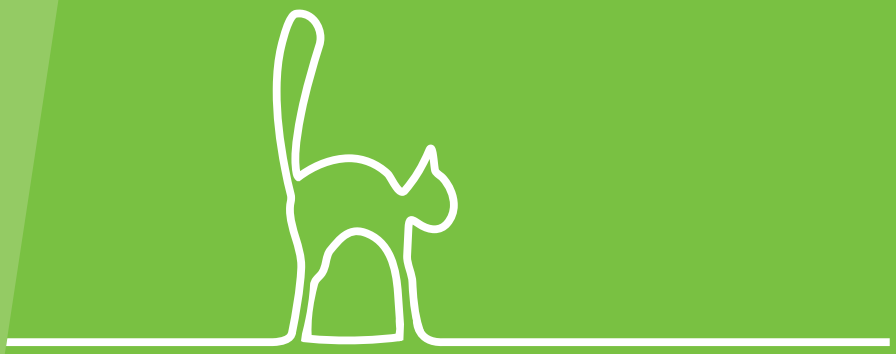
highways england

A428

Black Cat to Caxton Gibbet improvements

Preliminary Environmental Information report

Volume 1: Report



June 2019

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1. INTRODUCTION

1.1. Introduction to the Preliminary Environmental Information Report

Background

1.1.1. As the Government-owned company responsible for the operation, maintenance and improvement of England's motorways and major A-roads, Highways England is proposing to undertake improvements to the A428 between the existing Black Cat roundabout and Caxton Gibbet roundabout (the Scheme), located east of Bedford.

1.1.2. Highways England is planning to make an application for a Development Consent Order (DCO) to the Planning Inspectorate (the Inspectorate) for the Scheme in early 2020. The Inspectorate will examine the DCO application and will make a recommendation to the Secretary of State on whether development consent for the Scheme should be granted or refused.

1.1.3. A statutory process of Environmental Impact Assessment (EIA) is being undertaken for the Scheme to identify its likely significant effects on the environment, as required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) [REF 1-1].

Purpose

1.1.4. This Preliminary Environmental Information (PEI) Report presents the emerging results of the EIA process, and has been compiled by Highways England in accordance with their statutory pre-application consultation obligations under the Planning Act 2008 [REF 1-2].

1.1.5. PEI is defined in Section 12(2) of the EIA Regulations [REF 1-1] as:

"…information referred to in regulation 14(2) which –

(a) has been compiled by the applicant; and

(b) is reasonably required for the consultation bodies to develop an informed view of the likely significant effects of the development (and of any associated development).

1.1.6. This PEI Report accordingly provides:

a. a statement of the main environmental information gathered to date as part of the EIA process.

b. an indication of the likely effects on the environment resulting from the construction, operation and future maintenance of the Scheme.

c. a summary of the potential measures likely to be required to mitigate the environmental effects of the Scheme.

1.1.7. The information contained within this PEI Report has been produced to enable both specialist and non-specialist consultees gain an understanding of the likely environmental effects of the Scheme and to help inform their responses to statutory consultation (see Section 1.5).

1.1.8. In addition to supporting the statutory consultation, the information contained within this PEI Report will also be used by Highways England to support engagement with stakeholders, for example local landowners and businesses, statutory environmental bodies, relevant local planning authorities and local interest groups.

1.1.9. The information presented within this PEI Report is preliminary. It reflects the current design position of the Scheme and the status of the individual assessments being progressed as part of the EIA, and is subject to change following statutory consultation.

1.1.10. Feedback received from the statutory consultation will be considered within both the design of the Scheme and the EIA, the final outcomes of which will be reported in an Environmental Statement. The Environmental Statement will confirm the scale and significance of the Scheme's likely environmental effects and any measures required to mitigate those effects.

1.1.11. The Environmental Statement will form one of a number of documents comprising the DCO application.

1.2. Overview and Need for the Scheme

1.2.1. The A428 connects communities between St Neots and Cambourne and links the East of England to important regional, national and international hubs such as the Felixstowe and Harwich ports. The route also connects Bedford, Milton Keynes and the M1 motorway to Cambridge and the M11 motorway and is used by both local and long-distance traffic.

1.2.2. Between St Neots and Cambridge, the A428 is the only stretch of single carriageway along this route and motorists are subject to regular delays and congestion. There are also a high number of incidents along the route, with delays directly affecting journey times.

1.2.3. There is potential for significant growth in the local area, with new housing and transport developments likely to come forward in the near future which will exacerbate the current problems on this section of the road network.

1.2.4. The Department for Transport outlined in its Road Investment Strategy for the 2015-2020 period [REF 1-3] the case for "*improvement of the A428 near St Neots, linking the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge… The scheme is expected to include significant improvements to the Black Cat roundabout, where the A1 currently meets the A421*".

1.2.5. Since the announcement, Highways England has developed, consulted upon and assessed a range of different options for the Scheme (see Chapter 3), the purpose being to develop a solution that, on balance, best addresses the problems and issues associated with the A428 between the existing Black Cat and Caxton Gibbet roundabouts .

1.2.6. Following an evaluation of these options in 2017, Highways England confirmed its preferred route for the Scheme on 18 February 2019 (see Chapter 2).

1.2.7. In summary, the preferred route for the Scheme comprises the following key features:

a. An 18.6 kilometres long new dual carriageway, which will connect the Black Cat roundabout and Caxton Gibbet roundabout.

b. A new three tier junction at Black Cat roundabout, which will allow traffic to flow freely.

c. New junctions at Caxton Gibbet and Cambridge Road, which will connect the new dual carriageway to the existing A428.

d. A new Roxton Road link, which will connect Wyboston and Chawston.

e. New bridges crossing over the new dual carriageway at Roxton Road, Barford Road and Chawston.

f. New bridges over the River Great Ouse and the East Coast Main Line railway.

g. Retention of the existing A428 between St Neots and Caxton Gibbet, for local traffic and public transport.

h. Retention of existing bus stops on the A1.

i. All local roads will be maintained although direct access to the A1 from some roads will be removed for safety reasons.

j. Safer and alternative access to side roads at Chawston, Wyboston and Eltisley.

k. Safer routes for walkers, cyclists and horse riders, which will maintain links with existing public rights of way.

l. Better connections to St Neots town centre and train station.

1.3. Legislative and Policy Framework

Planning Act 2008

1.3.1. The Scheme is classed as a Nationally Significant Infrastructure Project (NSIP) under Section 22 of the Planning Act 2008[1] [REF 1-2] as, when constructed:

a. the highway will be wholly within England.

b. the Secretary of State will be the highway authority for the highway.

c. the area of development will be greater than the relevant limit set out in subsection (4) (the relevant limit being 12.5 hectares, as the speed limit for any class of vehicle is expected to be 50 miles per hour or greater).

1.3.2. The Planning Act 2008 [REF 1-2] sets out the statutory framework for orders granting development consent for NSIPs, and requires that certain bodies, groups and communities must be consulted as part of the pre-application process.

1.3.3. This PEI Report has been prepared in support of statutory consultation.

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

1.3.4. The Scheme qualifies for mandatory EIA as it comprises construction of a new road of four lanes and of 10 kilometres or more in a continuous length, as listed in paragraph 7(3) of Schedule 1 of the EIA Regulations [REF 1-1].

1.3.5. The EIA of the Scheme is being undertaken in accordance with the requirements of the EIA Regulations [REF 1-1].

National Policy Statement for National Networks

1.3.6. The National Policy Statement for National Networks (NPSNN) [REF 1-5] sets out the need for, and Government's policies to deliver development of, NSIPs on England's national road network. It forms the primary basis for making decisions of development consent for NSIPs in England.

1.3.7. As the Scheme comprises an NSIP relating to the national road network, the general principles of assessment and assessment methodologies contained within Section 4 and Section 5 respectively of the NPSNN [REF 1-5] are being referenced and adopted as part of the EIA, where appropriate, to ensure compliance with this policy document.

[1] Section 22 of the Planning Act 2008 [REF 1-2] was amended by The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013 [REF 1-4].

National Planning Policy Framework

1.3.8. The National Planning Policy Framework (NPPF) [REF 1-6] sets out the Government's planning policies for England and the requirements for the planning system.

1.3.9. Although NSIPs are determined in accordance with the decision-making framework set out in the Planning Act 2008 [REF 1-2] and relevant National Policy Statements for major infrastructure, the NPPF [REF 1-6] can be an important and relevant consideration in decisions on NSIPs.

1.3.10. Where relevant, the individual policies contained within the NPPF [REF 1-6] are being considered as part of the EIA.

1.4. Highways England

1.4.1. Highways England has been responsible for developing the objectives for the Scheme (see Chapter 2) and has appointed AECOM as the designer of the Scheme.

1.4.2. The roles and responsibilities of the designer include the preparation of the Scheme design, undertaking and reporting the EIA, undertaking consultation activities, and the preparation of the DCO application on behalf of Highways England.

1.5. Stakeholder Engagement and Consultation

Stakeholder Engagement

1.5.1. Effective stakeholder engagement and consultation has formed a fundamental part of the development of the Scheme from the initial identification and appraisal of route options through to the selection of a single preferred route.

1.5.2. Highways England has engaged a wide range of stakeholders as part of the development and assessment of the Scheme, the objectives being to inform and influence its design and record their views and feedback (and where practicable ensure their concerns are addressed).

1.5.3. Stakeholders engaged to date include landowners, statutory consultees, local communities and specialist interest groups. Engagement has involved meetings and workshops to discuss design and technical matters, for example the incorporation of facilities for walkers, cyclists and horse riders, as well as liaison with organisations, parishes and elected members to understand local issues and concerns.

