17 February 2020
- Feering conservation area appraisal – updated appraisal and management plan approved in July 2020
- Hatfield Peverel – the neighbourhood plan was 'made' on 16 December 2019 and is now part of Braintree emerging Draft Local Plan Section 2
- Kelvedon – the neighbourhood plan is currently being drafted after Regulation 14 consultation was held in September 2018
- Kelvedon conservation area appraisal – updated appraisal and management plan approved in July 2020

B.4.11 The emerging Local Plan Section 2 for Braintree District Council has been submitted to the Planning Inspectorate and contains polices for this authority area only, including policies on environmental protection, design and housing allocations. Examination of Section 2 of the Local Plan is under preparation.

B.4.12 The relevant adopted and emerging Local Plan policies are listed in Table B.2.

Table B.2 Braintree District Council planning policy

Braintree District Council: Plan	Braintree District Council: Policy
Multi-disciplinary	
Local Plan Review (2005), saved policies	RLP 73 – Waste Minimisation RLP 77 – Energy Efficiency RLP 90 – Layout and Design of Development RLP 11 – Utilities Development RLP 164 – Environmental Impact Assessment
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development SP2 – Spatial Strategy for North Essex SP5 – Infrastructure & Connectivity SP6 – Place-shaping Principles
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 44 – Sustainable Transport Policy LPP 46 – Protected Lanes Policy LPP 47 – Transport Related Policy Areas Policy LPP 48 – New Road Infrastructure Policy LPP 51 – An Inclusive Environment Policy LPP 55 – Layout and Design of Development Policy LPP 62 – Enabling Development Policy LPP 74 – Climate Change Policy LPP 75 – Energy Efficiency
Air quality	
Local Plan Review (2005), saved policies	RLP 62 – Development Likely to Give Rise to Pollution or the Risk of Pollution RLP 63 – Air Quality
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP5 – Infrastructure & Connectivity Section B and C
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 73 – Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards

Braintree District Council: Plan	Braintree District Council: Policy
Cultural heritage	
Local Plan Review (2005), saved policies	RLP 95 – Preservation and Enhancement of Conservation Areas RLP 96 – Demolition in Conservation Areas RLP 98 – Environmental Improvements in Conservation Areas RLP 99 – Demolition of Listed Buildings RLP 100 – Alterations and Extensions and Changes of Use to Listed Buildings and their Settings RLP 103 – Parks and Gardens of Special Historic Interest RLP 104 – Ancient Monuments and Sites of Archaeological Importance RLP 105 – Archaeological Evaluation RLP 106 – Archaeological Excavation and Monitoring
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP2 – Spatial Strategy for North Essex SP6 – Place-shaping Principles
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 9 – Tourism Development within the Countryside Policy LPP 50 – Built and Historic Environment Policy LPP 56 – Conservation Areas Policy LPP 60– Heritage Assets and their Settings Policy LPP 61 – Demolition of Listed Buildings or Structures Policy LPP 63 – Archaeological Evaluation, Excavation and Recording
Landscape and visual	
Local Plan Review (2005), saved policies	RLP 65 – External Lighting RLP 80 – Landscape Features and Habitats RLP 81 – Trees, Woodlands, Grasslands and Hedges RLP 86 – River Corridors RLP 87 – Protected Lanes
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP2 – Spatial Strategy for North Essex SP5 – Infrastructure & Connectivity Section C SP6 – Place-shaping Principles

Braintree District Council: Plan	Braintree District Council: Policy
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 39 – Replacement Dwelling in the Countryside Policy LPP 40 – Rural Workers Dwellings in the Countryside Policy LPP 42 – Residential Conversion of Buildings in the Countryside Policy LPP 46 – Protected Lanes Policy LPP 56 – Conservation Areas Policy LPP 67 – Natural Environment and Green Infrastructure Policy LPP 71 – Landscape Character and Features
Biodiversity	
Local Plan Review (2005), saved policies	RLP 80 – Landscape Features and Habitats RLP 81 – Trees, Woodlands, Grasslands and Hedges RLP 82 – Sites of Special Scientific Interest RLP 83 – Local Nature Reserves, Wildlife Sites, and Regionally Important Geological/Geomorphological Sites RLP 84 – Protected Species RLP 86 – River Corridors
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP6 – Place-shaping Principles
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 67 – Natural Environment and Green Infrastructure Policy LPP 68 – Protected Species, Priority Species and Priority Habitat Policy LPP 69 – Tree Protection Policy LPP 70 – Protection, Enhancement, Management and Monitoring of Biodiversity Policy LPP 73 – Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards
Geology and soils	
Local Plan Review (2005), saved policies	RLP 62 – Development Likely to Give Rise to Pollution or the Risk of Pollution RLP 64 – Contaminated Land RLP 83 – Local Nature Reserves, Wildlife Sites, and Regionally Important Geological/Geomorphological Sites

Braintree District Council: Plan	Braintree District Council: Policy
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 73 – Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards
Material assets and waste – policy from Essex minerals and waste local plans	
Noise and vibration	
Local Plan Review (2005), saved policies	RLP 62 – Development Likely to Give Rise to Pollution or the Risk of Pollution
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS)
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 73 – Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards
Population and health	
Local Plan Review (2005), saved policies	RLP 28 – Employment Land Provision RLP 49 – Pedestrian Networks RLP 50 – Cycleways RLP 54 – Transport Assessments RLP 55 – Travel Plans RLP 86 – River Corridors RLP 92 – Accessibility RLP 128 – Maintenance of Rural Services and Facilities RLP 136 – Formal Recreation Policy RLP 140 – River Walks/Linear Parks and Disused Railway Lines RLP 151 – Protection of Community Services
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP2 – Spatial Strategy for North Essex SP3 – Meeting Housing Needs SP4 – Providing for Employment SP5 – Infrastructure & Connectivity Section B, C, D and E

Braintree District Council: Plan	Braintree District Council: Policy
	SP6 – Place-shaping Principles
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 52 – Health and Wellbeing Impact Assessment Policy LPP 53 – Provision for Open Space, Sport and Recreation Policy LPP 64 – Educational Establishments Policy LPP 65 – Local Community Services and Facilities
Road drainage and the water environment	
Local Plan Review (2005), saved policies	RLP 62 – Development Likely to Give Rise to Pollution or the Risk of Pollution RLP 69 – Sustainable Drainage RLP 70 – Water Efficiency RLP 71 – Water Supply, Sewerage and Land Drainage RLP 72 – Water Quality
North Essex Authorities Shared Strategic Section 1 Local Plan (2021)	SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP5 – Infrastructure & Connectivity Section E SP6 – Place-shaping Principles
Braintree Publication Draft Local Plan Section 2 (June 2017) (Emerging)	Policy LPP 73 – Protecting and Enhancing Natural Resources, Minimising Pollution and Safeguarding from Hazards Policy LPP 78 – Flooding Risk and Surface Water Drainage Policy LPP 79 – Surface Water Management Plan Policy LPP 80 – Sustainable Urban Drainage Systems
Climate – covered under 'multi-disciplinary'	

Chelmsford City Council

B.4.13 The current development plan documents of relevance to Chelmsford City comprise:

- Chelmsford Local Plan – Our Planning Strategy 2013 to 2036 (May 2020)
- Essex Minerals Local Plan 2014
- Essex and Southend-on-Sea Waste Local Plan (July 2017)
- Boreham Neighbourhood Plan (January 2017)
- Broomfield Neighbourhood Plan (March 2016)

B.4.14 Chelmsford City Council have several adopted SPDs, three which may be relevant to the proposed scheme. These are Making Places, Essex Coast Recreational disturbance Avoidance and Mitigation Strategy (RAMS), and Planning Obligations.

B.4.15 The Chelmsford Local Plan was adopted in May 2020. The adopted Local Plan sets out nine strategic priorities, the long-term vision and spatial principles to manage and accommodate growth, sustainable development needs, housing, infrastructure, and employment requirements. It also contains policies regarding protecting the environment and promoting economic growth in the area while ensuring good design.

B.4.16 The relevant Local Plan policies are listed in Table B.3.

Table B.3 Chelmsford City Council planning policy

Chelmsford City Council: Plan	Chelmsford City Council: Policy
Multi-disciplinary	
Chelmsford Local Plan, May 2020	Strategic Policy S1 – Spatial Principles Strategic Policy S2 – Addressing Climate Change and Flood Risk Strategic Policy S3 – Conserving and Enhancing the Historic Environment Strategic Policy S4 – Conserving and Enhancing the Natural Environment Strategic Policy S5 – Protecting and Enhancing Community Assets Strategic PolicyS6 – Housing and Employment Requirements Strategic Policy S7 – Spatial Strategy Strategic Policy S8 – Delivering Economic Growth Strategic Policy S9 – Infrastructure Requirements Strategic Policy S10 – Securing Infrastructure and Impact Mitigation Strategic Policy S11 – The Role of Countryside Strategic Policy S12 – Role of City, Town, and Neighbourhood Centres Policy DM19 – Renewable and Low Carbon Energy
Air quality	
Chelmsford Local Plan, May 2020	Strategic Policy S2 – Addressing Climate Change and Flood Risk Policy DM29 – Protecting Living and Working Environments Policy DM30 – Contamination and Pollution
Cultural heritage	
Chelmsford Local Plan, May 2020	Strategic Policy S3 – Conserving and Enhancing the Historic Environment Strategic Policy S4 – Conserving and Enhancing the Natural Environment

Chelmsford City Council: Plan	Chelmsford City Council: Policy
	Policy DM13 – Designated Heritage Assets Policy DM14 – Non-Designated Heritage Assets Policy DM15 – Archaeology
Landscape and visual	
Chelmsford Local Plan, May 2020	Strategic Policy S3 – Conserving and Enhancing the Historic Environment Strategic Policy S4 – Conserving and Enhancing the Natural Environment Strategic Policy S11 – The Role of Countryside Strategic Policy S12 – Role of City, Town, and Neighbourhood Centres Policy DM17 – Trees, Woodland and Landscape Features Policy DM6 – New Buildings in the Green Belt Policy DM7 – New Buildings and Structures in the Green Wedge Policy DM8 – New Building and Structures in the Rural Area Policy DM9 – Infilling in the Green Belt, Green Wedge and Rural Area Policy DM10 – Change of Use (Land and Buildings) and Engineering Operations Policy DM11 – Extensions to Existing Buildings within the Green Belt, Green Wedge and Rural Area Policy DM12 – Rural and Agricultural / Forestry Workers' Dwellings Policy DM13 – Designated Heritage Assets Policy DM14 – Non-Designated Heritage Assets Policy DM15 – Archaeology
Biodiversity	
Chelmsford Local Plan, May 2020	Strategic Policy S4 – Conserving and Enhancing the Natural Environment Policy DM16 – Ecology and Biodiversity Policy DM17 – Trees, Woodland and Landscape Features
Geology and soils	
Chelmsford Local Plan, May 2020	Strategic Policy S4 – Conserving and Enhancing the Natural Environment Policy DM30 – Contamination and Pollution
Material assets and waste – policy from Essex minerals and waste local plans	

Chelmsford City Council: Plan	Chelmsford City Council: Policy
Noise and vibration	
Chelmsford Local Plan, May 2020	Strategic PolicyS6 – Housing and Employment Requirements Strategic Policy S9 – Infrastructure Requirements Strategic Policy S10 – Securing Infrastructure and Impact Mitigation Policy DM29 – Protecting Living and Working Environments Policy DM30 – Contamination and Pollution
Population and health	
Chelmsford Local Plan, May 2020	Strategic Policy S5 – Protecting and Enhancing community Assets Strategic Policy S6 – Housing and Employment Requirements Strategic Policy S8 – Delivering Economic Growth Strategic Policy S9 – Infrastructure Requirements Strategic Policy S10 – Securing Infrastructure and Impact Mitigation Strategic Policy S11 – The Role of Countryside Strategic Policy S12 – Role of City, Town, and Neighbourhood Centres Policy DM20 – Delivering Community Facilities Policy DM21 – Protecting Community Facilities Policy DM23 – High Quality and Inclusive Design Policy DM24 – Design and Place Shaping Principles in Major Developments Policy DM25 – Sustainable Buildings Policy DM26 – Design Specification for Dwellings Policy DM28 – Tall Buildings Policy DM29 – Protecting Living and Working Environments Policy DM30 – Contamination and Pollution
Road drainage and the water environment	
Chelmsford Local Plan, May 2020)	Strategic Policy S2 – Addressing Climate Change and Flood Risk Strategic Policy S4 – Conserving and Enhancing the Natural Environment Policy DM18 – Flooding/SUDS
Climate – covered under 'multi-disciplinary'	

Colchester Borough Council

B.4.17 The current development plan documents of relevance to Colchester Borough comprise:

- Colchester Local Development Framework – Development Policies amended 2014
- Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021
- Essex Minerals Local Plan 2014
- Essex and Southend-on-Sea Waste Local Plan (July 2017)
- Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)
- Tiptree Jam Factory Plan (2013)

B.4.18 Colchester Borough Council has several adopted SPDs. Those which may be relevant to the proposed scheme include: Sustainable Drainage Systems, Cycling Delivery Strategy, Sustainable Construction, and Vehicle Parking Standards.

B.4.19 There are two proposed neighbourhood plans at Marks Tey, and Copford and Easthorpe, which are within the proposed scheme area. After a consultation period in 2020, both neighbourhood plans are being considered by the respective parishes.

B.4.20 The emerging Section 2 Local Plan for Colchester Borough Council has been submitted to the Planning Inspectorate and contains polices for this authority area only, including policies on environmental protection, design and spatial planning. Examination of Section 2 of the Local Plan took place in April 2021, with adoption expected in later 2021.

B.4.21 The relevant adopted and emerging Local Plan policies are listed in Table B.4.

Table B.4 Colchester Borough Council planning policy

Colchester Borough Council: Plan	Colchester Borough Council: Policy
Multi-disciplinary	
Colchester Local Development Framework – Development Policies amended 2014	DP1 – Design and Amenity DP18 – Transport Infrastructure Proposals
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	Policy SP1 – Presumption in Favour of Sustainable Development Policy SP2 – Spatial Strategy for North Essex Policy SP5 – Infrastructure and Connectivity Policy SP6 – Place Shaping Principles

Colchester Borough Council: Plan	Colchester Borough Council: Policy
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy SG1 – Colchester's Spatial Strategy Policy SG7 – Infrastructure Delivery and Impact Mitigation Policy SG8 – Neighbourhood Plans Policy ENV1 – Environment Policy ENV5 – Pollution and Contaminated Land Policy CC1 – Climate Change Policy PP1 – Generic Infrastructure and Mitigation Requirements Policy WC1 – Stanway Strategic Economic Area Policy WC2 – Stanway Policy SS11 – Marks Tey Policy SS14 – Tiptree Policy DM15 – Design and Amenity Policy DM20 – Promoting Sustainable Transport and Changing Travel Behaviour Policy DM25 – Renewable Energy, Water, Waste and Recycling
Air quality	
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP 5 – Infrastructure & Connectivity Section B and C
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy DM1 – Health and Wellbeing Policy ENV5 – Pollution and Contaminated Land
Cultural heritage	
Colchester Local Development Framework – Development Policies amended 2014	DP14 – Historic Environments Assets DP21 – Nature Conservation and Protected Lanes
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP2 – Spatial Strategy for North Essex SP6 – Place-shaping Principles
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy DM5 – Tourism, Leisure, Culture and Heritage Policy DM16 – Historic Environment

Colchester Borough Council: Plan	Colchester Borough Council: Policy
Landscape and visual	
Colchester Local Development Framework – Development Policies amended 2014	DP 21 – Nature Conservation and Protected Lanes
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021)	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP2 – Spatial Strategy for North Essex SP5 – Infrastructure & Connectivity Section C SP6 – Place-shaping Principles
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy ENV3 – Green Infrastructure Policy OV2 – Countryside
Biodiversity	
Colchester Local Development Framework – Development Policies amended 2014	DP 21 – Nature Conservation and Protected Lanes
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP6 – Place-shaping Principles
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy ENV1 – Environment Policy ENV3 – Green Infrastructure Policy DM18 – Provision of Public Open Space
Geology and soils	
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS)
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy ENV1 – Environment
Material assets and waste – policy from Essex minerals and waste local plans	
Noise and vibration	

Colchester Borough Council: Plan	Colchester Borough Council: Policy
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS)
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy ENV5 – Pollution and Contaminated Land Policy SG4 – Local Economic Areas Policy WC3 – Stanway (vi) Policy DM15 – Design and Amenity (v)
Population and health	
Colchester Local Development Framework – Development Policies amended 2014	DP2 – Health Assessment DP5 – Appropriate Employment Uses and Protection of Employment Land and Existing Business DP15 – Retention of Open Spaces and Indoor Sports Facilities DP17 – Accessibility and Access
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP1 – Presumption in Favour of Sustainable Development SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP2 – Spatial Strategy for North Essex SP3 – Meeting Housing Needs SP4 – Providing for Employment SP5 – Infrastructure & Connectivity Section B, C, D and E SP6 – Place-shaping Principles
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy DM1 – Health and Wellbeing Policy DM2 – Community Facilities Policy DM3 – Education Provision Policy DM4 – Sports Provision Policy DM5 – Tourism, Leisure, Culture and Heritage Policy DM17 – Retention of Open Space and Recreation Facilities Policy DM18 – Provision of Public Open Space Policy DM20 – Promoting Sustainable Transport and Changing Travel Behaviour Policy DM21 – Sustainable Access to Development
Road drainage and the water environment	

Colchester Borough Council: Plan	Colchester Borough Council: Policy
Colchester Local Development Framework – Development Policies amended 2014	DP20 – Flood Risk and Management of Surface Water Drainage
Colchester Local Plan 2017 – 2033 Section One: Shared Strategic Plan Adopted February 2021	SP1a – Recreational Disturbance Avoidance and Mitigation Strategy (RAMS) SP5 – Infrastructure & Connectivity Section E SP6 – Place-shaping Principles
Colchester Local Plan 2017 – 2033 Section Two – Local Plan for Colchester (Emerging)	Policy DM23 – Flood Risk and Water Management Policy DM24 – Sustainable Urban Drainage Systems Policy DM25 – Renewable Energy, Water, Waste and Recycling
Climate – covered under 'multi-disciplinary'	

Maldon District Council

B.4.22 The Maldon District Local Development Plan was approved by the Secretary of State on 21 July 2017. The development plan sets out the planning policies relevant to this authority area. Maldon is within Essex County Council's authority area which is the authority for highways, minerals and waste. As such, the following minerals and waste local plans are part of the Maldon District Local Development Plan:

- Essex Minerals Local Plan 2014
- Essex and Southend-on-Sea Waste Local Plan (July 2017)

B.4.23 There are no neighbourhood plan areas which would affect the proposed scheme area within Maldon District.