1.5.4. Forums have been established to engage a range of stakeholders including both local and national groups, the aim being to bring together organisations and community representatives with shared interests in the Scheme. These have included, for example, council members' forums, environmental forums and community forums. Organisations invited to participate in the environmental forums include the Environment Agency, Historic England, Natural England and the Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire. Through the forums, these organisations have provided views and feedback on the Scheme.

1.5.5. Engagement has also taken place with other key stakeholders including local landowners and utility companies.

Non-Statutory Consultation

1.5.6. Highways England undertook non-statutory consultation on the Scheme between 6 March 2017 and 23 April 2017.

1.5.7. The purpose of this consultation was to seek feedback from stakeholders and the local community on the need to improve the journey between the existing Black Cat and Caxton Gibbet roundabouts to reduce congestion problems. Feedback was also sought on a number of route options for a new dual carriageway between these two roundabouts, and on design options for Black Cat junction.

1.5.8. A total of 4,189 responses were received during the consultation period, which were taken into account in the identification of the preferred route for the Scheme.

Consultation on the Scope of the Environmental Impact Assessment

1.5.9. Consultation undertaken to date with statutory bodies, non-statutory bodies and the public has been used to inform the scope of the EIA.

1.5.10. Under the provisions of the EIA Regulations [REF 1-1], Highways England requested a Scoping Opinion from the Secretary of State as to the form and nature of the environmental assessments to be undertaken within the EIA. The request was submitted to the Inspectorate on 2 April 2019 and was accompanied by a Scoping Report [REF 1-7] which set out Highways England's proposed approach to the EIA and the scope of the individual assessments to be undertaken.

1.5.11. The Inspectorate issued Highways England with the Secretary of State's Scoping Opinion [REF 1-8] on 13 May 2019.

1.5.12. The content of the Scoping Opinion [REF 1-8] and the comments received from consultees engaged as part of that process have been reviewed by Highways England. Chapter 4 summarises how this feedback will be used to shape and influence the general approach to the EIA and the content of the Environmental Statement, and Chapters 5 to 14 summarise the changes to the scope of the technical assessments to be reported within the Environmental Statement.

1.5.13. The Environmental Statement will include a schedule of the responses received within the Scoping Opinion [REF 1-8] and will identify how each of the comments has been addressed within the EIA.

Statutory Consultation

1.5.14. Statutory consultation on the Scheme will be undertaken over an eight week period, commencing 3 June 2019 and ending on 28 July 2019.

1.5.15. As part of this process, local communities will be consulted under Section 47 of the Planning Act 2008 [REF 1-1], the approach to which has been published in the Statement of Community Consultation for the Scheme [REF 1-9].

1.5.16. Methods of engagement that will be undertaken as part of the statutory consultation include the following:

a. Public exhibitions, at which members of the community can interact directly with members of Highways England's project team.

b. Publication of a consultation brochure and response form and other information made available in the local area and online.

c. Media advertisements, press releases and posters in local newspapers.

d. Engagement with local council and community forums.

e. Briefings to local stakeholders affected by the Scheme.

f. Social media.

1.5.17. Relevant local authorities, those with land interests and prescribed consultees will also be consulted under Section 42 of the Planning Act 2008 [REF 1-2]. This engagement is expected to be undertaken through a combination of correspondence, telephone calls and meetings.

1.5.18. This PEI Report will be available for review and comment throughout the statutory consultation period.

1.6. Structure, Scope and Context of the Preliminary Environmental Information Report

1.6.1. Volume 1 of this PEI Report is structured in the following manner:

a. Chapter 1 introduces the purpose of this PEI Report and provides an overview of the Scheme.

b. Chapter 2 describes the need for the Scheme and its objectives, the geographical location and environmental context of the Scheme, the Scheme's main components, and the planned approach to its construction and future maintenance.

c. Chapter 3 summarises the options and alternatives considered during the design-development of the Scheme.

d. Chapter 4 explains the approach to the EIA being undertaken.

e. Chapters 5 to 14 present the preliminary information gathered within the topic-specific assessments that are being evaluated as part of the EIA, with each setting out the existing environmental conditions, the likely effects on those conditions, and any proposed mitigation measures.

f. Chapter 15 presents the approach to, and the preliminary findings of, the cumulative assessment, which considers the interaction of the effects of the Scheme and those associated with other planned developments.

g. Chapter 16 summarises the main findings of the preliminary assessments.

h. Chapter 17 provides a list of documents, information sources and weblinks referenced.

i. Chapter 18 contains a glossary of terms and abbreviations used.

1.6.2. Volume 1 contains a single appendix (Appendix 6.1) which supports the cultural heritage assessment reported within Chapter 6.

1.6.3. The content of Volume 1 is supported by Volume 2, which comprises a separate document containing illustrative figures which place the Scheme in its environmental context.

1.6.4. A separate non-technical summary of the content of this PEI Report has been produced for wider readership.

1.7. Next Steps

1.7.1. Highways England will collect and analyse all responses to the statutory consultation prior to submitting the DCO application.

1.7.2. A record will be made of all responses received during the consultation period, and these will be taken into account as part of the ongoing design-development and EIA of the Scheme.

1.7.3. The responses received will be summarised within a Consultation Report, which will include a description of how the DCO application has been informed by consultee feedback and what changes have been made as a result.

1.7.4. Following submission of the DCO application, the Inspectorate will decide whether the DCO application meets the required standards to proceed to examination, and will determine whether the consultation undertaken by Highways England has been adequate.

1.7.5. Upon acceptance of the DCO application, the public will be able to make relevant representations about the Scheme and its likely environmental effects. These representations will then be considered by the Inspectorate as part of the examination of the DCO application, prior to a recommendation being made to the Secretary of State on whether development consent should be granted or refused.

1.7.6. Subject to the DCO being granted by the Secretary of State, construction is expected to start in late 2021 and the road is expected to be open in early 2025.

2. THE SCHEME

2.1. Background to the Scheme

Overview

2.1.1. England's strategic road network drives local, regional and national economic activity by enabling new housing and business developments to come forward, encouraging trade and attracting investment.

2.1.2. In 2013, the Government announced plans for the biggest ever upgrade of the strategic road network within Investing in Britain's Future [REF 2-1], which included proposals to significantly increase investment in road projects by 2020/2021. In 2015, the Department for Transport identified the need for improvements to the strategic road network in the Road Investment Strategy for the 2015-2020 period (RIS) [REF 2-2].

2.1.3. Within the East of England area, the RIS [REF 2-2] outlines the case for "*improvement of the A428 near St Neots, linking the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge… The scheme is expected to include significant improvements to the Black Cat roundabout, where the A1 currently meets the A421*".

Existing Problems

2.1.4. The A428 between Wyboston interchange and Caxton Gibbet in Cambridgeshire is the only remaining stretch of single carriageway between the two key economic hubs of Milton Keynes and Cambridge. The road carries twice the traffic it was designed for, and drivers suffer daily congestion, delays and incidents.

2.1.5. The existing Black Cat roundabout, where the A1 meets the A421 and the A428 near St Neots is a daily source of queues, delays and congestion. Similar problems exist at the Barford Road, Cambridge Road (St Neots) and Caxton Gibbet junctions.

2.1.6. Journey times between the Black Cat roundabout and the Caxton Gibbet roundabout are significantly longer in peak periods than in off-peak periods. This is a consequence of road sections and intermediate junctions reaching capacity, which results in delays along the route. There are also a high number of incidents, with collision clusters at both junctions.

2.1.7. Other problems identified on this part of the road network relate to the following:

a. Inadequate public transport options along the corridor, which has limited bus services and no parallel rail service provision.

b. A lack of viable alternative east-west routes between Cambridge and other economic centres such as Milton Keynes, Northampton and Bedford.

c. Poor provision for walkers, cyclists and horse riders (WCH).

d. Rat-running on local roads through villages (resulting from drivers seeking alternative routes to avoid the A428)

e. Junctions along the corridor operating close to, or at capacity.

f. Speeds on the single carriageway sections are significantly lower than those on the dual carriageway sections.

g. Low network resilience against accidents and incidents.

h. A lack of driver information along the corridor.

i. Safety and maintenance issues along the route.

j. Constrained economic growth, as a result of the above problems.

2.1.8. Significant traffic growth is predicted on the road network, with potential developments in surrounding areas expected to contribute to an increase in future traffic flows on the A428. Without improvement, these developments are likely to exacerbate the current problems of safety, congestion and journey reliability on the route and could inhibit growth in homes and jobs along the St Neots – Cambridge corridor.

Purpose and Objectives

2.1.9. The purpose of the Scheme is to address the identified issues of congestion, journey delays and accidents between the Black Cat and Caxton Gibbet roundabouts.

2.1.10. Based on the overarching objectives set out in the RIS [REF 2-2], the following objectives for the Scheme have been developed by Highways England to address the problems identified on this part of the strategic road network, and to take advantage of the opportunities that new and improved road infrastructure can deliver to local communities and the environment:

a. **Connectivity**: Cut congestion and increase capacity and journey time reliability between Milton Keynes and Cambridge.

b. **Safety**: Improve safety at junctions, side roads and private accesses by reducing traffic flows on the existing A428. Improve safety on the A1 by removing existing substandard side road junctions and private accesses onto the carriageway.

c. **Economic growth**: Enable growth by improving connections between people and jobs and supporting new development projects.

d. **Environmental improvements**: Maintain existing levels of biodiversity and have a beneficial impact on air quality and noise levels in the surrounding area.

e. **Accessibility**: Ensure the safety of walkers, cyclists and horse riders and those who use public transport by improving the routes and connections between communities.

f. **Resilience**: Improve the reliability of the road network so that it can cope better when accidents occur, without local roads being used as diversion routes.

g. **Customer Satisfaction**: Listen to what is important to our customers to deliver a better road for everyone and improve customer satisfaction.

2.2. Scheme Location

Location

2.2.1. Figure 1.1 within Volume 2 illustrates the geographic location of the Scheme. The Scheme will be implemented on land within the administrative areas of the following authorities, located in the east of England:

a. Huntingdonshire District Council.

b. South Cambridgeshire District Council.

c. Central Bedfordshire Council.

d. Bedford Borough Council.

e. Cambridgeshire County Council.

Existing Environment

2.2.2. The following sections describe the main designations, features and elements associated with the receiving environment, as illustrated on Figure 2.1 and Figure 2.2 within Volume 2.

Transportation

2.2.3. The A428 connects the Bedford Borough and the Central Bedfordshire unitary authorities with the districts of South Cambridgeshire and Huntingdonshire.

2.2.4. The A428 connects into the A1 Great North Road at the Wyboston interchange approximately 2 kilometres north of the Black Cat roundabout and runs in a broadly east – west direction for approximately 17 kilometres, before connecting into Caxton Gibbet roundabout, south of Papworth Everard.

2.2.5. Black Cat roundabout is a partially signalised at-grade roundabout that connects the A1 with the A421 and Bedford Road, south of Chawston. The roundabout comprises a two lane circulatory, with the eastern side of the junction having segregated lanes to separate A1 southbound traffic from A421 traffic. Although the existing roundabout was signalised and widened in 2015, congestion remains a problem and further improvements are now required.

2.2.6. The A421 continues west from the Black Cat roundabout through to the south of Renhold, bypassing the settlements of Great Barford and Roxton.

2.2.7. The A1 is a dual carriageway running in a north – south direction, the alignment of which lies broadly parallel with the River Great Ouse and the East Coast Main Line railway.

2.2.8. Between its junctions with the A1 north of the Black Cat roundabout and the A1198 at Caxton Gibbet roundabout, the A428 comprises a single carriageway road. The route is principally accessed from the local road network via its junctions with Barford Road (south of Eynesbury), the B1428 Cambridge Road (east of St Neots), and the B1040 St Ives Road (north and west of Eltisley). A number of smaller local roads, unnamed roads and farm access tracks also connect directly onto the A428.

2.2.9. The existing Caxton Gibbet roundabout comprises an at-grade roundabout that connects the A428 to the A1198. East from this roundabout, the A428 continues as a dual carriageway towards Cambridge.

2.2.10. The East Coast Main Line railway forms a key route on the national railway network and connects the larger settlements of St Neots (north of the A1/A428 junction) and Sandy (south of the Black Cat roundabout).

2.2.11. The existing roundabouts at Black Cat and Caxton Gibbet, and the A428 between Wyboston and Caxton Gibbet, have limited facilities for WCHs. A section of the Sustrans National Cycle Network Route 12 connects the village of Great Barford to the west of the Black Cat roundabout to St Neots, and passes close to the villages of Roxton, Chawston and Wyboston.

Landform, Topography and Soils

2.2.12. The area surrounding the A428 is characterised by varying landform. Local topography at the existing Black Cat roundabout, the A1 and the western extents of the A428 in the Wyboston locality is relatively flat and situated around 20m to 30m Above Ordnance Datum (AOD), rising gradually to around 40m AOD near the settlement of Great Barford to the west.

2.2.13. East of St Neots, the profile of the land gradually rises in elevation before reaching 65m AOD surrounding Caxton Gibbet roundabout. West of St Neots, the local topography generally lies between 30m to 40m AOD.

2.2.14. South of the A428, the topography of the wider landscape gradually rises to between 50m to 60m AOD, west of Abbotsley.

2.2.15. The majority of land along and surrounding the A428, and to the north and west of the existing Black Cat roundabout, is mapped on Natural England's Agricultural Land Classification Map: Eastern Region [REF 2-3] as being best and most versatile land, comprising Grade 2 soils. Small pockets of Grade 1 soils are located around the Chawston, Wyboston and Roxton locality. An area of Grade 3 soil is located to the east of Black Cat roundabout, associated with the Little Barford locality.

Settlement and Land Use

2.2.16. Land use is marked by a contrast of urban development within St Neots, Eynesbury and Eaton Socon on the western extents of the A428 against the more open landscapes and smaller settlements and farms along and surrounding the remainder of the A428.

2.2.17. The A428 predominantly passes through an area characterised by agriculture, comprising a pattern of agricultural fields and pockets of plantation woodland framed by a network of hedgerows and farm access tracks.

2.2.18. Built form associated with the A1 south of Eaton Socon comprises ribbon development within the settlements of Chawston and Wyboston north of the Black Cat roundabout, and the settlements of Tempsford and Church End south of the Black Cat roundabout. The village of Roxton located south west of the Black Cat roundabout comprises another area of settlement in proximity to the A1, with the larger village of Great Barford located further to the west along Bedford Road. Cambourne, located east of Caxton Gibbet roundabout, forms a substantial settlement adjacent to the dualled section of the A428.

2.2.19. The agricultural landscapes surrounding the A428 contain the dispersed villages of Little Barford, Abbotsley, Croxton, Eltisley and Caxton to the south, and the village of Yelling and the settlement of Papworth Everard to the north.

2.2.20. Commercial interests including hotels, plant nurseries, garages and local businesses are focused around the Black Cat roundabout, along the A1, and around Wyboston interchange. Further commercial interests including supermarkets and fast food outlets are located around the junction of the B1428 Great North Road at Little End, south of Eaton Socon. A number of individual business, residential properties and farms front onto the A428 to the east of St Neots.

2.2.21. Industrial land uses are characterised by a large electricity generating station situated east of the River Great Ouse (south of the B1043/A428 junction) at Little Barford, an industrial estate and depot adjacent to the electricity generating station, and an active aggregate quarry accessed from the existing Black Cat roundabout.

2.2.22. Recreational and leisure facilities include parkland associated with Croxton Park and Roxton Park, Wyboston Leisure Park and Golf Course, driving ranges, and the Abbotsley Hotel, Golf and Country Club.

Water

2.2.23. The River Great Ouse runs parallel to the A1 and the East Coast Main Line railway and comprises an important habitat and landscape feature due to its extensive floodplain. Parts of the floodplain are subject to mineral extraction operations.

2.2.24. Hen Brook and Fox Brook are tributaries to the River Great Ouse and join the river within St Neots. Both tributaries have an associated floodplain.

2.2.25. Other watercourses include the Rockham Ditch which crosses the A421 and Bedford Road south of the Black Cat roundabout, and South Brook which crosses the A1 south of Chawston.

Geology

2.2.26. The solid geology is characterised by the Oxford Clay Formation, formed of silicate mudstone with sporadic limestone beds.

2.2.27. There are superficial deposits and river terrace deposits associated with the River Great Ouse, comprising of sand and gravel, and alluvium deposits comprising of clay, silt, sand and gravel.

Environmental Designations

2.2.28. European sites comprise Eversden and Wimpole Woods Special Area of Conservation (SAC), located approximately 8.5 kilometres south of the Caxton Gibbet roundabout (designated for bats, particularly barbastelle bat (*Barbastella barbastellus*)), and Portholme SAC, located approximately 10 kilometres north of the settlement of Croxton (designated for its lowland hay meadows).

2.2.29. Nationally important ecological sites include the following:

a. Papworth Wood Site of Special Scientific Interest (SSSI) – located approximately 2 kilometres north of Caxton Gibbet roundabout.

b. Elsworth Wood SSSI – located approximately 1.8 kilometres north east of Caxton Gibbet roundabout.

c. St Neots Common SSSI – located approximately 3 kilometres north of Wyboston interchange.

d. Little Paxton Pits SSSI – located approximately 4.8 kilometres north of Wyboston interchange.

e. Little Paxton Wood SSSI – located approximately 5.2 kilometres north of Wyboston interchange.

2.2.30. Little Paxton Pits Local Nature Reserve comprises two separate areas of land to the east of Little Paxton, approximately 2.5 kilometres north of the B1428/A428 junction.

2.2.31. Stands of ancient woodland are located within or near to the settlements of Eltisley (approximately 900m south of the A428) and Papworth Everard (approximately 2.1 kilometres north of Caxton Gibbet roundabout). Further stands of ancient woodland are located approximately 1.7 kilometres north east of the Caxton Gibbet roundabout, approximately 3.3 kilometres east and 2.8 kilometres west of the Black Cat roundabout.

2.2.32. To the south west of the A428, a number of Scheduled Monuments are located within and in proximity to the settlements of Wyboston, Chawston, Tempsford, Roxton, Great Barford, Church End and Eaton Socon. Scheduled Monuments are also recorded south of the A428 near to the settlements of Croxton and Eltisley, and within Papworth

Everard north of Caxton Gibbet roundabout. Further sites are also located to the south of the Caxton Gibbet roundabout.

2.2.33. Conservation areas are associated with the towns, settlements and villages of St Neots, Yelling, Eltisley, Croxton, Caxton, Papworth Everard, Tempsford, Church End, Roxton and Great Barford.

2.2.34. Numerous listed buildings of predominantly Grade II listing are located in close proximity to the A428, with a focus of buildings within Croxton and Eltisley. Groups of Grade II listed buildings are also situated within Chawston and Wyboston, north of the Black Cat roundabout, and within Roxton and Great Barford to the south west of the junction. A small number of Grade II* listed buildings are also located within the settlements of Roxton, Little Barford, Eaton Socon, Croxton, Eltisley and Caxton. The settlement of Croxton also contains the historic Croxton Park, a Grade II* listed Registered Park and Garden. The Grade I listed Barford Bridge and Causeway is located on the River Great Ouse, south of Great Barford.