B.4.24 Maldon District Council has adopted eight SPDs since 2017, of which three are relevant to the proposed scheme. These are part of the Maldon Local Development Scheme 2020-2022 and are thus a material planning consideration. Below is a list of the relevant adopted SPDs:

- Maldon District Design Guide 2017
- Renewable and Low Carbon Technologies 2018
- Green Infrastructure Strategy 2019

B.4.25 The relevant adopted and emerging Local Plan policies are listed in Table B.5.

Table B.5 Maldon District Council planning policy

Maldon District Council: Plan	Maldon District Council: Policy
Multi-disciplinary	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	S1 – Sustainable Development S2 – Strategic Growth S8 – Settlement Boundaries and the Countryside D1 – Design Quality and the Built Environment D2 – Climate Change & Environmental Impact of New Development D4 – Renewable and Low Carbon Energy Generation N1 – Green Infrastructure Network
Air quality	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	D2 – Climate Change & Environmental Impact of New Development
Cultural heritage	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	D3 – Conservation and Heritage Assets
Landscape and visual	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	N1 – Green Infrastructure Network N2 – Natural Environment and Biodiversity S3 – Place Shaping S8 – Settlement Boundaries and the Countryside
Biodiversity	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	N2 – Natural Environment and Biodiversity
Material assets and waste – policy from Essex minerals and waste local plans	
Geology and soils	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	N2 – Natural Environment and Biodiversity
Noise and vibration	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	D2 – Climate Change & Environmental Impact of New Development

Maldon District Council: Plan	Maldon District Council: Policy
Population and health	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	S7 – Prosperous Rural Communities E3 – Community Services and Facilities H3 – Accommodation for 'Specialist' Needs N3 – Open Space, Sport and Leisure T1 – Sustainable Transport T2 – Accessibility I1 – Infrastructure and Services I2 – Health and Wellbeing
Road drainage and the water environment	
Maldon District Approved Local Development Plan 2014 – 2029 (2017)	D5 – Flood Risk and Coastal Management
Climate – covered under 'multi-disciplinary'	

Essex Minerals Local Plan

B.4.26 The Essex Minerals Local Plan covers the whole region of Essex and was adopted in July 2014.

B.4.27 The purpose of the Minerals Local Plan is to provide policy guidance for the development and operation of minerals operations until 2029.

B.4.28 Strategic objective (Policy S2) in the Minerals Plan states that the strategic priorities for minerals development will be promoted by: *'…Safeguarding mineral resources of national and local importance, mineral transhipment sites, Strategic Aggregate Recycling facilities and coated roadstone plants, so that non-minerals development does not sterilise or compromise mineral resources and mineral supply facilities*.'

B.4.29 Policy S4 – Reducing the use of mineral resources states that '*all development proposals shall ensure that mineral waste is minimised and that minerals on development / redevelopment sites are re-used and recycled*.'

B.4.30 The use of borrow pits is provided for where extraction takes place over a limited period for the exclusive use of a specific construction project such as for a specific road scheme. There is also provision for 'prior extraction to prevent mineral sterilisation', though there is no specific policy to this effect.

B.4.31 Of relevance to the proposed scheme are the sand and gravels reserves within the county, relating to the safeguarded areas along the A12 corridor and the existing quarry workings alongside the existing carriageway, including Colemans Farm Quarry.

Essex and Southend-on-Sea Waste Local Plan

B.4.32 The Essex and Southend-on-Sea Waste Local Plan covers the whole of Essex County and was adopted in July 2017. This document sets out the context for the management of waste arisings and development of waste management facilities within the Waste Local Plan area. There is a principle that waste should be disposed of as close to its source as possible, subject to suitable waste management facilities being available. Any waste arising from the proposed scheme would have to be managed in accordance with the Waste Local Plan and relevant waste management legislation. Where possible, materials should be reused on site.

B.5 Other

Local Enterprise Partnerships

B.5.1 The route corridor is located within the South East Local Enterprise Partnership (SELEP) area. The SELEP does not have a strategic economic plan in place, but it secured a Growth Deal in 2014, which was updated in January 2015 and again in February 2017, which seeks to improve transport infrastructure within the SELEP area. The SELEP also has a transport working group who advise on strategic infrastructure within the SELEP area.

Local Transport Plan

B.5.2 The Local Transport Plan for Essex (Essex Transport Strategy) was adopted in June 2011. This is a long-term plan covering 15 years which sets out the Council's aspirations for improving travel in the county, demonstrating the importance of the transport network to achieving sustainable long-term economic growth. The Essex Transport Strategy seeks to achieve five broad outcomes:

- Provide connectivity for Essex communities and international gateways to support sustainable economic growth and regeneration
- Reduce carbon dioxide emissions and improve air quality through lifestyle changes, innovation and technology
- Improve safety on the transport network and enhance and promote a safe travelling environment
- Secure and maintain all transport assets to an appropriate standard and ensure that the network is available for use
- Provide sustainable access and travel choice for Essex residents to help create sustainable communities

B.5.3 Reference is made to enhancements to the A12 within the strategic transport priorities of the strategy.

Appendix C Major accidents and disasters

C.1 Introduction

C.1.1 A disaster is defined as a sudden, catastrophic event that can result in serious damage to human welfare or the environment. A disaster can result in major disruption to society or communities and can result in economic and environmental losses. Disasters can be caused by both natural processes and human actions.

C.1.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') require that risks due to accidents and disasters be considered within the Environmental Impact Assessment (EIA). This appendix provides a risk assessment of the major accidents and disasters that could affect the proposed scheme, and where these are being reported and mitigated within the environmental assessment.

C.2 Methodology

C.2.1 A screening matrix (Table C.1) has been completed detailing a long list of major accidents and disasters that could reasonably occur. This long list has been compiled using information from the International Federation of Red Cross and Red Crescent Societies website[23] and National Risk Register (NRR) of Civil Emergencies[24].

C.2.2 The screening matrix considers the proposed scheme's location and intended land use to determine if it is at risk from a major accident or disaster. For example, as the proposed scheme would be located near water bodies, the location presents a potential risk from major flooding. Likewise, as the proposed scheme would be used as a transport route, the risk of a major transport accident exists. Where potential risks were identified, these were taken forward for further consideration.

[23] International Federation of Red Cross and Red Crescent Societies. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/. Accessed January 2021

[24] Cabinet Office (2017). National Risk Register of Civil Emergencies 2017 Edition

Table C.1 Major accidents and disasters screening matrix

Accident/disaster	Location risk	Land-use risk	Further consideration required
Biological hazards: epidemics	×	×	×
Biological hazards: animal and insect infestation	×	×	×
Earthquakes	×	×	×
Mass movements/ground hazards	✓	×	✓
Tsunamis	×	×	×
Volcanic eruptions	×	×	×
Drought	×	×	×
Heatwaves	✓	×	✓
Wildfires	×	×	×
Inland floods	✓	×	✓
Coastal floods	×	×	×
Tropical storms	×	×	×
Storms and gales	✓	×	✓
Industrial accidents	×	×	×
Transport accidents	✓	✓	✓
Famine	×	×	×
Displaced populations	×	×	×
Terrorist attacks	×	×	×
Cyber attacks	×	×	×
Public disorder	×	×	×
Critical infrastructure failure	×	✓	✓
Heavy snowfall/low temperatures	✓	×	✓
Armed conflict/complex emergency	×	×	×

Bold text indicates major accidents or disasters requiring further consideration due to either the location of the proposed scheme or its intended use

C.2.3 Accidents and disasters requiring further consideration were subject to a more detailed risk assessment (Table C.2). This looked at the probability of an event occurring, and the consequence/effect if an event did occur. Probabilities of event occurrence were obtained from the NRR, considering the local context of the proposed scheme and future climate change (see Chapter 15: Climate of this Preliminary Environmental Information Report (PEIR)). These factors were used to determine if an event presented a significant risk and how this is considered in the environmental assessment. In this instance, a significant risk is one with the potential to cause loss of life or long-lasting/permanent environmental damage and would require a response beyond existing response measures in place.

C.3 Screening and scoping

C.3.1 The risk assessment (Table C.2) has been used to screen and scope potential environmental impacts from major accidents and disasters.

C.3.2 This shows how risks are being managed through the scheme design or reported and mitigated within other areas of the environmental assessment (e.g. climate change adaptation). Major accidents and disasters will therefore not be scoped into the environmental assessment as an EIA aspect chapter but will be reported on within relevant aspects. The scheme design will consider the potential effects associated with accidents and disasters, with mitigation embedded into the design where required.

Table C.2 Major accidents and disasters risk assessment

Yellow shading: risks considered within the scheme design; green shading: risks that are not considered further

Event	Likelihood	Consequence	Further considerations
Mass movements/ ground hazards	A Preliminary Sources Study Report (PSSR) has been produced for the proposed scheme. This contains a risk assessment which has identified several ground hazards which are 'probable' or 'likely' to occur, including collapsible and compressible ground.	Subsidence and other ground hazards can occur rapidly with little warning. They can cause damage to infrastructure, disruption to the traffic network, and casualties and fatalities. Depending on the nature of the incident, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages.	Geophysical hazards are being considered in the scheme design. The PSSR summarises the potential hazards and risks associated with the ground conditions that need to be factored into the ongoing design process. Ground investigations are ongoing. The findings of the investigations, along with the associated design requirements and risk mitigation, will be documented in a Ground Investigation Report.
Heatwaves	The NRR probability of a heatwave occurring in the next five years is between 1 in 20 and 1 in 2. Summer temperatures are predicted to increase in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Hot weather increases the risk of tarmac melting and technology overheating. This could result in unsafe driving conditions, potentially leading to accidents. Hot temperatures could also result in increased driver stress, increasing the likelihood of an accident occurring. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather, which reduces the risk of drivers driving in extreme weather. There is a minor risk of high temperatures damaging the road surface and technology, however, the likelihood of this resulting in a catastrophic event is considered unlikely. Heatwaves will therefore not be considered further.

Event	Likelihood	Consequence	Further considerations
Storms and gales	The NRR probability of a storm/gale occurring in the next five years is between 1 in 20 and 1 in 2. It is uncertain if wind speeds are likely to increase or decrease in the east of England due to climate change.	High wind speeds can fell trees and man-made structures. This can result in property damage, disruption to the transport network, disruption to critical infrastructure, and casualties and fatalities. Large-scale events have the potential to impact at a regional or even national scale.	High wind speeds have caused historic disruption to transport networks in the east of England, and there is potential for future events to impact the A12. The proposed scheme will be designed in accordance with best practice (BS EN 1991-1-4:2005 – Actions on Structures (covering wind)[25] and the associated UK National Annex[26]), and no further measures taken. Therefore, no additional consideration is needed.
Inland floods	The NRR probability of inland flooding occurring in the next five years is between 1 in 200 and 1 in 20. Locally, the proposed scheme would be located in areas of flood zone 3 (1 in 100-year event). Winters are predicted to get wetter in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Large-scale flooding events can result in damage to property, disruption of the transport network, and casualties and fatalities. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Depending on the nature of the event, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages. The magnitude and severity of an event could increase due to future climate change and land use change (e.g. development within floodplain).	The proposed scheme would involve development in floodplain. There are also areas at high risk from surface water flooding. The scheme is therefore at risk from a flood event and potentially increases the risk of flooding elsewhere. This problem is likely to be exacerbated by future climate change. As such, the Flood Risk Assessment will include an allowance for climate change and propose mitigation measures as required to reduce potential future risks.

[25] BSI (2005). BS EN 1991-1-4:2005+A1:2010: Eurocode 1. Actions on structures. General actions. Wind actions.

[26] BSI (2005). NA to BS EN 1991-1-4:2005+A1:2010: UK National Annex to Eurocode 1. Actions on structures. General actions. Wind actions

Event	Likelihood	Consequence	Further considerations
Transport accidents	The NRR probability of a major transport accident occurring in the next five years is between 1 in 2,000 and 1 in 200. This probability could increase (e.g. due to future stress on the network) or decrease (e.g. through advances in technology) beyond five years.	Major accidents can result in fatalities, casualties and damage to infrastructure, causing disruption to the network. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	Although accidents are likely to take place on the A12, these are not likely to occur at a scale that would be considered a national or regional disaster. The proposed scheme is also being designed to increase capacity and improve safety, which should reduce the probability of an incident occurring. Traffic accidents would be managed through existing emergency service procedures and would be unlikely to need a coordinated government response. Traffic accidents will therefore not be considered further.
Critical infrastructure failure	The NRR probability of a widespread electricity failure occurring in the next five years is between 1 in 200 and 1 in 20. Excluding an event in August 2019, this has never occurred in the UK before; however, the risk could increase due to the increased risk of severe weather.	The A12 is a strategic route that relies on powered technology, such as variable message signs and traffic signals, to allow safe operation of the road. A critical electricity failure could disrupt this technology, resulting in potential casualties and fatalities due to road accidents.	The Department for Business, Energy & Industrial Strategy works closely with industry and government to provide contingency planning in the event of a widespread electricity shutdown occurring. Existing measures are in place to manage this event, and it is therefore not considered further.

Event	Likelihood	Consequence	Further considerations
Heavy snowfall/ low temperatures	The NRR probability of heavy snowfall occurring in the next five years is between 1 in 20 and 1 in 2. Winters are predicted to get milder in the UK due to climate change, potentially reducing the likelihood of this event occurring.	Heavy snowfall can result in serious disruption to the transport network, resulting in road closures and increasing the hazard of vehicle accidents. This has the potential to result in casualties and fatalities. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather. Highways England and local authorities operate gritting lorries and manage operations for removing snow. These existing mitigation measures reduce the risk of accidents occurring. Although a residual risk remains for an accident to occur, the chance of one resulting in catastrophic damage to human health or the environment is considered unlikely. As such, snowstorms will not be considered further.