2.2.35. Noise Important Areas (NIA) are located on: the A1 between the Black Cat roundabout and Wyboston interchange; the A1 between Wyboston interchange and Little Paxton; in the locality of Church End on the A1 south of the Black Cat roundabout; between Church End and the north of Sandy on the A1; on the A428 (the first approximately 1 kilometres east of the A428/B1428 Cambridge Road roundabout and the second approximately 0.7 kilometres east of Caxton Gibbet roundabout); and on Bedford Road between Great Barford and Roxton.

2.2.36. An Air Quality Management Area (AQMA) has been designated by Huntingdonshire District Council on St Neots' High Street, approximately 5.4 kilometres to the north of the Black Cat roundabout. A second AQMA has been designated by Central Bedfordshire Council along a section of the A1 immediately west of Sandy, approximately 5 kilometres south of the Black Cat roundabout.

Utilities

2.2.37. Underground gas mains, water mains, fuel pipelines and overhead electricity transmission infrastructure cross the landscapes between the Black Cat roundabout and Caxton Gibbet roundabout. This infrastructure is particularly focused on land between the Black Cat roundabout and the East Coast Main Line railway.

Development Land and Planning Applications

2.2.38. A number of sites within the jurisdictions of Huntingdonshire District Council, South Cambridgeshire District Council, and Central Bedfordshire Council have been allocated for future development. These include parcels of land to the east of the Black Cat roundabout and the A1, land adjacent to the A428 in St Neots, and land along the River Great Ouse valley north of the A428.

2.2.39. A number of planning applications within some of these allocated sites have been identified which seek to bring forward new housing, commercial and industrial development.

2.2.40. Plans are also being developed by the East West Rail Company to deliver the East West rail scheme (also known as the "Varsity Line") between Oxford and Cambridge, which is expected to be completed by the mid 2020s.

2.3. Scheme Description

Design Principles

2.3.1. The RIS [REF 2-2] includes the government's vision to "*…see the Strategic Road Network working more harmoniously with its surroundings, impacting less on local communities and the environment*".

2.3.2. In response to this, an independent design review panel has been established by Highways England, the role of which is to support and advise on the design quality of road projects delivered through the RIS [REF 2-2].

2.3.3. The panel has developed an overarching design vision and a set of good road design principles for road projects, against which the success of individual projects can be assessed during their design-development, implementation and operational stages.

2.3.4. The Road to Good Design [REF 2-4] contains a set of ten principles for good road design, established by the panel in 2018. Centred on the themes of connecting people, places and processes, they encourage better design and provide a basis for road schemes to be objectively reviewed at key stages of their development.

2.3.5. In balancing and co-ordinating the aesthetic, functional and technological considerations of highway design, the document [REF 2-4] states that good roads design:

a. Makes roads safe and useful.

b. Is inclusive.

c. Makes roads understandable.

d. Fits in context.

e. Is restrained.

f. Is environmentally sustainable.

g. Is thorough.

h. Is innovative.

i. Is collaborative.

j. Is long-lasting.

2.3.6. The above principles have been taken account of as part of the development of the Scheme and will continue to be used to shape and inform its design.

Development Consent Order Site Boundary

2.3.7. The extents of land potentially required to implement the Scheme, referred to as the Development Consent Order (DCO) site boundary, are illustrated on Figure 1.1 within Volume 2.

2.3.8. The DCO site boundary has been based on the maximum anticipated area of land required either temporarily and/or permanently to construct, operate and maintain the Scheme.

2.3.9. The outcomes of statutory consultation, the Environmental Impact Assessment (EIA) process and ongoing design modifications are expected to result in refinements being made to the DCO site boundary, the final extents of which will be presented in the Environmental Statement.

Limits of Deviation

2.3.10. The DCO application will allow for the Scheme to be constructed within certain Limits of Deviation (LoD), for example to allow the design of the Scheme to be adjusted during construction in response to adverse ground conditions.

2.3.11. Indicative horizontal and vertical LoDs for the Scheme have defined as part of the design-development process, the extents of which are contained within the DCO site boundary. Once finalised, the LoDs will define the maximum amount by which the Scheme can deviate both horizontally and vertically.

2.3.12. The LoDs will be presented within the plans that will accompany the DCO application, and will be taken into account as part of the EIA.

2.3.13. Further information regarding LoDs and how design flexibility will be considered as part of the EIA is presented within Chapter 4.

Engineering Components

2.3.14. Figure 2.3 within Volume 2 illustrates the general arrangement (engineering design) of the Scheme.

2.3.15. The Scheme involves: creating an 18.6 kilometre long all-purpose trunk road (new dual carriageway) from west of the A421/A1 Black Cat roundabout through to east of the A428/A1198 Caxton Gibbet roundabout, with a grade separated junction at Black Cat and grade separated junctions at Cambridge Road and Caxton Gibbet.

2.3.16. At the Black Cat roundabout, a new junction will be constructed to allow traffic to flow freely along the A1 and the new dual carriageway. Additionally, a link will be provided between the A421 eastbound carriageway and the A1 northbound carriageway.

2.3.17. The new Black Cat junction will be on three levels: the A1 carriageway will be on the lower level passing under the new junction; the new at-grade roundabout will be constructed at existing ground level; and the new dual carriageway will pass over the new junction at the higher level. The existing Roxton Road Bridge will be demolished due to the need to lift the A421. A new structure, just to the west of the existing structure, to maintain the Roxton Road link to Bedford Road will be constructed.

2.3.18. As a result of the Scheme direct access onto the A1 from School Lane, Chawston Lane, Nagshead Lane and The Lane will be prevented, and the existing public access to Kelpie Marina and the Great North Road will be closed. The Scheme will provide a new road linking The Lane, Nagshead Lane and Chawston Lane to Bedford Road via the new Roxton Road Bridge to provide alternative, safe access. The Scheme will also provide an alternative access to Kelpie Marina, and a new connection from the south end of Great North Road to the new Black Cat junction. The Scheme will provide a segregated service road from the BP garage to the at-grade roundabout of the new Black Cat junction. The service road will be adjacent to the southbound carriageway of the A1. Over part of its length it will also provide access to Great North Road.

2.3.19. From the new Black Cat junction, the Scheme comprises a new dual carriageway which will run east across the River Great Ouse and its floodplain, passing under existing overhead high voltage power lines before crossing over the East Coast Main Line railway.

2.3.20. The new dual carriageway will cross the river and its floodplain on a multi-span viaduct. At the East Coast Main Line railway, a new three-span overbridge will be constructed.

2.3.21. After crossing the railway, the route of the Scheme changes to a northerly direction, passing to the west of the Abbotsley Golf Course and crossing the Potton Road and

B1046 before turning east again to the south of the existing A428 single carriageway road.

2.3.22. A single overbridge will be provided on the B1046 to cross over the new dual carriageway. Potton Road will be diverted north from its junction with the Eynesbury Plant Hire Company, up to a new priority junction with the B1046 on the eastern side of the new dual carriageway.

2.3.23. The new dual carriageway will cross the existing A428 to the east of the existing junction with the B1428 Cambridge Road, before continuing in a north easterly direction towards the C182 Toseland Road.

2.3.24. A new grade separated junction will be constructed to the east of the existing Cambridge Road roundabout to provide for all movements and maintain a continuous link for the existing A428. A new overbridge will be constructed on Toseland Road to maintain this link over the new dual carriageway.

2.3.25. After crossing Toseland Road the new dual carriageway will dip south east to cross the B1040 St Ives Road, before again crossing over the existing A428 to the east of Eltisley to run along the southern side of the existing road.

2.3.26. To the northeast of Eltisley the existing A428 will be diverted via two new roundabout junctions and a new overbridge to the northern side of the new dual carriageway. From here the existing A428 will continue east to tie-in to the existing road past North East Farm and Pembroke Farm before connecting into the new Caxton Gibbet Junction.

2.3.27. At the Caxton Gibbet roundabout, the new dual carriageway will pass on embankment to the north of the existing junction with the A1198. The new dual carriageway will then tie-in to the existing A428 dual carriageway to the east of the roundabout.

2.3.28. A new grade separated all movement junction is proposed at Caxton Gibbet in addition to maintaining access to the existing fuel filling station and businesses on the south side and linking into the existing A428 on the north side. This grade separated junction will incorporate the existing junction on the south side of the new dual carriageway, and a new roundabout will be constructed on the north side.

2.3.29. The existing A428 between St Neots and Caxton Gibbet will be downgraded and de-trunked. Responsibility for operating and maintaining the road will pass from Highways England to Cambridgeshire County Council and Bedford Borough Council on completion of the Scheme.

Earthworks

2.3.30. Earthwork slopes incorporated into the design of the Scheme vary to accommodate the profile of the new dual carriageway within the local landscape. Earthworks slopes typically include embankments, cuttings and earth bunds, the extent of which will be finalised as part of the DCO application.

Landtake and Demolitions

2.3.31. Land will be required both temporarily and permanently to construct, operate and maintain the Scheme.

2.3.32. The Scheme will require the extinguishment of some existing businesses and the demolition of some existing premises. This currently includes the following:

a. Extinguishment and demolition of the Travelodge – located north west of the Black Cat roundabout.

b. Extinguishment and demolition of the Shell Garage and service area – located north west of the Black Cat roundabout.

c. Extinguishment and demolition of the A1 Keen Screens and associated businesses – located just north of the Black Cat roundabout.

d. Demolition of Brook Cottages, a Grade II listed building – located to the north of the Black Cat roundabout and accessed off the A1 northbound carriageway.

e. Extinguishment of a car wash business and demolition of a disused fuel filling garage – located to the west of the Caxton Gibbet roundabout, on the north side of the existing A428.