Appendix D1 Stage 2 establishing a shortlist of 'other existing development and/or approved developments'

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
1	Braintree District Council	20/01264/OUT	Gladman Developments Limited	Demolition of the existing buildings and redevelopment of the site for up to 130 dwellings	1.50	Submitted Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dated 2020, but not yet decided/approved. Assuming it progresses to construction and based on an assumed completion rate of 50 houses per year it is anticipated to have been completed or in final stages of completion prior to the 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
2	Braintree District Council	15/01186/FUL	Gold Care Homes Ltd	Construction of a 60-bed care home development	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	Care home sensitive receptor – operation. highlight to air quality / noise team	No
3	Braintree District Council	16/00545/OUT	Gladman Developments Limited	Construction of up to 80 dwellings	1.20	Approved Application	Tier 1	Landscape, biodiversity, population and health water	Unlikely	Application dates to 2016, and following refusal was then allowed on appeal in 2017. It is not clear if construction has been started or completed for this development. Assuming this development has now progressed to construction this is a relatively small development of houses. Based on an assumed completion rate of 50 houses per year it is anticipated to be complete prior to the 2023 construction start of the proposed scheme. Development is only 80 dwellings and is 1.2km from the proposed scheme - based on this and the details included, no likely significant cumulative effects are anticipated.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
4	Braintree District Council	16/01538/FUL	Redrow Homes	Construction of a primary road network for Phase 1 with associated footpaths, cycleways, necessary drainage infrastructure including a foul water pumping station, and other minor access roads where appropriate. Land adjacent to Lodge Farm, Hatfield Road, Witham	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2016 and subsequently approved in 2017. A Construction Environmental Management Plan was produced in 2017 including traffic management, build sequence, compound, and parking layout etc. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	Associated footpaths and cycleway	No
5	Braintree District Council	15/00430/OUT	Redrow Homes	Construction of up to 750 dwellings, a Primary School, and early years centre. Land adjacent to Lodge Farm, Hatfield Road, Witham	1.00	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Unlikely	Application dates to 2015 and was approved in 2016. This is a large development which appears to be in the process of discharging conditions and clarifying S106 agreements. An environmental statement concluded no or negligible residual effects during operation and construction for this development. Redrow Homes website suggests that the development has now been completed or is in final stages of construction. It is anticipated to have been completed prior to the 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	Primary School and early years centre sensitive receptors – operation. highlight to air quality / noise team	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
6	Chelmsford City Council	Strategic Growth Site 6 (North East Chelmsford) of the Adopted Chelmsford Local Plan	Chelmsford City Council	Chelmsford Garden Community, 3,000 dwellings	1.5 to 2km	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Included in scoping opinion feedback from Chelmsford City Council. The City Council notes the strategic nature of the Chelmsford Garden Community (CGC) proposals (Strategic Growth Site 6 of the Adopted Chelmsford Local Plan), supported by Homes England, and the detailed master planning work which is currently underway. On the basis that the CGC is a continuation of the Beaulieu and Channels development sites, both of which are at an advanced stage of construction by the same promoters and developers, the 3,000 new homes in the adopted Chelmsford Local Plan should be classified as 'More than Likely' using Highway England's table to ascertain degrees of certainty for development proposals. A masterplan is due to be approved in 2021 for the CGC with planning applications expected in late 2021. The City Council sees no rationale for leaving these sites out of the modelling baseline.	Traffic	Yes - Construction and Operation
7	Chelmsford City Council	09/01314/EIA	Countryside Zest (Beaulieu Park) LLP	Outline application for mixed use development for residential dwellings (approximately 3,600), business park (40,000m^2), retail (62,000m^2 of commercial space), hotel, leisure, education and community	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	The Beaulieu Park development is currently under construction and includes proposals to improve junction 19. Highways England is working with the developer to understand how the developer's proposals tie in with the proposed scheme. There is also planning permission approved for construction of a new railway station to serve the proposed Beaulieu Park development; and for 62,000m^2 of commercial space including a hotel; and a 40,000m^2 business park. This will be located near the new railway station. Given the proximity to the proposed scheme, temporal overlap and the scale of the Beaulieu Park development, there is the potential for significant cumulative effects during construction and operation in relation to air quality, cultural heritage, soil resource, biodiversity and population and health.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
8	Braintree District Council	17/02246/OUT	Bovis Homes Limited	Construction of up to 300 dwellings	1.00	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dates to 2017 but was not granted permission until 2019. This is a large development and the LPA has advised that work has not yet started. It is possible construction programmes could overlap and there is potential for significant cumulative effects during construction and operation.	Nursery sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
9	Braintree District Council	17/00359/OUT	Trine Developments Ltd	Demolition of all existing buildings, erection of six residential units, with all matters reserved for up to a maximum of an additional 42 residential units and new public space off West Street, Coggeshall.	1.00	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2017 and was approved in 2018. It is a relatively small development in the process of discharging conditions. LPA has advised it will be complete by end of 2021. There are no anticipated cumulative effects during the construction phase and no likely significant cumulative effects in operation due to scale and distance.	N/A	No
10	Braintree District Council	15/00280/OUT	Redrow Homes	Construction of up to 350 dwellings.	3.38	Approved Application	Tier 1	Population and health	Yes	Application documents date back to 2015. Development is in the process of discharging conditions. Whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely during construction. Potential operational cumulative effects in relation to population and health only.	N/A	Yes - Operation only
11	Braintree District Council	19/00001/LDO	Horizon 120 (owner Braintree District Council)	Construction of a Business and Innovation Park comprising Office, Industrial Process, General Industrial, storage or Distribution uses.	9.70	Approved Application	Tier 1	Population and health	Possible	Development is in the process of discharging condition. LPA has advised this employment site is not likely to be complete before 2033. Therefore, it is possible that construction programmes could overlap. The potential for any cumulative effects during construction or operation will be assessed for the population and health aspect only. Development is outside of the ZOI for other environmental aspect assessments, therefore cumulative effects scoped out for other aspects.	N/A	Yes - Construction and Operation
12	Braintree District Council	16/02144/OUT	Countryside Properties PLC	Construction of up to 225 residential dwellings.	6.10	Approved Application	Tier 1	Population and health	No	Whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
13	Braintree District Council	16/00397/OUT	M Scott Properties Ltd	Construction of up to 118 house units and the creation of a pedestrian footway link to Cressing Station, via Bulford Mill Lane.	6.20	Approved Application	Tier 1	Population and health	No	The development is 6.2km from the scheme and relatively small only comprising 118 dwellings. Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase and no likely significant cumulative effects in operation due to scale and distance.	N/A	No
14	Braintree District Council	19/02234/REM	Bloor Homes Eastern	Construction of 162 dwellings, new public open space, car parking and associated infrastructure works. Inworth Road.	0.30	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application for approval of reserved matters following outline approval 16/00569/OUT. Application 19/02234/REM was subsequently withdrawn.	N/A	No
15	Braintree District Council	WIN7H	Braintree District Council	Allocation for 10 or more new dwellings. Construction of 20 homes between 2017-2033.	0.51	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Yes	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
16	Braintree District Council	17/00341/OUT	The Honourable J F Strutt	Construction of up to 51 dwellings (Use Class C3), public open space, vehicular access, and associated infrastructure.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2017 and was approved in 2018. This is a relatively small development and is assumed to have now been completed. There are no anticipated cumulative effects during the construction phase. Potential for operational effects will be considered within respective aspect chapters as required.	N/A	No
17	Braintree District Council	16/02096/OUT	Arla Foods UIK	Construction of residential development for up to 145 dwellings (Use Class C3) with public open space, vehicular access, and associated infrastructure.	0.01	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Application dates to 2016 and was approved in 2017. LPA has advised construction estimated to be complete 2023/2024. It is anticipated that construction will be completed or in final stages by the time the proposed scheme constructed is started. There are no anticipated cumulative effects during the construction phase. Due to proximity to the A12 and the assumption that the whole urban redevelopment exceeds the 5ha threshold for screening EIA development under the EIA Regulations, there is potential for operational cumulative effects.	N/A	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
18	Braintree District Council	06/01143/OUT	The Landowners	Construction of circa 268 Dwellings, B1 business park, primary school, neighbourhood centre, community facilities, open space, landscaping, and ancillary infrastructure.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	School sensitive receptor - operation highlight to air quality / noise team	No
19	Braintree District Council	12/01071/OUT	Churchmanor Estates PLC	Revised masterplan for a mixed-use development.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application documents date back to 2012 and 2013. Gershwin Park website suggests that the development has now been completed or in final stages of construction. There are no anticipated cumulative effects during the construction phase. Potential for cumulative effects in operation.	N/A	Yes - Operation only
20	Braintree District Council	08/01171/REM	Barratt Eastern Counties	Construction of 55 new dwellings with associated access, play area and landscaping - Land Parcel 14.	0.27	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, noise, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
21	Braintree District Council	14/00100/REM	Taylor Wimpey UK Ltd	Construction of 135 new dwellings, associated access, infrastructure, parking and landscaping, provision of playing fields and associated changing facilities.	0.12	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
22	Braintree District Council	12/01620/FUL	Bloor Homes Eastern	Construction of 94 new dwellings with new site access, estate roads, drainage, carports, parking, landscaping, and acoustic barrier to A12 boundary together with all ancillary works.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
23	Braintree District Council	14/00005/COUPA	Swanvale Management Ltd	Change of use of an office building to 32 flats.	0.18	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Permitted development and construction has been completed. There are no anticipated cumulative effects during the construction phase. No likely significant cumulative effects from this scale of development.	N/A	No
24	Braintree District Council	16/00082/FUL	Simarco Holdings	Demolition of existing Pickford warehouse and associated office, total footprint area 945m^2. Erection of a distribution warehouse B8 with associated office B1, total footprint area 7,698m^2.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates back to 2016 and was approved in 2016. Erection of a distribution warehouse B8 with associated office B1, total footprint area 7,698m^2. It is assumed this development is now complete or will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Assumed limited operational effects aside from traffic which will be accounted for in the traffic model.	N/A	No
25	Braintree District Council	15/00799/OUT	Mrs Sarah Cornwell	Hybrid planning application comprising: (I) full application for 222 dwellings including affordable homes, 279m^2 gross floorspace for retail (Class A1), public open space.	0.02	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Unlikely	Application documents primarily date back to 2016. Development is discharging conditions. Bellway Homes website is currently marketing the homes and suggests that parts of the development have now been completed with the remaining homes nearing completion of construction. There are no anticipated cumulative effects during the construction phase. Due to proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that operational effects could have cumulative effects.	N/A	Yes - Operation only
26	Braintree District Council	15/00926/FUL	Mr S Brice	Operational golf course development.	0.02	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2015 and was approved in 2016. This is a small development within existing facilities. It is assumed this development has now been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
27	Braintree District Council	17/00418/OUT	Parker Strategic Land Ltd	Construction of up to 250 new dwellings, including the demolition of two properties (Kings Villas) to facilitate the access.	0.81	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dates to 2017 and was subsequently approved. Development is discharging conditions. LPA has advised that the development is not due for completion until 2027/28. Due to the proximity to the A12 and the assumption that the whole development exceeds the 5ha threshold for screening EIA development under the EIA Regulations, it is possible that construction and operation could have cumulative effects.	N/A	Yes - Construction and Operation
28	Braintree District Council	14/01617/FUL	Colemans Cottage Fisheries	Construction of holiday cabins and mega pods	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2014 and was approved in 2015. This is a small development within existing facilities. It is assumed that this development has now been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
29	Braintree District Council	16/02156/OUT	David Wilson Homes Eastern	Construction of up to 120 dwellings, public open space, landscaping, new vehicular and pedestrian access, highway work, and drainage infrastructure works.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dates to 2016 and was approved 2017. Development is in the process of discharging conditions. LPA has advised that the development is not due for completion until 2025/26. Due to proximity to the A12 and assumed that whole development exceeds the 5ha threshold for screening EIA development under the EIA Regulations, it is possible that construction and operation could have cumulative effects.	N/A	Yes - Construction and Operation
30	Braintree District Council	15/00962/FUL	Greenfields Community Housing	Demolition of existing properties and erection of seven 1-bed flats, twelve 2-bed houses and six 2-bed flats.	0.16	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2015 and was approved 2016. This is a small development which is discharging conditions. It is assumed this development has now been completed. No likely significant cumulative effects from this scale of development.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
31	Braintree District Council	16/01813/OUT	Gladman Developments Ltd.	Construction of up to 140 dwellings.	0.15	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dates to 2016 and was approved in 2017. Development is discharging conditions. LPA has advised that the development is not due for completion until 2026/27. Due to proximity to the A12 and the assumption that the whole development exceeds the 5ha threshold for screening EIA development under the EIA Regulations, it is possible that construction and operation could have cumulative effects.	N/A	Yes - Construction and Operation
32	Braintree District Council	15/00012/SCR	The Crown Estate	Screening & Scoping Opinion Request - Residential development comprising of 180 dwellings. Inworth Road.	0.04	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Screening Opinion dates to 2015. Concluded that with reference to the scale, nature, and location of the development the LPA would not require an EIA and that an Environmental Statement will not be required to support a planning application for this development. No subsequent planning application was identified on the planning portal associated with this screening opinion.	N/A	No
33	Braintree District Council	16/00569/OUT	The Crown Estate / Bloor Homes	Construction of up to 165 dwellings (C3), vehicular access from London Road, public open space.	0.04	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dates to 2016 and was subsequently approved. The development is discharging conditions. LPA has advised that the development is not due for completion until 2024/25. Due to proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that construction and operation could have cumulative effects.	N/A	Yes - Construction and Operation
34	Braintree District Council	14/01557/FUL	Greenfields Community Housing Ltd	Construction of 18 new houses.	0.70	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application documents primarily date back to 2014 / 2015 and a discharge of conditions document dated 2018. It is assumed this development has been completed. No likely significant cumulative effects from this scale of development.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
35	Braintree District Council	14/01559/FUL	Greenfields Community Housing Ltd	Construction of 17 flats and one bungalow.	0.74	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application documents primarily date back to 2014 / 2015 and a discharge of conditions document dated 2018. It is assumed this development has been completed. No likely significant cumulative effects from this scale of development.	N/A	No
36	Braintree District Council	14/01556/FUL	Greenfields Community Housing	Construction of four flats and nine houses.	0.62	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application documents primarily date back to 2014 / 2015 and a discharge of conditions document dated 2018. It is assumed this development has been completed. No likely significant cumulative effects from this scale of development.	N/A	No
37	Braintree District Council	15/01498/FUL	Nexus Land Ltd	Construction of 25 dwellings.	0.35	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2015. This is a small development. It is assumed this development has been completed. No likely significant cumulative effects from this scale of development.	N/A	No
38	Braintree District Council	14/01644/FUL	Greenfields Community Housing	Construction of 31 dwellings.	0.51	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application documents primarily date back to 2014 / 2015 and a discharge of conditions documents dated 2016. It is assumed this development has now been completed or will be completed prior to commencement of the proposed scheme construction works in 2023. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
39	Braintree District Council	16/01907/FUL	Framar Developments Ltd	Construction of 13 apartments and houses.	0.62	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2016 and was approved in 2018. This is a small development. It is assumed this development has now been completed or will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
40	Braintree District Council	17/00973/FUL	Countryside Properties (UK) Ltd	Construction of 50 dwellings.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2017 and was approved in 2018. This is a relatively small development and is discharging planning conditions. LPA has advised that the development is under construction. It is assumed development will be completed prior to commencement of the proposed scheme construction works in 2023 and so is unlikely to coincide. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline or future baseline receptor to be considered where relevant within respective aspect chapters. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
41	Braintree District Council	17/00679/OUT	Barkley Projects (Kelvedon) LLP	Construction of up to 250 dwellings, a school site, health centre, employment area, local retail area, open space, and landscape buffers, with two accesses onto London Road.	0.02	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dates to 2017 but is pending consideration. There have been several objections to the development. It is not clear if this development will attain approval. Nevertheless, this is potentially a large development and if it is subsequently approved then construction programmes could overlap with the proposed scheme. Given the size and proximity of the potential development there is potential for significant cumulative effects during construction and operation.	N/A	Yes - Construction and Operation
42	Braintree District Council	N/A	East of England Strategic Health Authority	Demolition of existing building and redevelopment of 65 flats.	0.70	Pre-Application Advice Sought	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This is for redevelopment of an existing site. LPA has advised that this development changed from an office to residential use, for 98 dwellings and that construction work is complete. The redevelopment is understood to be relatively small scale, and with good design unlikely to give rise to significant environmental effects during operation.	N/A	No
43	Braintree District Council	N/A	Pre-app -TBC	Construction of 50 dwellings.	0.90	Pre-Application Advice Sought	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
44	Braintree District Council	17/01145/FUL	Churchill Retirement Living	Redevelopment to form 60 retirement living apartments, including lodge manager's accommodation, communal facilities, access, car parking and landscaping.	0.74	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Appeal dismissed 23rd July 2018. Planning permission refused. Granted permission as 18/02304/FUL for 58 dwellings.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
45	Braintree District Council	17/01092/FUL	Bellway Homes Limited	Construction of 163 one-, two-, three- and four-bedroom houses and apartments. Land at Forest Road, Rivenhall, Witham.	0.02	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2017 and approved in 2018. Development is discharging conditions. LPA has advised that the development is under construction. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. Due to proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, there is potential for cumulative operational effects.	N/A	Yes - Operation only
46	Braintree District Council	17/01730/OUT	Mrs Sarah Cornwell	Construction of up to 65 dwellings. Land South of Rickstones Road.	0.93	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application refused 15 May 2018 and subsequent appeal withdrawn.	N/A	No
47	Braintree District Council	17/01979/OUT	Mr Coster	Construction of up to 125 dwellings and up to 2000m^2 of employment floorspace (Class B1).	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Application dates to 2017 but is pending consideration. There have been several objections to the development. It is not clear if this development will attain approval. Nevertheless, this is potentially a large development in proximity to the proposed scheme and if it is subsequently approved then construction programmes could overlap. Given the size and proximity of the potential development there could be potential for significant cumulative effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
48	Braintree District Council	17/02271/OUT	Parker Strategic Land Ltd	Construction of up to 35 dwellings, open space and parkland with access from Coggeshall Road.	0.93	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2017 and was approved in 2019. This is a relatively small development and is in the process of discharging conditions. The LPA has advised that this development will be completed in 2024/25. Although there may be some overlap in the final stages of completion this is a relatively small development (below EIA threshold of 150 dwellings) and there are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. With good design procedures it is deemed that there are unlikely to be significant construction or operation cumulative effects.	N/A	No
49	Braintree District Council	18/00947/OUT	Bellway Homes Limited	Construction of up to 58 dwellings including affordable homes, public space including local equipped area for play, sustainable drainage systems, landscaping including retention of Rickstones Road hedgerow on site and all associated development.	0.93	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2017 and was approved in 2019. This is a relatively small development and is discharging conditions. LPA has advised that the development is currently under construction. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
50	Braintree District Council	18/01346/FUL	Mr Ian Twinley	Internal alterations and refurbishment of a number of existing outbuildings to a bridal suite; demolition of existing dilapidated outbuildings.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2018 and was subsequently approved. This a primarily a redevelopment of an existing property with limited additional development and unlikely to generate significant cumulative effects. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
51	Braintree District Council	18/02010/FUL	Gimsons	Demolition of existing dwelling and construction of 78 dwellings including access, landscaping, parking and associated works. 3.48ha	0.14	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2018 and was approved in 2020. This is a relatively small development (3.48ha) and is in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. The whole development is less than 5ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
52	Braintree District Council	18/01912/REM	Mr Chris Gatland. Land adjacent To Lodge Farm Hatfield Road Witham Essex	Application for approval of Reserved Matters (Appearance, Landscaping, Layout and Scale) for Phase 2 comprising 61 dwellings and associated landscaping, access, and parking. Lodge Farm phase 2.	0.14	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Unlikely	Application dates for reserved matters back to 2018 and approved in 2019. This application is for Phase 2 of a larger development (15/00430/OUT), presumed to be already completed. Phase 2 is a relatively small development comprising 61 dwellings. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
53	Braintree District Council	18/01853/OUT	Mr Arran Gordon	Construction of 10 dwellings with associated parking, garaging and community footpath.	1.32	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application refused 29 March 2019.	N/A	No
54	Braintree District Council	19/00026/FUL	Mr Conan Farningham	Construction of 150 residential dwellings with associated infrastructure and landscaping.	1.33	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dated 2019, and was subsequently approved. Based on an assumed completion rate of 50 houses per year it is anticipated to have been completed or in final stages of completion prior to the 2023 construction start of the proposed scheme. Due to proximity to the A12 and that the development is for 150 dwellings meeting the threshold for screening EIA development under the EIA Regulations, it is possible that operational effects could have cumulative effects.	N/A	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
55	Braintree District Council	18/02316/REM	Mrs Sarah Cornwell	Provision of access, appearance, landscaping, layout and scale for 58 dwellings, public open space.	0.93	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2018 and was approved 2019. This is a relatively small development and appears to be in the process of discharging conditions. LPA has advised that the development is under construction. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings and the whole development less than 5ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
56	Braintree District Council	18/02200/FUL	Pegasus Planning Group	Erection of three employment units (B1c/B2/B8 Use) with access and parking. 0.89ha	0.13	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2018 and was approved in 2019. The development is currently in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
57	Braintree District Council	19/01025/FUL	CALA Homes (North Home Counties) Ltd	Construction of 237 new dwellings with associated garden and parking provision.	0.81	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application is dated 2019 and is pending consideration. This is a large development in proximity to the proposed scheme and if it is subsequently approved then construction programmes could overlap. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
58	Braintree District Council	19/00679/REM	Parker Strategic Land Ltd	Construction of up to 250 new dwellings.	0.81	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application for approval of reserved matters following outline approval 17/00418/OUT. Application 17/00418/OUT dates to 2017 and was subsequently approved. Development is discharging conditions. LPA has advised that the development is not due for completion until 2027/28. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation
59	Braintree District Council	19/01222/REM	Mr Giuseppe Cifaldi	Construction of 165 dwellings, new public open space, car parking and associated infrastructure works. Inworth Road.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application for approval of reserved matters following outline approval 16/00569/OUT. Development appears to be in the process of discharging conditions. LPA has advised that the development is not due for completion until 2024/25. Due to the proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that construction and operation could have cumulative effects.	N/A	Yes - Construction and Operation
60	Braintree District Council	19/01803/FUL	Mrs Jennifer Carroll (Agent)	Demolition of existing farm building and four houses and erection of 46 dwellings with associated parking, landscaping, estate roads, public open space.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Unlikely	Application is dated 2019 and was approved 2020. This development is relatively small and in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. No likely significant operational cumulative effects from this scale of development.	N/A	No
61	Braintree District Council	19/01896/OUT	Meeson on Behalf of Countryside Properties	Construction of up to 450 residential dwellings, commercial floorspace, residential care home and day nursery.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application is dated 2018 and is pending consideration. This is a large development in proximity to the proposed scheme and if it is subsequently approved then construction programmes could overlap. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
62	Braintree District Council	17/02227/FUL	Design MAD	Refurbishment of Albert Road Station entrance and new associated station building on eastern side of track, together with upgraded parking bays in the forecourt and improved cycle storage facilities.	0.60	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2017 and was approved 2019. This is a relatively small development on an existing site. The development is in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. The scale of development is such that no likely significant cumulative effects would occur during operation.	N/A	No
63	Braintree District Council	18/00884/REM	Redrow Homes	Provision of 'Appearance', 'Landscaping', 'Layout' and 'Scale' for Phase 1B comprising 84 dwellings with associated landscaping, access and parking. Lodge Farm phase 1.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Unlikely	Application dates to 2018 for reserved matters concerning appearance, landscaping, layout and scale. This is Phase 1b of a larger development (15/00430/OUT), presumed to be already completed. Phase 1b appears to be in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. Assumed unlikely to have significant operational cumulative effects. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
64	Braintree District Council	19/00109/FUL	St Giles Development Ltd.	Redevelopment of the site involving the erection of two x 3-bed, five x 4-bed and six x 5-bed dwelling houses (13 units) together with associated parking and landscaping.	0.55	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application is dated 2019 and was subsequently approved. This is a small development and in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Scale is unlikely to have significant operational cumulative effects. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
65	Braintree District Council	20/000105/VAR	Foresight Group (Agent)	No description available.	0.09	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	No results found on planning portal. LPA advised to delete.	N/A	No
66	Braintree District Council	20/00128/OUT	Mr. Simon Boulton	Construction of B1c (Light Industrial), B2 (General Industry) and B8 (Storage and Distribution) uses, comprising a maximum gross internal floor space of 15,470 square metres, (166,518 square feet).	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application is dated 2020 and is pending consideration. This is potentially a large development in proximity to the proposed scheme and if it is subsequently approved then construction programmes could overlap. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation
67	Braintree District Council	19/00494/REM	Arla Dairy	Layout, scale, appearance, and landscaping for residential development for up to 145 dwellings.	0.01	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Changes to landscaping at the site-scale. Reserved matters for application 16/02096/OUT and varied by permission ref. 18/01650/VAR. Considered for shortlisting under application 16/02096/OUT. LPA has advised that construction is estimated to be complete 2023/2024. It is anticipated that construction will be completed or in final stages by the time the proposed scheme construction is started. There are no anticipated cumulative effects during the construction phase. Due to proximity to the A12 and the assumption that the whole urban redevelopment exceeds the 5ha threshold for screening EIA development under the EIA Regulations, there is potential for operational cumulative effects.	N/A	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
68	Braintree District Council	19/01980/FUL	The Club Company Ltd	Change of use of land to site 18 holiday caravans, extension to overflow carpark, relocation of playground, creation of two tennis courts and spa garden with ancillary building and associated hard and soft landscaping.	0.05	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application is dated 2019 and was approved 2020. This development is relatively small for change of use of land to site 18 holiday caravans and limited associated infrastructure and is unlikely to generate significant cumulative effects. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Scale is unlikely to have significant operational cumulative effects.	N/A	No
69	Braintree District Council	20/00906/REM	Barratt Homes	Layout, scale, appearance, and landscaping for residential development of 100 dwellings. Gleneagals Way.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Unlikely	Application for approval of reserved matters (layout, appearance, scale, and landscaping) of outline planning consent 16/02156/OUT. Pending decision. The application 16/02156/OUT dates to 2016 and was applying to discharge conditions 2016. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
70	Braintree District Council	20/00386/OUT	Keens and Hunt LTD	Demolition of garage and erection of a two-storey building comprising ten 2-bed eco-friendly motel rooms.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application refused 28 February 2020.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
71	Braintree District Council	20/01434/FUL	Redrow Homes	Installation of Phases 3B & 4 infrastructure for the provision of secondary road network with associated footpaths, and necessary drainage infrastructure. Lodge Farm phase 3&4.	0.46	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dated 2020 and was subsequently approved. This application is related to application 15/00430/OUT which dates to 2015 and was approved in 2016. Application 20/01434/FUL is for the access and drainage provision related to a large development of 750 properties which appears to be in the process of discharging conditions and clarifying S106 agreements. An environmental statement concluded no or negligible residual effects during operation and construction for this development. Redrow Homes website suggests that the development has now been completed or is in final stages of construction. It is anticipated to have been completed prior to the 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. Scale/nature of development is unlikely to have significant operational cumulative effects.	N/A	No
72	Braintree District Council	HAT17H	Braintree District Council	Allocation for circa 50 dwellings.	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. LPA has advised there is currently no planning permission. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
73	Braintree District Council	Arla Dairy	Braintree District Council	Allocation for employment area, including Business (BA1), general industrial (B2), storage and distribution (B8).	0.06	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Unsure - more information required and need to check with LPA about this allocation. Taken forward to Stage 3 as a precaution.	N/A	Yes - Construction and Operation
74	Braintree District Council	WIS2H	Braintree District Council	Allocation for circa 94 new dwellings.	0.02	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
75	Braintree District Council	WIS9H	Braintree District Council	Allocation for circa 213 new dwellings.	0.07	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
76	Braintree District Council	WIS9E	Braintree District Council	Allocation for Business uses (B1).	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Allocation for Business use B1 - uses which can be carried out in a residential area without detriment to its amenity. This allocation is for greater than 5ha of land. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
77	Braintree District Council	WIS9RW	Braintree District Council	Allocation for retail warehousing - up to a maximum of 2.287ha.	0.07	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 5ha of land. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
78	Braintree District Council	WIS10H	Braintree District Council	Allocation for circa 20 new homes.	0.54	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
79	Braintree District Council	WIW1H	Braintree District Council	Allocation for circa 40 new homes.	1.32	Adopted Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. LPA advises this has been deallocated - currently to be confirmed at public examination. Nevertheless, since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
80	Braintree District Council	WIN7H	Braintree District Council	Allocation for circa 15 new homes.	0.51	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
81	Braintree District Council	WCH27H	Braintree District Council	Allocation for circa 10 new homes.	0.37	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
82	Braintree District Council	WCH22H	Braintree District Council	Allocation for circa 24 new homes.	0.48	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
83	Braintree District Council	WCH21H	Braintree District Council	Allocation for circa 10 new homes.	0.82	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
84	Braintree District Council	FEE4H	Braintree District Council	Allocation for circa 15 new homes.	0.04	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
85	Braintree District Council	KEL2CH	Braintree District Council	Allocation for the extension of St Dominic's Care Home.	0.35	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
86	Braintree District Council	RIV2H (BTE/15/0799)	Braintree District Council	Allocation for circa 300 new dwellings and associated community uses. Land off Forest Road, Rivenhall, Witham	0.02	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3	N/A	Yes - Operation only
87	Braintree District Council	WIS6H (BTE/15/0430) (BTE/16/1538) (BTE/16/1681)	Braintree District Council	Allocation for circa 1,000 new dwellings and associated community uses. Lodge Farm.	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
88	Braintree District Council	FEER230	Braintree District Council	Allocation for circa 30 new homes.	0.20	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. The LPA has advised there is currently no planning permission. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
89	Braintree District Council	KELV 332	Braintree District Council	Allocation for 41 Specialist Housing (St Dominic's Care Home, Kelvedon) and provision of up to 250 dwellings	0.35	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	41 specialist housing and provision of up to 250 dwellings. The LPA has advised there is currently no planning permission, but that construction is estimated to be completed 2027/28. It is therefore assumed that the construction programme for this development could overlap with the proposed scheme starting in 2023. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have significant construction and operation cumulative effects, and so is being taken through to stage 3.	Care home sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
90	Braintree District Council	RIVE 360 (RIV2H BTE/15/0799)	Braintree District Council	Strategic Growth Location - Land off Forest Road, Rivenhall, Witham.	0.02	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	370 dwellings (potentially under construction) on 16.3 ha of land. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
91	Braintree District Council	Site Ref: RIVE 362 Policy Ref: Policy LPP 2	Braintree District Council	Allocation for Employment - Extension to Eastways Industrial Estate, Witham (Rivenhall Parish).	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	6.8ha Employment Policy Area - Extension to Eastways Industrial Estate, Witham (Rivenhall Parish). No planning permission yet. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
92	Braintree District Council	WITN 425	Braintree District Council	Allocation for 30 new dwellings. Chipping Hill, Witham	0.80	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
93	Braintree District Council	WITN 426	Braintree District Council	Allocation 150 homes estimated to completed 2023/24. North of Conrad Road	1.33	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Yes	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
94	Braintree District Council	WITN 427	Braintree District Council	Allocation for 10 or more new dwellings. Estimated to build and complete 2026/27. North of Contad Road, Witham.	1.30	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Yes	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
95	Braintree District Council	WITN 613	Braintree District Council	Allocation for 10 or more new dwellings.	0.80	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	Allocation same as for WITN 425, Chipping Hill. LPA suggested delete.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
96	Braintree District Council	Site Ref: WITN 429 Policy Ref: LPP 30	Braintree District Council	Allocated for 14 dwellings. Rickstones, Witham Estimated to build and complete 2025/26.	0.76	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	13 dwellings and 0.68 ha of land. This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
97	Braintree District Council	WITC 424	Braintree District Council	Former East of England strategic health authority, 98 dwellings.	0.67	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. LPA has advised that this development has been completed. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
98	Braintree District Council	WITW 431	Braintree District Council	Allocation for 10 or more new dwellings. Construction of 20 homes between 2017-2033.	1.32	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Yes	LPA has advised this has been deallocated - currently to be confirmed at public examination. Nevertheless, since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
99	Braintree District Council	WITC 422	Braintree District Council	Allocation for 10 or more new dwellings. Old Ivy Chimneys	0.54	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
100	Braintree District Council	WIS9H(S)	Braintree District Council	Allocation for 10 or more new dwellings. Construction of 63 homes between 2017-2033.	0.07	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
101	Braintree District Council	WITC 423	Braintree District Council	Strategic Growth Location	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Allocated in adopted Core Strategy at South West Witham Lodge Farm (site is understood to already has planning permission). 750 dwellings. It is not known if the construction programme for this development would overlap with the A12 starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
102	Braintree District Council	Site Ref: HATF 315 & 316 Policy Ref: LPP 23	Braintree District Council	Strategic Growth Location for the construction of up to 450 new homes and a new stand-alone early years and childcare nursery. Wood End Farm	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is associated with 19/01896/OUT. Wood End Farm	Childcare Nursery sensitive receptor - operation highlight to air quality / noise team	N/A see application 19/01896/OUT (ID 61)
103	Braintree District Council	Site Ref: WITC 421 Policy Ref: LPP 32	Braintree District Council	Allocation for 10 or more new dwellings. Construction of 40 dwellings.	0.14	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Gimsons, granted permission, see 18/02010/FUL as described in ID 51.	N/A	No
104	Braintree District Council	FEER232	Braintree District Council	Allocation for 30 or more new dwellings.	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
105	Braintree District Council	FEER233. Policy Ref: LPP 17	Braintree District Council	Allocation for 834 new dwellings.	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3	N/A	Yes - Construction and Operation
106	Braintree District Council	Site Ref: RIVE 363 Policy Ref: Policy LPP 2	Braintree District Council	Allocation for Employment Policy Area - Extension to Eastways Industrial Estate, Witham (Rivenhall Parish).	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	6.8ha Employment Policy Area - Extension to Eastways Industrial Estate, Witham (Rivenhall Parish). No planning permission yet. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
107	Braintree District Council	Comprehensive Redevelopment Area. Policy LPP 31	Braintree District Council	The following development is supported within the comprehensive redevelopment area at land between A12 and GEML. Mixed use development of up to 200 dwellings on former Arla Dairy site (3.8ha). Up to 45 dwellings on Sorrells Field (2ha). Up to 20 dwellings on Bury Farm (2.8ha). Up to 20 dwellings to the rear of Station Road.	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 5ha of land. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
108	Braintree District Council	KELV 332	Braintree District Council	Allocation for 250 or more new dwellings.	0.35	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for greater than 150 dwellings. LPA has advised that this development has not yet started construction. It is assumed the construction programme for this development could overlap with the proposed scheme starting in 2023. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have significant cumulative effects during construction and operation, and so is being taken through to stage 3	N/A	Yes - Construction and Operation
109	Braintree District Council	N/A	Braintree District Council (Government's 'Restoring Your Railway fund')	Blackwater Rail Restoration	0.00	Early in bid process	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	A Restoring Your Railway bid to the ideas fund is being worked up for round 3. This is in the early stages of project design: Braintree District Council are bidding for the ideas fund to proceed to preliminary route design. Due to the early stages of the potential development it is not possible to provide a reliable assessment of whether the development will result in significant cumulative effects. At this time the bid is not being taken forward to Stage 3.	N/A	No
110	Chelmsford City Council	18/00293/EIASO	Countryside Zest (Beaulieu Park) LLP	EIA Screening Opinion for construction of the Radial Distributor Road (Phase 2B), including one new roundabout and one signal junction, one signal crossing, provision of cycle, pedestrian and bridleway crossings.	1.30	EIA Screening Request Sought	Tier 3	Landscape, biodiversity, population and health, water	Yes	The construction of a Radial Distributor Road is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
111	Chelmsford City Council	16/01293/FUL	HIFML	Mixed use development (retail, business, general industrial and storage)	5.00	Approved Application	Tier 1	Population and health	No	Application documents primarily date back to 2016/ 2017 and a discharge of conditions document dated 2017. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
112	Chelmsford City Council	19/02123/OUT	Mr G Sharp, CCC Property	55 residential dwellings	9.00	Submitted Application	Tier 1	Population and health	Unlikely	Application is dated 2019 and is pending decision. The development is relatively small scale, and with good design is unlikely to give rise to significant environmental effects. Whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely. Development is outside of the study area for other environmental aspect assessments.	Public open spaces with children's play area and drainage infrastructure	No
113	Chelmsford City Council	19/00384/OUT	Castle Homes SPV5 Ltd	92 residential dwellings	9.00	Approved Application	Tier 1	Population and health	No	Application is dated 2019 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
114	Chelmsford City Council	16/01630/MAT/3	Taylor Wimpey UK Ltd	Material amendment to permission 16/01630/MAT/1 (421 residential units and conversion of non-residential structure to 25 residential units)	5.00	Approved Application	Tier 1	Population and health	No	Application dates to 2016 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
115	Chelmsford City Council	18/01326/FUL	Unknown. Agent is Mr Stuart Wilsher, Phase 2 Planning and Development	Mixed use scheme including 315 student residential units and retained buildings for leisure purposes	3.00	Approved Application	Tier 1	Population and health	No	Application dates to 2018 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
116	Chelmsford City Council	18/00840/FUL	Bellway Homes	Mixed use scheme including 203 residential units, three commercial units and relocation/installation of substations	3.00	Approved Application	Tier 1	Population and health	No	Application dates to 2018 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
117	Chelmsford City Council	18/00255/OUT	Bellway Homes Ltd and Trustees of the Fullborunes Trust	120 dwellings and land for expansion of Great Leighs Primary School	7.00	Approved Application	Tier 1	Population and health	No	Application reference not found searching Chelmsford Planning Portal. Assumed this planning application was refused and development did not go ahead.	School sensitive receptor - operation highlight to air quality / noise team	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
118	Chelmsford City Council	16/01630/FUL	Taylor Wimpey East London	421 residential dwellings	2.50	Approved Application	Tier 1	Population and health	No	Application dates to 2016 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
119	Chelmsford City Council	20/00002/MAS	Countryside, Broadway Malyan, David Lock Associates, Essex County Council and Bellway	1,000 residential dwellings, 1,000m^2 of business and retail space, primary school, neighbourhood centre, leisure facilities	9.60	Submitted Application	Tier 1	Population and health	Possible	Currently at Masterplan stage and pending consideration. There is provision within the masterplan to provide circular routes or connections to the wider public rights of way network, multi-user crossings of the B1012 and capacity improvements to a section of the A132. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
120	Chelmsford City Council	20/00071/FUL	Aquila EHS Ltd	Retail food store, retail/café units, general industry and storage/distribution units	2.50	Submitted Application	Tier 1	Population and health	Yes	This development is pending consideration. There are no pedestrian facilities within the vicinity of the site. There is currently no specific cycling infrastructure associated with the site. Proposing approximately 282 parking spaces. It is not clear how or if the pedestrian and cycling provision would be improved, but various plans and policies require development proposals accessible to people of all abilities and by all forms of sustainable modes of transport. It is assumed construction programmes could overlap. The Transport Assessment for this development considers links with the Greater Beaulieu Park development. Although outside of the study area for other environmental aspect assessments there could be potential for population and health benefits.	Potential cycling and pedestrian benefits linking into the wider network, and transport links with the Greater Beaulieu Park development	Yes - Construction and Operation
121	Chelmsford City Council	20/00071/OUT	Aquila EHS Ltd	Retail food store, retail/café units, general industry, and storage /distribution units	2.50	Submitted Application	Tier 1	Population and health	Yes	Application dated 2020 and pending consideration. The Transport Assessment for this development considers pedestrian and cycling access links beyond the development site, linking into the wider network, including with the Greater Beaulieu Park development. Although outside of study area for other environmental aspect assessments there could be potential for population and health benefits.	Potential cycling and pedestrian benefits linking into the wider network, and transport links with Greater Beaulieu Park	Yes - Construction and Operation
122	Chelmsford City Council	19/01618/FUL	Seven Capital (Chelmsford Limited)	231 residential dwellings (three apartment blocks)	3.50	Submitted Application	Tier 1	Population and health	Possible	This development is pending consideration. The Health Assessment undertaken for the development identifies it being located within the defined boundary for Chelmsford Town Centre with access to both existing services and public transport and within walking distance of Chelmsford's main retail area. Any improvements to pedestrian or cycling provision are contained within the development. It is outside of study area for other environmental aspect assessments. With good design it is unlikely to give rise to significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
123	Chelmsford City Council	19/01488/REM	Watch Tower Bible and Tract Society of Britain	403 residential dwellings (nine residential blocks)	7.00	Approved Application	Tier 1	Population and health	No	Application is dated 2019 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Operation only
124	Chelmsford City Council	16/01728/FUL	Sainsbury's Supermarkets Ltd	Removal of car park deck and reconfiguration of existing car park	0.30	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, noise, population and health, water	No	Application dates back to 2016 with subsequent discharge of planning documents dated 2016. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. Scale is unlikely to have significant operational cumulative effects.	N/A	No
125	Chelmsford City Council	18/01442/FUL	Mr M Carroll, Royal London Asset Management	Part single-storey, part two-storey industrial/warehouse unit and ancillary office space, circulation and associated parking, landscaping, and attenuated drainage strategy. 3.39ha	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2018 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is less than 5ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
126	Chelmsford City Council	19/00729/FUL	Mr Hall, New Hall School	Demolition of residential flats. Construction of new Northern Access Road.	0.44	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application is dated 2019 and is discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. The scale and nature of this development, which involves brownfield development is unlikely to have significant construction or operational cumulative effects so is not taken forward.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
127	Chelmsford City Council	18/00687/FUL	Mr Lee, Bloor Homes Ltd	Demolition of existing buildings, construction of internal road and associated infrastructure	0.68	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2018. This application seeks full planning permission to demolish No. 10 and No.12 Plantation Road and to construct a vehicular access and roadway into the development site approved under 14/01552/OUT and 18/00682/REM. There are no differences between the access details now proposed and the details approved under outline consent and the reserved matters, on 10 August 2018. It is assumed access construction has been completed. The scale and nature of this development, which involves brownfield development, is unlikely to have significant construction or operational cumulative effects so is not taken forward.	N/A	No
128	Chelmsford City Council	16/01973/FUL	Mr Biggadike, Inchcape Estates Ltd	Extension to existing car showroom and car parking area	0.30	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, noise, population and health, water	No	Application dates to 2016 and is for an extension to an existing building. It is assumed access construction has been completed. There are no anticipated cumulative effects.	N/A	No
129	Chelmsford City Council	16/00544/FUL	Jump Street Ltd	Change of use from storage/distribution to assembly/leisure (trampoline park)	0.84	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2016 and for change of use of an existing building. There are no anticipated cumulative effects.	N/A	No
130	Chelmsford City Council	16/00057/FUL	Mr Floyd, New Hall School Trust	New hockey/rugby pitch	0.85	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2016 with subsequent discharge of planning documents also in 2016. It is assumed access construction has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. Development to provide a new hockey / rugby pitch is relatively small, below EIA thresholds and the nature of the development is unlikely to have any significant operational effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
131	Chelmsford City Council	Strategic Growth Site 1b: Essex Police Headquarters and Sports Ground, New Court Road	Chelmsford City Council	250 residential dwellings, primary school, nursery and flexible workspace facilities	1.64	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have significant cumulative effects and so is being taken through to stage 3.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
132	Chelmsford City Council	Strategic Growth Site 1d: Former St Peter's College, Fox Crescent	Chelmsford City Council	185 residential dwellings, two special schools, small workspaces	4.40	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
133	Chelmsford City Council	Existing Commitment EC4: East of Boreham	Chelmsford City Council	145 residential dwellings	0.30	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
134	Chelmsford City Council	Strategic Growth Site 3a: East Chelmsford - Manor Farm	Chelmsford City Council	250 residential dwellings and country park	1.22	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
135	Chelmsford City Council	Strategic Growth Site 3b: East of Chelmsford - Land North of Maldon Road	Chelmsford City Council	Office/business park (500m^2) and childcare nursery	0.92	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for less than 1ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	Childcare nursery sensitive receptor - operation highlight to air quality / noise team	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
136	Chelmsford City Council	Strategic Growth Site 3c: East of Chelmsford - Land South of Maldon Road	Chelmsford City Council	100 residential dwellings	1.39	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
137	Chelmsford City Council	Strategic Growth Site 6 of the Adopted Chelmsford Local Plan: North East Chelmsford	Chelmsford City Council	Chelmsford Garden Community, 3000 dwellings	1.5 to 2km	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This is a duplication of ID 6 which covers the North East Chelmsford Strategic Growth Site, which includes the garden community.	Traffic	No (duplicate of ID 6)
138	Chelmsford City Council	Site Allocation 1 - ASDA Car Park, Chelmer Village	Chelmsford City Council	Housing (number of dwellings unknown)	0.87	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	The site presently contains over 300 car parking spaces plus staff parking and a self-service petrol station. The car park area contains sufficient area to accommodate some development taking advantage of its close relationship to essential local services. The allocated site area retains shoppers parking for the centre and allows for vehicular access from Village Gate. This allocation is less than 5ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
139	Chelmsford City Council	Site Allocation 8 - Land south of Clements Close	Chelmsford City Council	Housing (number of dwellings unknown)	0.34	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	Allocated land approx. 1ha. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
140	Colchester Borough Council	Site Allocation 17 (CP22)	Chelmsford City Council	This site allocation will provide employment development of around 5,000m^2 of new B1 floorspace as part of a new office/business park which is expected to be delivered in 2021 and 2026.	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is greater than 1ha for non-dwelling development. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
141	Chelmsford City Council	Strategic Growth Site 3d: East Chelmsford - Land North of Maldon Road	Chelmsford City Council	Around 50 residential dwellings	1.17	Proposed Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
142	Chelmsford City Council	Strategic Growth Site 1a - Chelmer Waterside	Chelmsford City Council	Six sites with total potential for 1,000 residential dwellings	2.56	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
143	Chelmsford City Council	Strategic Growth Site 1b - Former St Peter's College Fox Crescent	Chelmsford City Council	Around 185 residential dwellings, two new SEND schools	4.40	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
144	Chelmsford City Council	Strategic Growth Site 1e - Former Royal Mail Premises, Victoria Road	Chelmsford City Council	Around 150 residential dwellings and childcare nursery	2.96	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	Childcare Nursery sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
145	Chelmsford City Council	Strategic Growth Site 1f - Riverside Ice and Leisure Land, Victoria Road	Chelmsford City Council	150 residential dwelling	2.98	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
146	Chelmsford City Council	Strategic Growth Site 1e - Civic Centre Land, Fairfield Road	Chelmsford City Council	Around 100 residential dwellings	3.72	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
147	Chelmsford City Council	Strategic Growth Site 1f - Eastwood House Car park, Glebe Road	Chelmsford City Council	Around 100 residential dwellings	3.48	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
148	Chelmsford City Council	Growth Site Policy GR1 -1g Chelmsford Social Club and Private Car Park, Springfield Road	Chelmsford City Council	Around 100 residential dwellings	2.88	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
149	Chelmsford City Council	Growth Site Policy 1h - Ashby House Car Parks, New Street	Chelmsford City Council	Around 100 residential dwellings	2.98	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
150	Chelmsford City Council	Growth Site Policy 1U – Rivermead, Bishop Hall Lane	Chelmsford City Council	Allocation for circa 80 new homes, with the potential for new bridges to Anglia Ruskin University and Springfield Hall Park connecting with the pedestrian and cycle network, and an improved pedestrian and cycle connection to Bishop Hall Lane.	3.08	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
151	Chelmsford City Council	Strategic Growth Site Policy 3A– East Chelmsford – Manor Farm	Chelmsford City Council	Allocation for circa 250 new homes, a new Country Park and new vehicular access road from Maldon Road into Sandford Mill.	1.22	Adopted Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
152	Chelmsford City Council	Strategic Growth Site Policy 3C – East Chelmsford, Land south Of Maldon Road	Chelmsford City Council	Allocation for circa 100 new homes.	1.39	Adopted Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No
153	Chelmsford City Council	Growth Site Policy 3D– East Chelmsford – Land North of Maldon Road (Residential)	Chelmsford City Council	Allocation for circa 50 new homes.	1.17	Adopted Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
154	Chelmsford City Council	Strategic Growth Site Policy 5b - Great Leighs - Land East of London Road	Chelmsford City Council	Allocation for circa 250 new specialist residential homes for elderly people.	7.31	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
155	Chelmsford City Council	Strategic Growth Site Policy 7C– Great Leighs– Land North and South of Banters Lane	Chelmsford City Council	Allocation for circa 100 new homes.	7.20	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
156	Chelmsford City Council	Strategic Growth Site Policy 7D - Great Leighs - Land East of Main Road	Chelmsford City Council	Allocation for circa 100 new homes.	7.17	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
157	Chelmsford City Council	Strategic Growth Site Policy 8 – North of Broomfield	Chelmsford City Council	Allocation for circa 450, including a new stand-alone early years and childcare nursery located in the southern portion of the site.	3.67	Adopted Allocation	Tier 3	Population and health	Yes	Included in scoping opinion feedback from Chelmsford City Council - the development used in the baseline modelling scenario for the junction 19 must take account of the recently adopted Chelmsford Local Plan (May 2020). Strategic Growth site 8 of the Adopted Local Plan for 450 new homes North of Broomfield, where a masterplan has now been approved by the City Council and where a planning application is expected before Christmas 2020. The City Council sees no rational for leaving the site out of the modelling baseline.	Childcare nursery sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
158	Chelmsford City Council	Strategic Growth Site Policy 9 – East of Boreham	Chelmsford City Council	Allocation for circa 143 new homes, with vehicular access from Plantation Road and provision of pedestrian and cycle connections.	0.30	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, noise, population and health, water	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	Potential beneficial effects for pedestrian and cycle links	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
159	Chelmsford City Council	Strategic Growth Site Policy 13 – Danbury	Chelmsford City Council	Allocation for circa 100 new homes.	5.11	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
160	Chelmsford City Council	09/01314/EIA	Countryside Zest (Beaulieu Park) LLP	Outline application for mixed use development including dwellings (approximately 3,600), business park, retail, hotel, leisure, education & community etc.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This is a duplication of ID 7 above. Application documents date back to 2009 and approved in 2014. In March 2020 a 'First Viability Review' was undertaken after meeting the required threshold for 1,400th residential unit. A Second Viability Review is to be undertaken prior to the implementation of the 2,400th unit. It is currently being constructed and includes proposals to improve junction 19. Highways England is working with the developer to understand how the developer's proposals tie in with the proposed scheme. There is also planning permission approved for construction of a new railway station to serve the proposed Beaulieu Park development. There is potential for significant effects	N/A	No (duplicated ID 7)
161	Chelmsford City Council	10/00021/EIA	Countryside Zest (Beaulieu Park) LLP	Outline application with all matters reserved for new railway station and associated development.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	The development a new railway station is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
162	Chelmsford City Council	16/00312/EIASO	Mr Nick Bowen	EIA Screening Opinion in respect of proposed Radial Distributor Road (RDR) Phase 3.	0.00	EIA Screening Request Sought	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Screening opinion dates back 2016 and with subsequent decision that not EIA development. However, there are 414 documents / planning applications related with this screening opinion. The construction of a Radial Distributor Road is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
163	Chelmsford City Council	15/01581/FUL	Mr David Hourd	New 400kV Gas-Insulated Substation.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application documents date back to 2015 / 2016. It is assumed this development has or will be completed prior to commencement of the proposed scheme. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. Due to the proximity to the proposed scheme and potential for operational effects on landscape and visual, there is potential for significant cumulative effects.	N/A	Yes - Operation only
164	Chelmsford City Council	16/00911/FUL	Mr David Hourd	New 400kV Air-Insulated Substation.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application documents primarily date back to 2016 and discharge of conditions documents dated 2017 / 2018. It is assumed this development has or will be completed prior to commencement of the proposed scheme. There are no anticipated cumulative effects during the construction phases. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. Due to the proximity and potential for operational effects on landscape and visual, there is potential for significant cumulative effects.	N/A	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
165	Chelmsford City Council	16/00713/EIASO	Pegasus Planning Group (agent name)	EIA Screening Opinion in respect of proposed construction of an AD plant.	0.00	EIA Screening Request Sought	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Screening opinion dates to 2016 with subsequent decision that the development is not EIA development. Related application 16/01833/CM dating back to 2016 which was refused by Essex County Council in December 2016.	N/A	No
166	Chelmsford City Council	14/01552/OUT	Mr Ivor Beamon	Residential development of up to 145 residential dwellings.	0.30	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, noise, population and health, water	No	Application dates to 2014 and was approved in 2015 following appeal. Development is in the process of discharging conditions. It is assumed this development has been or will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
167	Chelmsford City Council	13/00973/EIASO	Not Available	EIA Screening Opinion in respect of a proposed Solar PV Project.	0.16	EIA Screening Request Sought	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Screening opinion dates back 2013 and it was subsequently decided that this is EIA development on the basis that the proposed solar farm lies in an area of archaeological interest with cropmarks of linear features including a possible prehistoric enclosure (EHER 5767). The site is also adjacent to the Registered Garden of Boreham House and the conservation area of the Chelmer and Blackwater Navigation. An EIA for this site should include an archaeological and cultural heritage assessment. Although there are a further 19 related cases for this property, none where identified for the Solar PV Project. It is assumed this project did not progress further than the screening opinion.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
168	Chelmsford City Council	17/02165/OUT	Countryside Zest (Beaulieu Park) LLP	Alignment connecting the Radial Distributor Road (RDR) Phase 3 to the RDR Phase 2B Roundabout 5, to the Boreham interchange at Roundabout 6. Including footpath/ cycleway, a steel framed bridge and the associated and ancillary development.	1.00	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
169	Chelmsford City Council	17/02039/REM	Countryside Zest (Beaulieu Park) LLP	Radial Distributor Road (Phase 2B), including one new roundabout and one signal junction, one signal crossing, provision of cycle, pedestrian and bridleway crossings, landscaping and associated and ancillary development.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
170	Chelmsford City Council	18/01378/REM	Countryside Zest (Beaulieu Park) LLP	Radial Distributor Road (Phase 2C), including schools access road, cycle/ pedestrian paths and associated infrastructure.	0.93	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
171	Chelmsford City Council	16/01471/REM	Countryside Zest (Beaulieu Park) LLP	Demolition of existing buildings and construction of 266 houses and 55 apartments, car parking, landscaping and associated and ancillary development (amended by 19/00590/MAT for the addition of 1 no. one-bed residential apartment).	1.32	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
172	Chelmsford City Council	19/00586/REM	Countryside Zest (Beaulieu Park) LLP	Construction of 118 houses (Zones M, N & Q:) with associated infrastructure, servicing, landscaping, and car parking.	1.35	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
173	Chelmsford City Council	19/00581/REM	Countryside Zest (Beaulieu Park) LLP	Construction of 300 dwellings (Zones K and L) with associated infrastructure, servicing, landscaping, and car parking spaces.	1.52	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
174	Chelmsford City Council	19/01722/SCOPE	Countryside Zest (Beaulieu Park) LLP	EIA Scoping opinion for the proposed Development at Beaulieu Station Hub.	0.00	EIA Scoping Opinion Sought	Tier 2	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Included in scoping opinion from Essex County Council - Beaulieu Railway Station scheme. Main construction works for the station are anticipated in 2023, with the station opening 2025 / 2026. The new Beaulieu Railway station will provide access to the Great Eastern Main Line (GEML) and allows trains to be able to pass each other at the new station to make the whole line more reliable. It will relieve crowding at Chelmsford railway station and act as a transport interchange to encourage sustainable travel by bus, cycle, electric vehicles and on foot to strategic and local housing development. There will be a change in car parking provision.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
175	Chelmsford City Council	16/02194/REM	The Home Group	Construction of 240 dwellings, open space, hard and soft landscaping and associated highways and infrastructure works.	1.57	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dates to 2016 and approved in 2017. Details pursuant to Condition 1 of outline planning permission (Ref: 10/01976/OUT). It is assumed this development has now been completed. There are no anticipated cumulative effects with the proposed scheme during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. Due to proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that operational effects could have cumulative effects.	N/A	Yes - Operation only
176	Chelmsford City Council	19/01998/REM	Countryside Zest (Beaulieu Park) LLP	Construction of 111 dwellings (Zones O & P) with associated infrastructure, servicing, landscaping and car parking.	1.18	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
177	Chelmsford City Council	20/00207/REM	Countryside Zest (Beaulieu Park) LLP	Development of a bridge connecting the Hanson Roundabout to the Generals Lane Roundabout, crossing over the A138 on-slip to the A12 and existing railway line	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
178	Chelmsford City Council	20/00840/SCOPE	Barton Willmore	Request for an EIA scoping opinion for: up to 205 dwellings (Parcels 3c and 3d), up to 8,500m^2 of commercial use (3b), provision of a day care nursery (3b), and safeguarded land for Sandon Park and Ride.	0.00	EIA Scoping Opinion Sought	Tier 2	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water		Scoping Report provided - request for scoping opinion. 205 dwellings, up to 8,500 sq. m of commercial use and provision of day nursery. This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	Nursery sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation
179	Chelmsford City Council	17/00221/REM	Countryside Zest (Beaulieu Park) LLP	Construction of the Radial Distributor Road (Phase 2a), including two new roundabouts, provision of cycle and pedestrian crossings, substation, landscaping and associated and ancillary development.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	The construction of a Radial Distributor Road is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
180	Chelmsford City Council	17/00310/EIASO	Countryside Zest (Beaulieu Park) LLP	EIA Screening Opinion for Zone E development comprising the construction of 193 houses, with associated infrastructure, servicing, landscaping, and car parking.	0.00	EIA Screening Request Sought	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	This EIA Screening Request is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
181	Chelmsford City Council	17/02039/REM	Countryside Zest (Beaulieu Park) LLP	Construction of the Radial Distributor Road (Phase 2B), including one new roundabout and one signal junction, one signal crossing, provision of cycle, pedestrian and bridleway crossings, landscaping and associated and ancillary development.	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	The proposed construction of a Radial Distributor Road is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
182	Chelmsford City Council	17/02165/OUT	Countryside Zest (Beaulieu Park) LLP	Construction of the alignment of the Radial Distributor Road (RDR) Phase 3 to connect the RDR Phase 2B Roundabout 5, to the Boreham interchange at Roundabout 6. Including a footpath/cycleway, a steel framed bridge (maximum height of 14m) together with associated and ancillary development.	0.93	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	The proposed construction of a Radial Distributor Road is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation
183	Chelmsford City Council	17/02006/REM	Countryside Zest (Beaulieu Park) LLP	North-South Greenway, Beaulieu: Creation of landscaped open space including, provision of primary and secondary cycleways, footpaths.	1.3	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Yes	This application is associated with a planning application for a large mixed-use development comprising residential development of up to 3,600 dwellings at Greater Beaulieu Park, Chelmsford (09/01314/EIA). Therefore, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
184	Chelmsford City Council	N/A	Essex Highways	Junction improvements to A1060/A114 Army and Navy roundabout (flyover removal completed)	3.30	Future Planned Highway Authority Scheme	Tier 3	Population and health	Possible	Whilst within the ZOI for population and health, it is considered unlikely that the development would have significant negative impacts on access. It is anticipated that junction improvements would aim to benefit the local access network as per relevant planning policies / strategies. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No
185	Chelmsford City Council	Chelmsford City Growth Package	Essex Highways	Chelmsford Growth Strategy (signage and technology improvements, Tindal Square/Market Road cycle lane, Writtle cycleway/Admiral Park bridge)	Variable - exact locations unknown	Future Planned Highway Authority Scheme	Tier 3	Population and health (other aspects to be considered once further details of scheme available)	Possible	Tindal Square/Market Road cycle lane, Writtle cycleway/Admiral Park bridge could provide significant beneficial effects during operation for cycling access.	N/A	Yes - Operation only
186	Chelmsford City Council	N/A	EDF Renewables and Padero Solar Ltd (Longfield Solar Farm)	Longfield Solar Farm - a new solar photovoltaic array generating station (500MW). North-east of Chelmsford and north of the A12 between Boreham and Hatfield Peverel.	0.00	Pre-Application Advice Sought	Tier 3	Population and health (other aspects to be considered once further details of scheme available)	Possible	Included in scoping opinion from the Planning Inspectorate - Longfield Solar Farm is a Nationally Significant Infrastructure Project (NSIP).	N/A	Yes - Construction and Operation
187	Colchester Borough Council	182220	Mersea Homes and Hills Residential	420 residential units	3.2	Submitted Application	Tier 1	Population and health	No	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3. Potential for significant construction and operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments, therefore the scope is only for matters relating to population and health.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
188	Colchester Borough Council	193163	The Churchmanor Estates Company plc	Retail unit and six-unit retail terrace (resubmission of 172935)	0.44	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dated 2019 and approved in 2020. This is large retail park (Stane Retail Park) development which also includes junction improvements along the A12. It is assumed construction has not yet started and there is potential for construction programmes to overlap. Given the size and proximity of the potential development there could also be potential for significant operational effects.	N/A	Yes - Construction and Operation
189	Colchester Borough Council	180045	Mr Matthew Parsons	Demolish existing buildings and redevelop to create 262 residential dwellings	7.64	Approved Application	Tier 1	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3. Potential for significant construction and operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	Yes - Construction and Operation
190	Colchester Borough Council	100502	HCA & North Essex Partnership	248 residential units	8.19	Approved Application	Tier 1	Population and health	No	Application documents primarily date back to 2010. There are several documents thereafter concerning discharge of conditions. No documents concerning cycling or other benefits were identified. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
191	Colchester Borough Council	152733	C/O Agent - Miss Sophie Jenkinson	Reserved matters application following outline approval (730 residential dwellings)	8.20	Approved Application	Tier 1	Population and health	No	This application appears to be related to application 100502. There are several documents concerning applications to discharge conditions. No documents concerning cycling or other benefits were identified. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
192	Colchester Borough Council	190665	Colchester Borough Council	Healthcare campus including 300 older people's homes, hospital, medical centre and care home	9.20	Submitted Application	Tier 1	Population and health	No	The Transport chapter of the Environmental Statement for this development found that no likely significant traffic, transport, and access effects have been identified. Whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	Hospital and care home sensitive receptors - operation highlight to air quality / noise team	No
193	Colchester Borough Council	121272	Countryside Annington (Col) Ltd	Mixed use development including 1,137 residential dwellings, residential care (120 beds), retail/commercial/community uses, primary school and early years childcare and new relief road	7.79	Approved Application	Tier 1	Population and health	No	Development is in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
194	Colchester Borough Council	121949	Moritz llg	Solar park (36.54 ha)	0.09	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2012 and was approved in 2013. Development was discharging conditions in 2014. It is assumed this development has been completed. No anticipated likely significant cumulative effects during construction or operation. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
195	Colchester Borough Council	O/COL/01/0009	Mr Anthony Middlebrook	2,600 dwellings, mixed uses(retail, leisure, employment) and transport improvements	5.60	Approved Application	Tier 1	Population and health	No	Application dates to 2001 and was approved 2003. This is a large development which has been discharging conditions. There are no further documents beyond 2018. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
196	Colchester Borough Council	180873	Mr Davies	57 new residential properties	1.80	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dates to 2018 and was approved 2019. This is a relatively small development which is discharging planning conditions. It is assumed this development has been or will be completed prior to construction of the proposed scheme in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
197	Colchester Borough Council	172438	Essex County Council	New 200 place school	2.30	Submitted Application	Tier 1	Population and health	Possible	Application dates to 2017 and although shown valid, there has not been a decision noted on the planning portal. There are several online comments regarding the proposal for a school but no other associated documents. It is not clear if or when the school will be constructed. There may be some potential for localised traffic effects. However, it is considered that whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No
198	Colchester Borough Council	152826	C/O Agent Mr Nick Wanstall	93 dwellings	1.90	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dates to 2016. There are subsequently several documents relating to discharge of planning conditions in 2017/ 2018. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
199	Colchester Borough Council	172363	Mrs Natalie Webb	10 residential units	1.03	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Planning application/approval in 2018. Due to the relatively small size it is assumed this development has or will be completed prior to commencement of the proposed scheme. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
200	Colchester Borough Council	121041	O & H Properties Ltd	Resubmission of O/COL/02/0980 to extend the time limit for implementation	1.30	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Planning application dates to 2016. There are several subsequent applications for discharge of planning conditions. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
201	Colchester Borough Council	182570	Tollgate Partnership Ltd	External alterations to existing retail units, erection of one new retail unit and new service access road	1.10	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	The development is relatively small scale and is anticipated to be complete prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. Scale and nature unlikely to have significant cumulative effects.	N/A	No
202	Colchester Borough Council	192209 & 191716	Essex County Council	Primary school for 420 pupils	1.30	Application Approved	Tier 1	Landscape, biodiversity, population and health, water	No	No results found on planning portal - taken forward to Stage 3 as a precaution and will be checked with the LPA.	N/A	Yes - Construction and Operation
203	Colchester Borough Council	181859	C/O Agent Mr Matthew Parsons	102 residential dwellings	0.22	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Planning application dates to 2018. There are several subsequent applications for discharge of planning conditions which have been approved. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	Provision for cycle parking	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
204	Colchester Borough Council	201065	C/O Agent Mr Ben Shaw	2-year temporary change of use of vacant land to install pop up cinema	1.10	Submitted Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dated 2020 for a temporary change of use of vacant land for two years to enable the installation for a pop-up cinema with associated facilities which include a mobile projection unit, food stands, retail, and WCs. There are no anticipated cumulative effects during the construction phase. This development is less than the 1ha threshold for non-dwelling development. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
205	Colchester Borough Council	145494	C/O Agent Mr Michael Smith	358 new residential dwellings	0.23	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application and approval dates to 2014 / 2015. There are several subsequent applications for discharge of planning conditions up to 2018. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
206	Colchester Borough Council	200995	Mr Michael Siggs	31 residential dwellings	0.46	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Unlikely	Application dated 2020, but not yet decided/approved. Assuming progresses to construction this is a relatively small development of houses. Based on an assumed completion rate of 50 houses per year it is anticipated to be complete prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
207	Colchester Borough Council	200968	Michael Finlay	Repair/conversion of existing buildings to provide 36 residential units	0.30	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Unlikely	Application dated 2020, but not yet decided/approved. Assuming progresses to construction this is a relatively small redevelopment of existing buildings. It is anticipated to be complete prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
208	Colchester Borough Council	201236	Ms S Harrison	49 residential dwellings	0.55	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Unlikely	Application dated 2020, but not yet decided/approved. Assuming progresses to construction this is a relatively small development of houses. Based on an assumed completion rate of 50 houses per year it is anticipated to be complete prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
209	Colchester Borough Council	190699	Mr Taylor	Business park (3,009m^2 of offices)	0.29	Submitted Application	Tier 1	Cultural heritage, landscape, biodiversity, noise, population and health, water	Yes	Application is dated 2019 and was subsequently approved. The site is approx. 1.1 ha with a proposal for 32 new office units. The proposal includes 40 covered cycle parking and 178 parking spaces. To the north, the A12 provides vehicle commuting to the site, with the nearest junction located only one mile (1.6km) away via the Prince of Wales Roundabout in Marks Tey. The development is relatively small and with good design is unlikely to give rise to significant environmental effects during operation. However, there is potential for construction programmes to overlap and the proximity to the A12 means there could be potential for effects during construction.	N/A	Yes - Construction
210	Colchester Borough Council	181137	Mosum Ltd	Internal and external alterations and extensions to existing hotel	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2018 and was subsequently approved. This is a small redevelopment/extension to an existing building. It is assumed this development has been completed. There are no anticipated likely significant cumulative effects in construction or operation.	N/A	No
211	Colchester Borough Council	200388	Marks Tey Ltd.	Site redevelopment to provide new/replacement buildings for employment	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dated 2020, but not yet decided/approved. The site is 5 hectares and is located to north of Old London Road, which runs adjacent to the A12 and is accessed from the A12. Assuming redevelopment of the site gains approval there is potential for construction programmes to overlap. There is also potential for cumulative impacts within the ZOI. Due to the proximity to the proposed scheme, the size of the development and potential for construction overlap, there is potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
212	Colchester Borough Council	190760	Mrs Amanda Otto	Conversion of redundant stables to office/pharmacy	1.50	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dated 2019 and was subsequently approved. Conversion of redundant stables to office/pharmacy to be used in connection with established clinical use. There are no anticipated cumulative effects during the construction phase. This development less than the 1 ha threshold for non-dwelling development. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
213	Colchester Borough Council	190043	C/O Agent Michael Smith	119 residential dwellings in five apartment blocks	6.44	Submitted Application	Tier 1	Population and health	No	This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
214	Colchester Borough Council	190522	Bloor Homes (Eastern)	150 residential dwellings	5.50	Approved Application	Tier 1	Population and health	No	5.5km from the proposed scheme so only in the ZOI for population and health. This development only just meets the threshold for screening EIA development under the EIA Regulations. Whilst within the ZOI for population and health, the nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No
215	Colchester Borough Council	193163	The Churchmanor Estates Company plc	Retail park comprising retail and restaurant units	0.44	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dated 2019 and approved in 2020. This is large retail park (Stane Retail Park) development which also includes junction improvements along the A12. It is assumed construction has not yet started and there is potential for construction programmes to overlap. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
216	Colchester Borough Council	Policy WC2: Stanway	Colchester Borough Council	630 residential dwellings	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
217	Colchester Borough Council	Policy WC2: Stanway	Colchester Borough Council	150 residential dwellings	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
218	Colchester Borough Council	Policy WC2: Stanway	Colchester Borough Council	Up to 200 residential dwellings at land between Tollgate West and London Road (former Sainsbury's Site)	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
219	Braintree District Council	Site Ref: RIVE 364 Policy Ref: LPP 4	Braintree District Council	Special Employment Area for emergency services at Kelvedon Park	0.00	Proposed Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Allocated land approximately 3.35 acre. This allocation is for greater than 1ha for non-residential development. LPA has advised that there is currently no planning permission. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	Emergency services sensitive receptor - operation highlight to air quality / noise team	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
220	Colchester Borough Council	Site Allocation 1 - Land north of Hospital Approach and south of Woodhouse Lane	Colchester Borough Council	Greenfield site allocated for 150-200 new residential dwellings	3.58	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
221	Colchester Borough Council	Site Allocation 4 - Land north of Copperfield Road	Colchester Borough Council	Network of small agricultural fields allocated for residential development (220-270 dwellings).	4.24	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
222	Colchester Borough Council	Site Allocation 17 (CP22)	Colchester Borough Council	This site allocation will provide employment development of around 5,000m^2 of new B1 floorspace as part of a new office/business park which is expected to be delivered in 2021 and 2026.	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This allocation is for greater than 1ha. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
223	Colchester Borough Council	Policy SS5: Eight Ash Green	Colchester Borough Council	150 dwellings (preferred site allocated by Neighbourhood Plan)	0.60	Adopted Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water	Possible	This allocation is for 150 dwellings. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
224	Colchester Borough Council	Policy WC1: Stanway Strategic Economic Area	Colchester Borough Council	Land safeguarded for economic/employment uses	0.45	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, population and health, water		This allocation is for greater than 5ha of land. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
225	Colchester Borough Council	Site Allocation 2 - Land north of Copperfield Road	Colchester Borough Council	150-200 residential dwellings, relocation and expansion of Broomfield Primary School and associated community facilities	3.01	Adopted Allocation	Tier 3	Population and health	Possible	This allocation is for greater than 150 dwellings. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially have a significant cumulative effect on population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation
226	Colchester Borough Council	Boxted Neighbourhood Plan	Colchester Borough Council	Provision of dwellings with minimum of 25% affordable housing	3.01	Adopted Allocation	Tier 3	Population and health	Possible	Boxted is in rural location and whilst the Neighbourhood Plan (NP) supports the Essex Public Rights of Way Improvement Plan, the discussion of cycling provision is largely confined to improvements/designation to existing right of way within the parish. Connections into the wider network for Boxted pose difficulties where non-car travellers and those using vehicles are forced to share road space. It is assumed the whole development area is greater than 5ha. It is not known if the construction programme for this development would overlap with the proposed scheme starting in 2023, but it is considered possible. In addition, since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects for population and health and so is being taken through to stage 3.	N/A	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
227	Colchester Borough Council	Myland and Braiswick Neighbourhood Plan	Colchester Borough Council	Provision of houses, commercial, schools, mixed use and open space area as part of North Colchester Growth Area.	8.19	Adopted Allocation	Tier 3	Population and health	Possible	The Myland and Braiswick Neighbourhood Plan (NP) was adopted in 2016 and is dated until 2032. As a precautionary measure it can be assumed that construction programmes could overlap. The NP mentions the Severalls Phase 2 site as having outline planning permission for housing. It is assumed that this allocation is for the Northern Gateway and is a continuation of planning application 100502 for phase 1 (completed). The Northern Gateway site, although primarily focussed on sport and leisure, will also accommodate some housing and is also mentioned in the NP. Improved cycle, walking and bridleway routes to prime destinations are important actions. The focus being to improve pedestrian and cycle access to Colchester Town Centre. Development is outside of the ZOI for other environmental aspect assessments. There are no anticipated cumulative effects with the proposed scheme during the construction phase but the potential for any operational effects will be considered for the aspect of population and health.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Operation only
228	Colchester Borough Council	West Bergholt Neighbourhood Plan	Colchester Borough Council	120 dwellings divided between two sites	1.17	Adopted Allocation	Tier 3	Landscape, biodiversity, population and health, water	Possible	The West Bergholt Neighbourhood Plan (NP) will be for the period from 2018 to 2033. The NP doesn't mention any specific planning applications but does provide areas suitable for residential properties. There is limited information, and it is possible construction programmes could overlap. It is assumed that any current planning applications related to the West Bergholt NP have already been captured separately within this Stage 2 shortlisting process and assessed accordingly as to whether being progressed to Stage 3.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
229	Colchester Borough Council	Copford and Copford Green Allocation SS4	Colchester Borough Council	50 dwellings at Hall Road and 70 dwellings at Queensberry Avenue	0.21	Proposed Allocation	Tier 3	Cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
230	Colchester Borough Council	Great Tey Allocation SS8	Colchester Borough Council	10 dwellings at Brook Road and 30 dwellings at Greenfield Drive	2.77	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
231	Colchester Borough Council	Great Horkesley Allocation SS7	Colchester Borough Council	80 dwellings at Great Horkesley Manor and 13 dwellings at School Lane	6.09	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
232	Colchester Borough Council	North Colchester - Other Allocations NC3	Colchester Borough Council	70 dwellings	5.05	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
233	Colchester Borough Council	Fordham Allocations SS6	Colchester Borough Council	20 dwellings	4.15	Proposed Allocation	Tier 3	Population and health	Possible	This allocation is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed unlikely that there would be a significant cumulative effect on population and health.	N/A	No
234	Colchester Borough Council	90398	Mr N Moye	Construction of new headquarter office and a new nursery crescent building	0.04	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application / approval dates to 2009. It is assumed this development has been completed or was not subsequently constructed. There are no anticipated cumulative effects during construction. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
235	Colchester Borough Council	80194	Northumbrian Water Ltd	Construction of Wormingford Pumping Station	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2008. In 2011 there was a variation of condition for temporary construction access until April 2012 which was approved. No documents concerning cycling or other benefits were identified. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
236	Colchester Borough Council	81203	Magri Builders Limited	32 residential dwellings	0.01	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Planning application / approval dates to 2008. It is assumed this development has been completed. No documents concerning cycling or other benefits were identified. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
237	Colchester Borough Council	131471	AGM Plc	Two industrial buildings	0.31	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2013 and was subsequently approved. Development has been in the process of discharging conditions. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
238	Colchester Borough Council	81333	Tollgate Partnership Ltd	12 business units	0.82	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
239	Colchester Borough Council	130789	Tollgate Partnership Ltd	Mixed use development (business incubators, restaurant and drive through coffee shop)	0.77	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
240	Colchester Borough Council	100993	Sainsbury's and Tollgate Partnership	Erection of new food store (replacement of existing store) and petrol station	0.74	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Construction for this development has been completed. There are no anticipated likely significant cumulative effects during construction or operation due to the nature of the development.	N/A	No
241	Colchester Borough Council	121040	O&H Properties	Mixed use development comprising business, residential and leisure uses.	0.99	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application / approval dates to 2012. Compliance of conditions in 2014 / 2015. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phases. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
242	Colchester Borough Council	171529	Gladman Developments Ltd.	150 dwellings	1.39	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dates to 2017 and approved in 2019. Development appears to be in process of discharging conditions. Based on an assumed completion rate of 50 houses per year it is anticipated to be complete or in final stages of completion prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. Due to proximity to the A12 and the development exceeding the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that operational effects could have cumulative effects.	N/A	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
243	Colchester Borough Council	101255	Mr Sean Cooke	Nursery building	0.52	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dates to 2010 and is a relatively small development. It is assumed that construction is completed or did not go ahead. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
244	Colchester Borough Council	161380	Mr Stuart McAdam	176 residential dwellings	0.17	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2016 with subsequent discharge of conditions documents during 2017 / 2018. It is assumed this development is under construction or completed. There are no anticipated cumulative effects during the construction phase. Potential for operational effects since scale of development is over EIA thresholds.	N/A	Yes - Operation only
245	Colchester Borough Council	110736	Mr J.I.S Mason	Retrospective application for new units for storage use and use of existing units for office/storage use	0.34	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Construction for this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
246	Colchester Borough Council	150945	The Churchmanor Estates Company plc	One restaurant unit and two drive through restaurant/café units	0.56	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Approved after appeal, application dates back to 2016 with subsequent discharge of condition documents during 2017 and 2018. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
247	Colchester Borough Council	151479	Pippa Cheetham	65 residential dwellings	1.01	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dates back 2015 and was approved in 2016. This a relatively small development which has been discharging conditions. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No
248	Colchester Borough Council	172935	The Churchmanor Estates Company plc	Retail unit, retail terrace, two supermarkets and restaurant units	0.45	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dated 2019 and was approved in 2020. This is a large retail park (Stane Retail Park) development which also includes junction improvements along the A12. It is assumed construction has not yet started and there is potential for construction programmes to overlap. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation
249	Colchester Borough Council	145133	Push Energy Ltd & Mr J Strathern	Change of use of land from (1) agriculture to (2) mixed use for agriculture and use of the generation of renewable energy (solar).	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2014 and was subsequently approved. Development has been discharging conditions. It is assumed this development has been completed. There are no anticipated likely significant cumulative effects during construction or operation due to the nature of the development. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
250	Colchester Borough Council	181846	Mrs Burwood and Go Homes Ltd	25 residential dwellings	0.66	Refused Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application refused and the subsequent appeal dismissed in June 2019.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
251	Colchester Borough Council	190647	Marden Homes Ltd	150 residential dwellings	1.40	Application Approved	Tier 1	Landscape, biodiversity, population and health, water	Unlikely	Application dated 2019 and pending consideration. Assuming it progresses to construction and based on a completion rate of 50 houses per year there is potential for construction programmes to overlap during final stages of completion. Development requires demolition of existing buildings on the site and redevelopment to provide residential dwellings. Due to proximity to the A12 and that development meets the 150 dwellings threshold for screening EIA development under the EIA Regulations, it is possible that construction and operational effects could have cumulative effects.	N/A	Yes - Construction and Operation
252	Colchester Borough Council	ESS/40/18/BTE	Brice Aggregates Limited	Removal of two conditions on ESS/10/18/BTE (mineral extraction and ancillary use)	0.00	Submitted Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	No records found on the Colchester planning portal for either ESS/40/18/BTE or ESS/10/18/BTE.	N/A	No
253	Colchester Borough Council	192478	Mr Nigel Tedder (Agent)	20 residential dwellings	0.66	Refused Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application refused 6 January 2020.	N/A	No
254	Colchester Borough Council	172049	Mr Robert Eburne	100 residential dwellings	1.62	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	Unlikely	Application dates to 2017 but was not approved until 2020. This is a relatively small development which is in the process of discharging conditions. Based on an assumed completion rate of 50 houses per year it is anticipated that this development has or will be completed prior to 2023 construction start of the proposed scheme. There are no anticipated cumulative effects during the construction phase. This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design procedures it is deemed that there are unlikely to be significant operational cumulative effects.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
255	Colchester Borough Council	193134	Tollgate Partnership Ltd	Reserved matters application in accordance with permission 193133 (mixed use leisure and retail)	0.89	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Application dated 2020 for approval of reserved matters in accordance with application ref 193133 (S73) for: *'appearance, landscaping, layout and scale'*. Original application 150239 dates to 2015 for a large mixed-use development. There are a substantial number of documents and correspondence concerning this development including from Rt Hon Priti Patel (2018) advising that the development should go ahead. It is not clear if this development has now been approved or whether construction of the development has yet commenced. Assuming it has or will be approved there is potential for construction programmes to overlap with the start of construction in 2023. Given the size and proximity of the potential development there could be potential for significant effects.	N/A	Yes - Construction and Operation
256	Essex County Council	ESS/65/12/CHL	Essex County Council	Change of use of land to a Waste Transfer Station to include the erection of a building for the transfer/bulking of municipal waste.	0.17	EIA Scoping Opinion Sought	Tier 2	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Scoping opinion dates to 2013 and it was subsequently determined that EIA not required. Change of use of land to a Waste Transfer Station granted 2013. It is assumed this development has been completed. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
257	Essex County Council	Policy P1/ Site A46	Essex County Council	Preferred site for sand and gravel extraction - Coleman's Farm, Witham	0.00	Adopted Allocation	Tier 3	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Possible	Several allocations/applications identified at varying stages. This allocation is for 46ha and 2.5mt. Potential source of local construction materials. Due to the proximity of the development to the proposed scheme there is potential for cumulative operational effects.	Materials and waste, traffic	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
258	Essex County Council	ESS/39/14/BTE	Essex County Council	Extraction of sand and gravel.	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Application dates to 2016 with submission to discharge conditions in 2018. Pursuant to Conditions 42 (Soil Stripping Movements); 43 (Machine Movements) and 47 (Soil Storage Phasing) of planning permission ESS/39/14/BTE that was for the extraction of an estimated 2.5 million tonnes of sand and gravel. It is assumed that extraction has now been completed. Due to the proximity of the development to the proposed scheme there is potential for cumulative operational effects.	N/A	Yes - Operation only
259	Essex County Council	ESS/10/17/CHL	Eurovia Ltd	Continuation of inert waste recycling facility.	0.24	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application for continuation of inert waste recycling facility. Development/facility already exists. There are no anticipated cumulative effects during the construction phase. This is a continuation of use for waste recycling and so reflects the baseline situation, therefore not taken forward for cumulative effects assessment. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
260	Essex County Council	ESS/66/17/CHL/SO	Hanson Quarry Products Europe Limited	Continuation of development permitted by CHL/1019/87 ('Winning and working of sand and gravel')	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	Application dates to 2017 and approved 2018. Development / facility already exists and is a continuation of development permitted by CHL/1019/87 which was for winning and working of sand and gravel. There are no anticipated cumulative effects during the construction phase. This is a continuation of use for mineral extraction and so reflects the baseline situation, therefore not taken forward for cumulative effects assessment. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
261	Essex County Council	ESS/67/17/CHL/SO	Hanson Quarry Products Europe Limited	Continuation of development permitted by CHL/1890/87 ('Winning and working of sand and gravel, the erection of a processing plant and ready mix concrete and mortar plants, workshop and weighbridge and office.')	0.00	EIA Scoping Opinion Sought	Tier 2	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	Yes	EIA scoping opinion sought in 2017 and it was subsequently decided that EIA would be required for this development. Quarry activities are already operational at this site and are a continuation of development permitted by CHL/1890/87 which was for winning and working of sand and gravel. It is assumed the additional infrastructure required has been constructed. There are no anticipated cumulative effects during the construction phase. This is a continuation of use for mineral extraction and so reflects the baseline situation, therefore not taken forward for cumulative effects assessment. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
262	Essex County Council	CC/BTE/101/19	Essex County Council	New special educational needs (SEND) school. The application/red line area is 1.58ha, with approximately 1.25ha of the site proposed to be developed (the school building or hard surfacing associated with car parks/hard play area)	1.10	Approved Application	Tier 1	Landscape, biodiversity, population and health, water	No	Application dated 2019 and approved in 2020. Development is discharging conditions. Screening opinion in 2019 determined the development is not subject to EIA (CC/BTE/101/19/SO) - as a development proposal (a school) it is not considered that any such impacts resulting are likely to be particularly complex, in isolation or cumulatively with other (residential) development occurring in the locality. The likely impacts of the construction of the development itself are considered to be low, and the impacts of the operation of the school are considered to be minimal and of local significance It is assumed development will be completed prior to proposed scheme construction 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	School sensitive receptor - operation highlight to air quality / noise team	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
263	Essex County Council	ESS/10/18/BTE/11/1	Mr Simon Brice	Discharge of conditions application against Condition 11 (Plant Site Layout) of permission ESS/39/14/BTE (continuation of use of land for mineral extraction)	0.00	Approved Application	Tier 1	Air quality, cultural heritage, landscape, biodiversity, geology and soils, noise, population and health, water	No	Development is in the process of discharging conditions. It is assumed this development will be completed prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. This is a continuation of use for mineral extraction and so reflects the baseline situation, therefore not taken forward for cumulative effects assessment. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	N/A	No
264	Essex County Council	CC/CHL/14/20/SPO	Essex County Council	Chelmsford North East Bypass (CNEB) Phase 1: A single carriageway road between Roundabout 4 of the Beaulieu Park Radial Distributor Road (RDR1) and a new roundabout on the A131 at Chatham Green plus dualling of the existing A131 between Chatham Green and Deres Bridge roundabout.	0.85	EIA Scoping Opinion Sought	Tier 2	Cultural heritage, landscape, biodiversity, population and health, water	Yes	Included in scoping opinion feedback from Essex County Council. EIA Scoping Opinion sought in 2014 and subsequently decided that development would be subject to EIA. CNEB has not yet been constructed and is currently subject to environmental assessment. There are proposed improvements to J19 of the A12 resulting from the CNEB. It is likely the construction programme for the development could overlap with the construction programme for the proposed scheme starting in 2023. Therefore, there is potential for significant cumulative effects.	Traffic	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
265	Essex County Council	CC/COL/35/19	Essex County Council	Erection of 2-storey Primary School to accommodate 420 pupils (2-Form Entry), including outdoor play space, all-weather playing pitch, landscaping, cycle/scooter storage, staff parking and supporting infrastructure. 1.14ha.	1.00	Approved Application	Tier 1	Cultural heritage, landscape, biodiversity, population and health, water	No	Application dated 2019 and was subsequently approved. Development is in the process of discharging conditions. Screening Opinion (2019) determined that the development was not subject to EIA. Impacts of the construction of the development itself are low, and the impacts of the operation of the school are minimal and of local significance. It is assumed this development will be completed or in final stages of completion prior to commencement of the proposed scheme construction works in 2023. There are no anticipated cumulative effects during the construction phase. It is assumed that this development will be a baseline/future baseline receptor to be considered where relevant within respective aspect chapters.	School sensitive receptor - operation highlight to air quality / noise team	No
266	Maldon District Council	20/00427/OUT	Blenheim Consultancy Services Ltd and CML Microsystems PLC	Erection of B1/B2 Business Park and 60 residential units	4.00	Submitted Application	Tier 1	Population and health	No	Cycle parking provision is proposed along with pedestrian access that will be encouraged through several initiatives. The Travel Plan (April 2020) does not provide for any new or improved access provision for the wider network, instead using the existing network. There are no anticipated cumulative effects during the construction phase. It is assumed the whole development exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
267	Maldon District Council	19/00741/OUT	Countryside Properties & EC, MA & DC Watson & KL Watson-Knee	Residential development for 1,138 dwellings, residential care unit, primary school and early years childcare facility	4.30	Approved Application	Tier 1	Population and health	Possible	Application dated 2019 and was subsequently approved. This is a large mixed-use development subject to EIA. It is not clear if the development is under construction or has been constructed. The NTS summarised significance of impacts on pedestrian and cyclist amenity severance as being minor. The NTS states that *'in relation to pedestrian and cycle links, the Proposed Development includes for footways and cycle ways within the Application Site, including convenient crossing points along the Relief Road. In that context, it is considered that there would be a medium magnitude of effect, which combined with low sensitivity of routes, would have an effect of Minor significance and would be Beneficial in nature'*. It is assumed the whole development area exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	Potential minor beneficial effects for pedestrian and cycle links	Yes - Operation only
268	Maldon District Council	15/01327/OUT	Mr Nick Mann - Dartmouth Park Estates Ltd.	Residential development (320 homes), employment development (2000m^2) and new relief road to north of A414	8.00	Submitted Application	Tier 1	Population and health	No	Application dates to 2015 and was approved in 2016. This is a large residential and small-scale employment development subject to EIA. It is not clear if the development has been constructed. The NTS identifies that there would be pedestrian and cycle access throughout the development with linkages to the wider existing network and good connections with local facilities including schools, employment areas and shops. Assumed the whole development area exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	Potential beneficial effects for pedestrian and cycle links	Yes - Construction and Operation