Drainage and Structures

2.3.33. Appropriate locations for drainage have yet to be identified; however, surface water drainage will consist of a combination of attenuation measures and kerbs and gullies to capture, direct and attenuate flows to maintain the current rates of discharge into existing watercourses.

2.3.34. As the Scheme coincides with areas at risk of flooding, areas of land have been identified within the DCO site boundary for potential flood storage to compensate for the permanent loss of floodplain.

2.3.35. Structures incorporated into the Scheme include bridges and culverts, which are proposed in locations where the new dual carriageway will cross existing watercourses and the existing road network.

2.3.36. Depending on the outcomes of the EIA, permanent acoustic barriers may be required along sections of the Scheme to reduce traffic-related noise.

Lighting, Signage and Technology

2.3.37. Lighting, signage and technology will be provided as part of the Scheme, as follows:

a. Lighting will be introduced at the Black Cat junction, Cambridge Road junction and Caxton Gibbet junction.

b. Existing lighting along the A1 through the Black Cat junction will be maintained.

c. Variable Message Signs will be installed on the A1, A421 and new dual carriageway approaches to the Black Cat junction.

d. Closed Circuit Television Cameras will be installed to monitor the Black Cat junction, Cambridge Road junction and Caxton Gibbet junction.

2.3.38. Installation of this equipment will require improvements to be made to the communications network, for example the installation of new cabling.

Public Rights of Way, Footpaths and Crossings

2.3.39. Facilities to enable WCHs to safely cross the new dual carriageway and maintain existing connectivity between public rights of way, local roads and communities have been developed and incorporated into the Scheme.

2.3.40. These facilities comprise a combination of features including new bridges, underpasses, footpath and bridleway diversions, crossings, and new provisions for cyclists to maintain and (where possible) enhance access along existing and proposed routes.

2.3.41. The proposed changes to existing accesses and the public rights of way network are illustrated on Figure 2.3 within Volume 2.

Environmental Measures

2.3.42. Figure 2.4 within Volume 2 presents the preliminary environmental masterplan for the Scheme and illustrates the form and location of environmental measures that have been incorporated (embedded) into the design of the Scheme to mitigate adverse environmental effects.

2.3.43. In summary, the embedded mitigation comprises combinations of the following measures:

a. Landscape – comprising elements such as woodland, trees, hedgerows, shrubs and grassland to integrate the Scheme into the local landscape, provide visual screening for sensitive receptors and compensate for features lost as a result of the Scheme.

b. Ecology – comprising elements such as new and replacement habitats to mitigate impacts on protected species.

c. Water – comprising sustainable drainage features to improve water quality and provide habitats for aquatic species.

2.3.44. The final form and location of these measures will be determined through the EIA process, and through consultation with the relevant environmental bodies.

2.3.45. Further information relating to the different types of environmental mitigation measures proposed is provided in Chapter 4.

2.4. Construction

2.4.1. The Scheme allows for temporary traffic management areas, temporary working and storage areas, material stockpiles, construction compounds, vehicle recovery areas, and haul roads. At this stage several potential vehicle recovery areas have been identified; however, it is anticipated that not all of these sites will be required as part of the Scheme.

2.4.2. At the time of preparation of this PEI Report, there are limited details regarding the quantity of material to be excavated or material required to facilitate construction of the Scheme (referred to as the cut-fill balance); however, preliminary calculations have identified that borrow pits could be required to obtain sufficient material to improve the cut-fill balance.

Key Activities

2.4.3. The types of activities that are likely to be undertaken during construction of the Scheme include the following:

a. Movement of vehicles.

b. Enabling works (for example the clearance of vegetation to allow other works to proceed).

c. Diversion of utilities.

d. Earthworks.

e. Demolition works.

f. Excavation and installation of drains and communication ducts.

g. Construction of structures (for example retaining walls).

h. Road surfacing works.

i. Installation of verge furniture and landscaping.

j. Stock piling and storage of construction materials.

Compounds

2.4.4. The Scheme's contractor will require site compounds close to the Scheme for welfare facilities, materials handling and storage, and production facilities. The compound locations have yet to be finalised; however, at the current time the Scheme includes:

a. a main site compound located centrally between the B1046 and Cambridge Road, with access provided off the existing A428 via either a new roundabout or left-in/left-out junction to facilitate safe vehicular access.

b. a compound located at the western end of the Scheme, north of Bedford Road near to Roxton (previously used during construction of the A421 Great Barford Bypass), which will serve construction of the western extents of the Scheme and the Black Cat junction and will be accessed off Bedford Road.

c. a compound located at the eastern end of the Scheme, to the northwest or northeast of Caxton Gibbet junction, with access via a left-in/left-out junction arrangement off the A1198.

2.4.5. Traffic management measures will be agreed with the relevant local authorities and employed during construction with the aims of ensuring the safe movement of materials to working areas and compounds, reducing delays on other road users, and minimising interference with local traffic.

Phasing

2.4.6. A phased approach to construction of the Scheme will likely be adopted by the contractor, the full details of which will be presented within the Environmental Statement.

2.4.7. Within this phasing, it is expected that certain works will need to be undertaken in advance of the main construction activities. These are likely to include archaeological investigations, ecological surveys, utility diversions and the formation of the main construction compound to enable other works to proceed.

2.4.8. It is anticipated that the main construction activities will be split into three distinct sections which will include:

a. Section 1 – Black Cat junction to the East Coast Main Line railway.

b. Section 2 – The East Coast Main Line railway to the Cambridge Road junction (including establishment of the main construction compound).

c. Section 3 – The Cambridge Road junction to the Caxton Gibbet junction.

2.4.9. It is currently expected that the overall construction period for the Scheme will be around three and a half years. At this stage, it is also anticipated that all three sections will be under construction throughout this period.

2.4.10. The construction of the new Black Cat junction is anticipated to be the most complex section of the works and have the greatest impact on the travelling public during construction. Careful consideration will be given to the phasing of these works to mitigate as far as reasonably practical the impact of this section of the Scheme on road users and local communities close to the junction.

Working Hours

2.4.11. The exact details of construction working hours will be agreed with the relevant local authorities and will be presented within the Environmental Statement.

2.4.12. The main contractor will seek to obtain consents from the relevant local authority where required under Section 61 of the Control of Pollution Act 1974 [REF 2-5] for the proposed construction works, excluding non-intrusive surveys. Applications will include details on proposed working hours.

2.4.13. Core working hours are anticipated to be from 08:00 to 18:00 on weekdays and from 08:00 to 13:00 on Saturdays. The contractor will adhere to these core working hours for each site as far as is reasonably practicable or unless otherwise permitted under Section 61 of the Control of Pollution Act 1974 [REF 2-5].

2.4.14. The intention will be to avoid working on any online sections of roads during bank holidays to minimise potential disruption to road users.

2.4.15. Guidance on the site specific variations to core hours and/or additional hours likely to be required will be included within a Local Environmental Management Plan (LEMP) following consultation with the relevant local authority.

2.4.16. Except in the case of an emergency, any work required to be undertaken outside of core hours (not including repairs or maintenance) will be agreed with the relevant local authority prior to undertaking the works under Section 61 of the Control of Pollution Act 1974 [REF 2-5] within the framework set out by the LEMP and any agreed Code of Construction Practice.

2.4.17. It is anticipated that online sections of the Scheme will require night time working to facilitate traffic management, the installation of signs and technology, and surface tie-ins. For example, the majority of the online road surface may have to be laid during night time working hours. These working hours are dictated by network occupancy criteria.

2.4.18. Construction of the bridge over the East Coast Main Line railway will require some working close to the railway line. To ensure the safety of construction personnel and railway operations, certain activities will be required to be undertaken during closures (referred to as possessions) of the East Coast Main Line.

2.4.19. Where practicable, railway possessions will be used to install safety systems (for example protection decks and railway protection barriers) to enable a greater amount of the construction activities to be undertaken during core hours.

2.4.20. Certain operations such as earthworks are season and weather dependent. In these instances the contractor will seek to extend the core working hours and/or days for such operations to take advantage of daylight hours, following consultation with the relevant local authority.

2.4.21. Certain other specific construction activities will require extended working hours for reasons of engineering practicability. These activities include, but are not limited to, major concrete pours and piling/diaphragm wall works.

2.4.22. Environmental and engineering surveys may also need to be carried out outside of core working hours.

2.4.23. In the case of work required in response to an emergency or which if not completed would be unsafe or harmful to the works, staff, public or local environment, the relevant local authority will be informed as soon as reasonably practicable of the reasons for, and likely duration of, the works. Examples include: where pouring concrete takes

longer than planned due to equipment failure; or where unexpectedly poor ground conditions are encountered whilst excavating, require immediate stabilisation.

Construction Routes and Traffic Management

2.4.24. Liaison will be undertaken with the relevant local authorities to agree traffic management plans prior to commencing construction works, in order to minimise disruption on the local road network.

2.4.25. The principal routes that the contractor will use to access construction working areas are expected to be the A1, A428 and A1198. Other routes are likely to include the A421, Bedford Road, Roxton Road (southern end) and Barford Road (southern end). Limited access may be required from local side roads

2.4.26. The A1 and the existing A428 will remain open to traffic throughout the duration of the construction period, except during occasional overnight closures which will be required for safety reasons during certain operations, for example the off-loading of large items of plant and equipment or materials.

2.4.27. Bulk materials haulage will need to be undertaken during daytime periods. The contractor will seek to mitigate any related disruption by stockpiling materials and arranging for material deliveries to be brought to working areas during off-peak traffic periods, wherever possible.