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
269	Maldon District Council	15/00885/FUL	Persimmon Homes	145 residential dwellings	5.40	Approved Application	Tier 1	Population and health	No	This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects. Whilst within the ZOI for population and health, the distance and nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No
270	Maldon District Council	14/01103/OUT	CEG Land Promotions Ltd & Landowners	1,000 dwellings, employment area of 3.4 ha, primary school and 2 no. childcare facilities	8.00	Approved Application	Tier 1	Population and health	Possible	Application dates to 2014 and was approved in 2016. This is a large development subject to EIA. It is not clear if the development is under construction or has been constructed. The NTS concludes a negligible effect on pedestrian access during construction. The NTS identifies that there will be an onsite network of walking and cycling access routes connecting into the existing external networks. The NTS concludes a negligible effect on pedestrian access during construction. Assumed the whole development area exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
271	Maldon District Council	APP/X1545/W/19/3230267 15/00419/OUT	Countryside Properties (UK) Ltd &EC, MA and DC Watson, KL Watson Knee	Mixed use development including 1137 residential dwellings, residential care (120 beds), retail/commercial/ community uses, primary school and early years childcare and new relief road as well as associated supporting infrastructure and landscaping.	3.40	Approved Application	Tier 1	Population and health	Possible	Original application 15/00419/OUT dates to 2015 and was subsequently approved. This application is for compliance with conditions notification 15/00419/OUT allowed on appeal APP/X1545/W/19/3230267. This is a large development subject to EIA. It is not clear if the development is under construction or has been constructed. The NTS summarised significance of impacts on pedestrian and cyclist amenity and severance as being minor. The NTS states that *'in relation to pedestrian and cycle links, the Proposed Development includes for footways and cycle ways within the Application Site, including convenient crossing points along the Relief Road. In that context, it is considered that there would be a medium magnitude of effect, which combined with low sensitivity of routes, would have an effect of Minor significance and would be Beneficial in nature'*. Assumed the whole development area exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	Potential minor beneficial effects for pedestrian and cycle links	Yes - Operation only

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
272	Maldon District Council	18/00071/FUL	Code-Development Partners	Variation of conditions on approved application (OUT/MAL/14/01103) for 1,000 dwellings, employment area (3.4 ha), local centre and primary school and early years childcare facilities	6.52	Approved Application	Tier 1	Population and health	Possible	Application is for compliance with condition notification 18/00071/FUL. Variation of conditions on approved application OUT/MAL/14/01103 (14/01103/OUT, ID 354 above). This is a large development subject to EIA. It is not clear if the development is under construction or has been constructed. The NTS concludes a negligible effect on pedestrian access during construction. The NTS identifies that there will be an on-site network of walking and cycling access routes connecting into the existing external networks. Development area exceeds 1ha. Potential for significant operational cumulative effects in relation to population and health. Development is outside of the ZOI for other environmental aspect assessments therefore the scope is only for matters relating to population and health.	School sensitive receptor - operation highlight to air quality / noise team	Yes - Operation only
273	Maldon District Council	15/01327/OUT	Dartmouth Park Estates Ltd	320 dwellings, small scale employment (200m^2) and new relief road	6.20	Approved Application	Tier 1	Population and health	Possible	Assumed to be a duplication of application with same application number (ID 352 on Long List).	N/A	No
274	Maldon District Council	Unknown	CGN and EDF Energy	Bradwell B new nuclear power station and associated infrastructure	Within 10km	Pre-Application Advice Sought	Tier 3	Population and health	Yes	Included in scoping opinion feedback from Essex County Council - applicant must consider Bradwell B Nuclear Power station. Essex Council notes that this development in-combination with the proposed scheme is likely to have many significant cumulative impacts on many aspects including the highway network across the County. Such cumulative impacts on the highway network and other aspect areas explored therefore need to be investigated.	Traffic	Yes - Construction and Operation
275	Tendring District Council	17/00859/OUT	Gladman Developments Ltd - Ivor Beamon	145 residential dwellings	8.50	Application Under Appeal	Tier 1	Population and health	No	This development is for less than 150 dwellings. Since this is below the applicable thresholds for screening EIA development under the EIA Regulations, with good design and construction procedures it is deemed that there are unlikely to be significant cumulative effects.	N/A	No