2.4.28. It is anticipated that a site haul route will be established through each section of the works to minimise the impact of construction traffic on local roads, and to allow plant equipment and material to move along the length of the Scheme. Providing a continuous route through the site will be restricted by the River Great Ouse, the East Coast Main Line railway and the existing A428. Temporary bridge crossings of these constraints may be adopted but this has yet to be confirmed.

2.4.29. It is expected that at-grade traffic signal controlled plant crossings will be used where the haul road crosses local side roads. The use of such facilities will only be adopted with the prior agreement of the local highway authority.

Public Liaison

2.4.30. A community investment team will be appointed to keep local communities, businesses and other stakeholders (for example road users) fully informed during construction. Regular web-based and social media progress updates will be provided, as well as mail-drops and one-to-one meetings with interested parties.

2.5. Traffic

2.5.1. Traffic modelling is being undertaken to assess how the Scheme will reduce congestion, increase journey reliability and improve safety. Predictions are being made using computer modelling to determine how the Scheme will influence the movement of vehicles travelling on the road network once operational.

2.5.2. The modelling process has been informed by data and information relating to existing traffic flows, journey patterns, delays and congestion problems obtained for a large geographic area extending as far as Bedford and Cambridge.

2.5.3. The outputs from traffic modelling are being used to influence the following:

a. the design of the Scheme, for example the number of lanes and types of junctions required.

b. the EIA of the Scheme, to enable changes in air quality and noise to be calculated and assessed.

c. the economic assessment of the Scheme, to determine the Scheme's value for money by weighing its costs against its benefits.

2.5.4. Future traffic flows are being estimated for a number of future years, for example the year in which the Scheme is expected to be open for use and fifteen years after its opening, to meet the requirements of certain assessments being undertaken as part of the EIA.

2.5.5. The emerging outputs from the traffic modelling indicate that a significant amount of traffic will transfer onto the new dual carriageway from the existing A428, local roads and other east-west routes. The modelling also indicates that the percentage of the heavy goods vehicles that currently use the existing A428 will reduce through this transfer.

2.5.6. Traffic modelling is also being undertaken of the temporary arrangements that will be implemented during the construction phase of the Scheme, to understand the impact that the works may have on traffic flows.

2.6. Future Maintenance

2.6.1. The Scheme is being designed in a way that minimises the frequency of future maintenance events through the use of low maintenance equipment and features that will reduce the amount of repairs required. No significant maintenance activities are therefore anticipated to be required within the first five years of the Scheme being operational.

2.6.2. Following construction of the Scheme, the contractor will be responsible for undertaking landscape management works within a defined period, after which the longer term landscape maintenance and management responsibilities will transfer to Highways England.

2.6.3. Short term maintenance and repair activities are likely to follow routine inspections of the condition of the new road infrastructure and the installed equipment. Repair activities will also be required as part of any unplanned, emergency works, for example to repair damage following road traffic incidents.

2.6.4. Periodic maintenance operations, similar to those being undertaken elsewhere on the strategic and local road networks, will be carried out on the following equipment and features:

a. Highway verge infrastructure – such as barriers, lighting and roadside technology.

b. Structures – such as road bridges and viaducts.

c. Landscaping – such as woodland and grassland.

d. Drainage features – such as ponds and culverts.

e. Carriageway features – such as road markings and road studs.

2.6.5. These activities will, wherever feasible, be programmed in a way that enables them to be carried out at the same time as other planned operations to reduce disruption to road users.

2.6.6. Where required, traffic management will be used during maintenance and repair operations, which may involve measures such as temporary speed restrictions and lane closures.

2.7. Programme

2.7.1. Highways England plans to formally submit the DCO application for the Scheme in early 2020, following completion of statutory consultation and the undertaking of design refinements and the EIA process.

2.7.2. Subject to successfully progressing through the statutory procedures associated with DCO applications, construction is expected to start in late 2021 and the road is expected to be open in early 2025.

3. ASSESSMENT OF ALTERNATIVES

3.1. Alternative Options Considered

Background

3.1.1. The Scheme has been subjected to a process of option identification, assessment and selection to identify a preferred solution that best achieves the objectives presented in Chapter 2.

Initial Options Identification and Assessment

3.1.2. In 2016, Highways England explored a number of opportunities to improve the A428 between Black Cat and Caxton Gibbet roundabouts.

3.1.3. A total of 50 options were identified, which included improvements to the existing A428, the construction of a new road and junctions, public transport improvements, and improvements for walkers, cyclists and horse riders. Some of these options involved packages (combinations) of these improvements.

3.1.4. Each of these options was assessed against how it could help to resolve the identified problems on the road network and achieve the Scheme objectives.

3.1.5. Following assessment, a total of 16 options were taken forward for further evaluation, these being solutions that were likely to be feasible and deliverable.

Early Assessment and Sifting of Options

3.1.6. The 16 options were assessed to evaluate the strategic, economic, management, financial and commercial cases of each. The outcomes of this assessment concluded that the following eight options warranted further consideration:

a. **Option C1** – A428 full offline dualling with grade separation of Black Cat roundabout and grade separation of Caxton Gibbet roundabout.

b. **Option C2** – A428 full offline dualling with grade separation of Black Cat roundabout and signalisation of Caxton Gibbet roundabout.

c. **Option C5** – A428 bypass to Cambridge Road junction with grade separation at Black Cat roundabout, and grade separation at Caxton Gibbet roundabout.

d. **Option C6** – A428 bypass to Cambridge Road roundabout with grade separation at Black Cat roundabout, and signalisation at Caxton Gibbet roundabout.

e. **Option C7** – A428 single lane carriageway bypass to Cambridge Road roundabout with online dualling between Cambridge Road roundabout and Caxton Gibbet roundabout, grade separation at Black Cat roundabout and grade separation at Caxton Gibbet roundabout.

f. **Option C10** – Local junction widening with channelisation at existing A428 junctions, grade separation at Caxton Gibbet roundabout, grade separation at Black Cat roundabout and upgrades to existing A1 junctions.

g. **Option C11** – Local junction widening with channelisation at existing A428 junctions, signalisation at Caxton Gibbet roundabout, grade separation at Black Cat roundabout and upgrade to existing A1 junctions.

h. **Option C16** – A428 dual carriageway bypass to Cambridge Road roundabout with online dualling between Cambridge Road roundabout and Caxton Gibbet roundabout, grade separation at Black Cat roundabout and grade separation at Caxton Gibbet roundabout.

Development and Assessment of Route Options

3.1.7. The eight shortlisted options were then assessed against criteria relating to: strategic fit; value for money; financial and delivery.

3.1.8. From a strategic perspective, Option C1 was considered to be the best performing option for a number of reasons including its fit with government policy, its impact on the problems and issues affecting the existing A428, and its greater likelihood of public acceptability.

3.1.9. The eight options were subsequently consolidated and renamed into the following options:

a. **Option 1 (C1/C2)** – Full offline dualling between Black Cat and Caxton Gibbet with a grade separated junction at Cambridge Road. Grade separation of both Black Cat and Caxton Gibbet roundabouts.

b. **Option 2 (C10/C11)** – Minor junction improvements along the A428 at Wyboston, Cambridge Road, Croxton and Eltisley. Grade separation of both Black Cat and Caxton Gibbet roundabouts.

c. **Option 3 (C5/C6)** – A428 bypass between Black Cat and Cambridge Road roundabouts. No widening between Cambridge Road and Caxton Gibbet. Grade separation of both Black Cat and Caxton Gibbet roundabouts.

d. **Option 4 (C7/C16)** – Offline dual carriageway bypass between Black Cat and Cambridge Road and online widening between Cambridge Road and Caxton Gibbet. Grade separation of both Black Cat and Caxton Gibbet roundabouts.

3.1.10. Following analysis of Options 1 to 4 against factors including the proximity of the options to listed buildings, the number of road crossings required, and proximity to residential areas, the following four additional options (Options 5, 6, 7 and 8) were identified and developed:

a. **Option 5** – Full offline dualling between Black Cat and Caxton Gibbet with no connection to the Cambridge Road roundabout. The alignment lay to the north of Abbotsley. Grade separation of Black Cat and Caxton Gibbet roundabouts.

b. **Option 6** – Full offline dualling between Black Cat and Caxton Gibbet with no connection to the Cambridge Road roundabouts. The alignment lay to the south of Abbotsley. Grade separation of Black Cat and Caxton Gibbet roundabouts.

c. **Option 7** – Dualling between Wyboston and the River Great Ouse crossing, and a new roundabout at Wyboston. Minor junction improvements at Barford Road and Cambridge Road. Grade separation at Black Cat roundabout and a signalised junction at Caxton Gibbet.

d. **Option 8** – Grade separation of both Black Cat and Caxton Gibbet roundabouts.