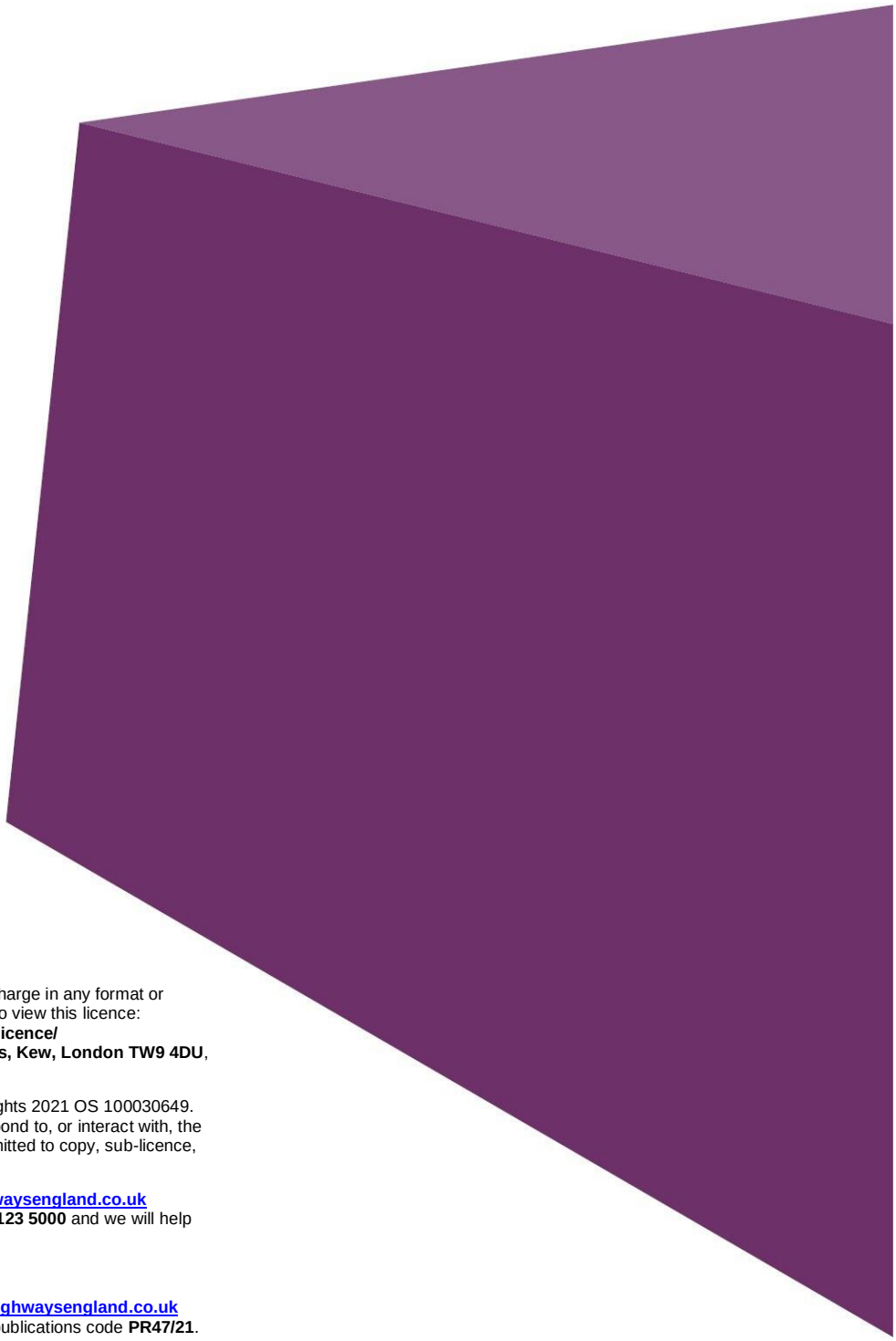
ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
276	Tendring District Council	18/02118/FUL	Mr Jon Cooper - Evolve Business Centre (Colchester) Ltd	The construction of 90 small B1 & B8 use commercial units with ancillary facilities, associated car parking and landscaping; and the construction of five commercial office blocks with B1 use with associated car parking and landscaping. 2.3ha.	9.00	Approved Application	Tier 1	Population and health	No	Application site area is 2.3ha. This allocation is for greater than 1ha for non-residential development. Since this meets the applicable thresholds for screening EIA development under the EIA Regulations, it is deemed that it could potentially result in significant cumulative effects for Population and Health and so is being taken through to stage 3.	N/A	Yes - Operation only
277	Tendring District Council	19/01939/OUT	Mr S Williams - SRC Aggregates and Hills Building Group	Proposed small business park development of B1, B2 and B8 storage. The construction of a new internal access from the existing access road, relocation of the existing temporary quarry office to a new building together with associated car and cycle parking	9.30	Approved Application	Tier 1	Population and health	No	Whilst within the ZOI for population and health, the scale, distance, and nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No
278	Tendring District Council	20/00594/FUL	Flying Trade Group PLC	Food storage and distribution facility and distribution warehouse, associated offices, parking, and logistics yard	9.30	Submitted Application	Tier 1	Population and health	No	Whilst within the ZOI for population and health, the scale, distance, and nature of the development means that no significant impacts on access are considered likely. Development is outside of the ZOI for other environmental aspect assessments.	N/A	No