Black Cat Junction Options

3.1.11. The following options for Black Cat junction were identified and considered:

a. **Option 1A** – Dumbbell roundabouts on Roxton Road with merge and diverge slips from A428 and A1 connecting to the two roundabouts.

b. **Option 1B** – Dumbbell roundabouts near the Black Cat roundabout with merge and diverge slips from A428 and A1 connecting to the two roundabouts.

c. **Option 1C** – Similar to Option 1B with merge and diverge on the A428 located further away from the mainline carriageway.

d. **Option 1D** – Dumbbell roundabouts on Roxton Road with merge and diverge slips from A428 connecting to the two roundabouts. New roundabouts on the A1 with merge and diverge slips from A1 connecting to the new roundabout, with a side road connecting the roundabout on the A1 and southern roundabout at Roxton.

e. **Option 1E** – Dumbbell roundabouts on Roxton Road and A1 with merge and diverge slips from A428 and A1 connecting to the two dumbbell roundabouts.

f. **Option 2A** – Dumbbell roundabouts on Roxton Road with diverge and merge from A428 connecting to the roundabouts. Another dumbbell to the east of A1 with diverge and merge from A428 connecting to these roundabouts with southbound diverge and merge on A1 connecting to east roundabout and link roads connecting east and west roundabouts.

g. **Option 2B** – One roundabout on Roxton Road with diverge and merge from A428 connecting to the roundabout. Another roundabout to the east of A1 with diverge and merge from A428 connecting to this roundabout with southbound diverge, merge on A1 and link roads connecting this roundabout.

h. **Option 3A** – One roundabout at the Black Cat roundabout with merge and diverge slip roads from A428 and A1 connecting the roundabout.

i. **Option 3B** – Similar to Option 3A with merge and diverge on the A428 moved further away from the mainline carriageway.

j. **Option 4** – Junction with slip roads and interchange links for all directions. Loop slip roads between A1 northbound and A428 eastbound as well as A1 southbound and A428 westbound.

k. **Option 5** – Eastbound diverge slip and westbound link from A428 connecting to A1 northbound and southbound respectively. Southbound diverge loop from A1 connecting to A428 westbound.

l. **Option 6** – Eastbound diverge link road from A428 connecting to A1 northbound and diverge slip connecting to the Black Cat roundabout. Southbound diverge link road from A1 connecting to A428 westbound, and westbound merge slip on A428 connecting from the existing Black Cat roundabout.

Non-statutory Consultation on Options

Route Options

3.1.12. Following assessment against a number of criteria including environment, safety, constructability and accessibility, Options 1, 5 and 6 were identified as the best performing route options as they would meet the majority of the Scheme objectives and would provide the most significant benefits with the lowest potential environmental impact. It was concluded that these three route options should be taken forward for further development and assessment.

3.1.13. To inform the process of assessment, Options 1, 5 and 6 were renamed and described as follows:

a. **Orange (Option 1)** – This route option comprised an offline solution between Black Cat roundabout and Caxton Gibbet roundabout, whilst also providing a grade separated junction at Cambridge Road. The route was approximately 18.9 kilometres in length and a dual two lane all-purpose carriageway, with both Black Cat roundabout and Caxton Gibbet roundabout being grade separated. After the route crossed the East Coast Main Line railway, the alignment changed to a north direction for approximately 2.5 kilometres, heading towards the existing A428 and

B1046/St Neots Road and on an improved two tier, grade separated Cambridge Road junction. The route then ran broadly parallel, and to the north of, the existing A428 for approximately 9 kilometres. The route crossed Toseland Road and B1040/St Neots Road, and passed through an improved Caxton Gibbet junction.

b. **Purple (Option 5)** – This route option comprised a wholly offline dual all-purpose carriageway running from Black Cat junction to Caxton Gibbet junction, approximately 18.4 kilometres in length. From Black Cat to Caxton Gibbet, the route was aligned east towards Abbotsley for approximately 5 kilometres. The alignment then changed to a north east direction, bypassing north Abbotsley for approximately 2 kilometres. Past Abbotsley, the route continued east for approximately 5 kilometres, passing north-west of Great Gransden. The alignment then changed to a north direction passing Eltisley to the south and joining Caxton Gibbet roundabout.

c. **Pink (Option 6)** – This route option comprised a wholly offline dual all-purpose carriageway running from Black Cat roundabout to Caxton Gibbet roundabout, approximately 18.4 kilometres in length. From Black Cat to Caxton Gibbet, the route was aligned directly east towards Little Gransden for approximately 7 kilometres. The alignment changed to a north east direction when it reached southern Abbotsley. The route bypassed Abbotsley to the south and continued in a north east direction for approximately 5.5 kilometres towards the mid-point between Eltisley and Great Gransden, where it continued in a northerly direction towards Caxton Gibbet roundabout.

3.1.14. The routes of the Orange, Purple and Pink options are illustrated on Figure 3.1 within Volume 2. These three route options were assessed to identify and compare their relative advantages and disadvantages, prior to being presented as part of a non-statutory consultation exercise. The main outcomes of this assessment are summarised in **Table 3-1**.

Table 3-1: Summary of the Assessment of the Orange, Purple and Pink Route Options

Aspect	Orange Option	Purple Option	Pink Option
Length	Approximately 18.9km	Approximately 18.4km	Approximately 18.4km
Traffic	Provides a connection for St Neots which could mean a greater amount of traffic use the new route. Encourages additional traffic to travel through St Neots to access the new route. Leads to more traffic using the B645, B660 to the west of the A1, as well as Ermine Street North.	Helps to remove traffic from local roads and near St Neots town centre. Cuts traffic on the B1042 and B1046. Leads to more traffic using Ermine Street North (towards Papworth Everard) and Ermine Street South (towards Caxton). Potential for traffic to increase during evening peak periods on some local roads to the west of the A1.	Encourages traffic to shift from other strategic routes going east or west and so would cut traffic on the B1042 and B1046. Leads to more traffic using Ermine Street North (towards Papworth Everard) and Ermine Street South (towards Caxton).

Aspect	Orange Option	Purple Option	Pink Option
	Removes traffic from the existing A428 and reduces traffic through Barford Road, Great Gransden and Little Gransden. Helps shift traffic away from local roads by encouraging drivers to use the existing dual carriageways of the A421 and A428.		
Air Quality	Traffic along the existing A428 would reduce and therefore there could be air quality benefits to the communities along the A428. There is also an AQMA in the centre of St Neots.		
Cultural Heritage	Potential to impact the setting of two deserted medieval villages at Weald and Wintringham, as well as the setting of a scheduled monument near the junction with the A1198 and a Grade II listed building to the east of Cambridge Road. Reduces traffic noise and emissions around Croxton Park leading to improved noise and air quality impacts.	Potential to impact a scheduled monument near the junction with the A1198 as well as nine Grade II listed buildings. This route option also passes within 500m of Abbotsley Conservation Area.	Potential to impact a scheduled monument near the junction with the A1198 as well as nine Grade II listed buildings. The route would be further away from the Abbotsley Conservation Area than the Purple Option.
	There is the potential for unknown archaeological remains.		
Visual Impact	Visual impact where junction improvements are proposed at Black Cat, Cambridge Road and Caxton Gibbet. Some rural properties may be affected as well as public rights of way to the east of St Neots.	Visual impact where junction improvements are proposed at Black Cat and Caxton Gibbet. To the east of the River Great Ouse, visual impacts could potentially be experienced by rural properties on the northern edge of Abbotsley and southeast edge of Eltisley, as well as people using Abbotsley Golf Course.	Visual impact where junction improvements are proposed at Black Cat and Caxton Gibbet. Potential visual impact to the east of the River Great Ouse, particularly for rural properties where the route is close to a number of farmsteads.
Ecology and Nature Conservation	Habitats which could be affected in the area include broadleaved woodland, lowland fen and floodplain grazing marshland.	Located within 5km of five Sites of Special Scientific Interest (SSSI) to the south of the route, and within 10 kilometres of the Eversden and Wimpole Woods Special Area of Conservation (SAC). Habitats which could be affected in the area include woodland and	Located within 1km of Weaveley and Sand Woods SSSI. It is also within 5km of five SSSIs. This is closer than the Purple Option and therefore more likely to have an impact. At this distance, impacts associated with air quality change, disturbance or habitat degradation could arise.

Aspect	Orange Option	Purple Option	Pink Option
		floodplain grazing pasture.	Located within 10km of Eversden and Wimpole Woods SAC. Deciduous woodland would be directly affected.
	Located next to the River Great Ouse County Wildlife Site with the potential for impacts due to direct habitat loss, habitat degradation, changes in air/water quality, noise/light disturbance, and severance. Presence of protected species including bats, badgers, great crested newts and reptiles.		
Geology and Soils	Temporary and permanent loss of best and most versatile agricultural land.		
Noise and Vibration	Properties in and to the east/south east of Little Barford and north of the A428 may experience an increase in noise.	Properties on the northern side of Abbotsley are likely to experience increases in traffic noise.	Properties on the southern side of Abbotsley are likely to experience increases in traffic noise.
	Reduced noise at residential properties along the A1 and south of St Neots. Residents in Croxton and Eltisley are likely to also experience a reduction in noise.		
Rights of Way	Crosses public rights of way and requires safe crossings, diversions, or closures. Opportunities to improve access for walkers, cyclists and horse riders along the existing A428.		
Water	Requires a new crossing over the River Great Ouse. Could alter existing flood risk patterns as a result of construction within the floodplain.		
Climate Change	Designed to be more resilient to climate change, including potential for increasing capacity of drainage systems and providing surfacing more resistant to extreme weather conditions.		
Sustainable Travel	Opportunities to improve access for walkers, cyclists and horse riders along the existing A428 with the potential for a positive effect on human health.		

Black Cat Junction Options

3.1.15. The 12 identified Black Cat junction options were assessed based on their constructability, safety, traffic flow and cost. This concluded that the following three options for Black Cat junction could be incorporated into the design of the route options, and should be taken forward to the non-statutory consultation:

a. **Option A** – Forming a combination of Options 1A and 1C, this comprised a three-tiered roundabout, removing the existing Black Cat roundabout, and involved the construction of two roundabouts to the west of the existing roundabout. A new free-flow continuous link from the A421 eastbound towards the A1 northbound would be created along with slip roads to and from the A421, the A1 and the A428. With this option the A1 would become a free-flow continuous road going under the slip roads.

b. **Option B** – Based on Option 6, this comprised a two-tiered roundabout, retaining the existing Black Cat roundabout and would create a new free-flow continuous link from the A421 eastbound towards the A1 northbound. The addition of slip roads would provide a free-flow link, bypassing traffic moving southbound onto the A421, with the A1 remaining the same.

c. **Option C** – Based on Option 3B, this comprised a three-tiered junction, enlarging the Black Cat roundabout and creating a new free-flow continuous link from the A421 eastbound towards the A1 northbound. Slip roads would be built from the A421 to the A1, and the A428 and the A1 would become a continuous free-flow road under the widened Black Cat roundabout.