ID (refer to Figure 16.1)	Local Planning Authority (LPA)	Application reference	Applicant or proponent	Brief description	Distance from scheme (km)	Application status	Tier	Within ZOI?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3?
279	Tendring District Council	19/00944/EIASCR	Turley	116 residential dwellings	8.30	EIA Screening Request Sought	Tier 3	Population and health	Possible	The Council has considered the development against the criteria set out in Schedule 3 of the regulations and has decided that EIA is not required. Given the relatively small scale of this proposal the development would not materially affect existing services or amenities subject to detailed design and/or S106 contributions. The proposals will include open space in line with the adopted Local Plan requirements. Assuming good design, this development is unlikely to give rise to significant environmental effects. It is outside of the ZOI for other environmental aspect assessments.	N/A	No

Appendix D2 Example of the CEA matrix to be completed and reported in the Environmental Statement

Assessment matrix (Planning Inspectorate Advice Note Seventeen, 2019). The assessment matrix will provide a means of summarising the potential adverse or beneficial cumulative effects of the proposed scheme with 'other existing development and/or approved development' and will be used to demonstrate that a systematic approach to CEA has been adopted.

ID	Tier	Application reference	Applicant for 'other development' and brief description	Assessment of cumulative effect with proposed scheme	Proposed mitigation applicable to proposed scheme including any apportionment	Residual cumulative effect



This document is also available on our website at **www.highwaysengland.co.uk**
For an accessible version of this publication please call **0300 123 5000** and we will help you.

If you have any enquiries about this publication email **info@highwaysengland.co.uk** or call **0300 123 5000***. Please quote the Highways England publications code **PR47/21**.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363