3.1.16. The three junction options were assessed to identify and compare their relative advantages and disadvantages, prior to being presented as part of a non-statutory consultation exercise. The main outcomes of this assessment are summarised in **Table 3-2**.

Table 3-2: Summary of the Assessment of the Black Cat Junction Options

Aspect	Option A	Option B	Option C
Air Quality	Air quality may improve slightly in the short term as traffic reduces at Black Cat junction. Until the route is built, there could be increased congestion around Wyboston which could have an impact on air quality. It will also be important to consider air quality at the Air Quality Management Area in St Neots.		
Cultural Heritage	Works to Tempsford Bridge could impact on the setting of the nearby scheduled monument. May affect the setting of the listed building to the north of Black Cat junction.	May result in the removal of the Grade II Listed building to the north of Black Cat junction.	
Archaeology	Potential to affect unknown buried archaeology. Affects areas of known archaeology, including cropmarks, and requires further archaeological investigation.		
Ecology and Nature Conservation	May impact habitats and species within the River Great Ouse corridor. The area is a habitat enhancement area.		
Geology and Soils	Affects two minerals sites. Would need to take into account the	Has a large area within a minerals site. Would need to take into account	Has a small area within a minerals site. Least likely to be affected by the

Aspect	Option A	Option B	Option C
	programme for mineral extraction.	the programme for mineral extraction.	programme for mineral extraction.
Noise and Vibration	May improve noise levels slightly in the short term to properties around Black Cat roundabout as well as improve noise levels in the Noise Improvement Area to the north of Black Cat roundabout. Until the route is built, there is likely to be increased congestion at Wyboston which could temporarily impact on noise levels in this area.		
Water	Has an area within the River Great Ouse floodplain and would require floodplain mitigation.	Has the largest area within the River Great Ouse floodplain compared to Options A and C and would likely have the greatest impact on flood risk. Requires floodplain mitigation.	Has the smallest area within the River Great Ouse floodplain compared to Options A and B. Requires some floodplain mitigation.

3.2. Outcomes

3.2.1. Feedback obtained from the non-statutory consultation in Spring 2017 demonstrated widespread support for the Orange route option, and for Option C for the Black Cat junction, these being the most popular solutions from the options presented.

3.2.2. The feedback identified that the Orange route option:

a. was close to the existing road.

b. provided additional connectivity to St Neots by the Cambridge Road junction.

c. improved traffic and congestion.

d. was seen to be the most beneficial to the local economy.

e. had the least environmental impact on ecology, designated sites, the visual environment, agriculture, heritage sites and the local community.

3.2.3. The feedback identified that Option C for the Black Cat junction:

a. created free-flowing traffic at the junction.

b. had the least impact on the local environment and the surrounding area.

c. had the least landtake.

d. improved traffic and congestion.

e. was seen to be the most practical option, having the greatest capacity and flexibility to cope with any future increases in traffic.

3.2.4. The assessments demonstrated that the Orange route option and Option C for the Black Cat junction presented the best value for money, had the least impact on the environment, and provided the greatest economic return compared to the other options.

3.2.5. It was determined from the assessments that, whilst all three route options improved journey times, the Orange route option provided a new junction at Cambridge Road, thereby giving greater access for more drivers travelling to and from St Neots and providing better connections into the town and the train station. The Orange route option was also identified as removing the largest number of vehicles from the existing A428 and local roads, with the new dual carriageway reducing rat-running on smaller local roads in surrounding villages and removing long distance traffic using these roads as a diversion route.

3.2.6. The assessments also determined that Option C for the Black Cat junction performed best in traffic modelling simulations as it provided an "all ways movement" junction that catered for all directions of travel, and required less land in comparison to Options A and B.

3.3. Further Comparative Assessment

Development of the Orange Route Option

3.3.1. Based on the feedback from the non-statutory consultation and the assessment of the route options, the design of the Orange route option was refined and developed further to take account of the following:

a. future traffic growth on the road network and possible growth around St Neots.

b. issues and constraints relating to landfill sites and overhead power lines.

c. responses received from local communities and landowner discussions.

Development of the Black Cat Junction Options

3.3.2. Based on the feedback from the non-statutory consultation and the assessment of the options for Black Cat junction, the height and visual impact of Option C was reduced by lowering the A1 under the junction.

3.4. Preferred Route

3.4.1. Highways England announced that the refined designs for the Orange route option and Option C for the Black Cat junction constituted the preferred route for the Scheme on 18 February 2019.

3.4.2. A description of the preferred route, and the Development Consent Order site boundary on which the Environmental Impact Assessment (EIA) is being undertaken, is presented in Chapter 2.

3.4.3. The design of the preferred route for the Scheme will be developed further through a 'reference design' stage and will take account of the outcomes of the statutory consultation.

3.4.4. The adoption of a reference design enables the EIA to identify, and be based on, a 'worst case' design (see Chapter 4), the full details of which will be presented within the Environmental Statement and will include consideration of any Limits of Deviation incorporated into the design (see Chapter 2). The Environmental Statement will describe where flexibility has been incorporated into the design, for example the inclusion of land around the engineering components of the new dual carriageway to allow minor alignment modifications to be made during construction.

3.4.5. The details of any alternatives and options which may be identified and assessed by Highways England as part of the design-development of the preferred route between the period of statutory consultation and the reference design stage, will be presented within the Environmental Statement.

4. ENVIRONMENTAL ASSESSMENT METHODOLOGY

4.1. General Approach

Scope of the Environmental Impact Assessment

4.1.1. In order to identify the individual assessments to be undertaken within the Environmental Impact Assessment (EIA) of the Scheme, Highways England carried out a scoping exercise between late 2018 and early 2019.

4.1.2. The scoping exercise involved a review of:

a. the Scheme design presented at Preferred Route Announcement (see Chapter 2).

b. the extent of land within the Development Consent Order (DCO) site boundary likely to be needed for its construction, operation and maintenance.

c. information gathered through desk studies, non-statutory consultation and field surveys.

d. the main findings of the environmental assessment work carried out to inform the selection of the preferred route for the Scheme (see Chapter 3).

4.1.3. The following documents were used to guide the scoping exercise:

a. **National Policy Statement for National Networks** – as the Scheme is a nationally significant infrastructure project (NSIP), the general principles and methods of assessment contained within the National Policy Statement for National Networks (NPSNN) [REF 4-1] were referenced and adopted, where appropriate.

b. **Infrastructure Planning (Environmental Impact Assessment) Regulations 2017** – the environmental and social factors stipulated in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [REF 4-2] (the EIA Regulations) were taken account of during the scoping exercise.

c. **Design Manual for Roads and Bridges** – guidance contained within the Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment [REF 4-3] was used to help identify the environmental topics to be considered in the EIA, and the detail that each assessment should include.

d. **Interim Advice Note 125/15** – guidance contained within Interim Advice Note 125/15: Environmental Assessment Update [REF 4-4] was referenced as part of the scoping exercise to supplement the content of the DMRB [REF 4-3].

4.1.4. The scoping exercise identified that the following environmental topics set out in the DMRB [REF 4-3] should be considered in the EIA as the Scheme could potentially result in significant effects on the environment:

a. Air Quality.

b. Cultural Heritage.

c. Biodiversity.

d. Landscape.

e. Noise and Vibration.

f. Population and Health.

g. Road Drainage and the Water Environment.

h. Material Assets and Waste.

i. Climate.

j. Assessment of Cumulative Effects (see Section 4.5).

4.1.5. Preliminary work undertaken to inform the scoping exercise in relation to the topics of Transboundary Effects, Major Accidents and Disasters, and Heat and Radiation, concluded a very limited likelihood of significant effects arising from the Scheme. The scoping exercise therefore concluded that assessments for these topics would not need to be undertaken as part of the EIA.

4.1.6. The scoping exercise also concluded that the Scheme is unlikely to be decommissioned in the future, due to it becoming an integral part of the road network.

Scoping Report

4.1.7. The findings of the scoping exercise were presented in a Scoping Report [REF 4-5]. This accompanied a formal request for a Scoping Opinion from the Secretary of State, which was submitted to the Inspectorate on 2 April 2019.

4.1.8. In examining the proposed scope of the EIA, the Inspectorate engaged a range of consultees (comprising statutory and non-statutory bodies, agencies and groups) for their views on the form and nature of the assessments, and the proposed content of the Environmental Statement.

Scoping Opinion

4.1.9. The Inspectorate provided its Scoping Opinion [REF 4-6] to Highways England on 13 May 2019.

4.1.10. Due to the limited time between the receipt of the Scoping Opinion [REF 4-6] and the publication of this Preliminary Environmental Information (PEI) Report, the comments within the Scoping Opinion [REF 4-6] have yet to be fully accounted for within the overall scope of the EIA. Notwithstanding this, its content has been reviewed to establish where modifications to the scope of the EIA will be required.

4.1.11. In summary, the Scoping Opinion [REF 4-6] has identified a number of general requirements relating to the following; these will be taken account of as part of the EIA and will be reported within the Environmental Statement or in other documentation comprising the DCO application:

a. Regulatory requirements: detail relating to the points raised by consultee bodies and demonstrating how these will be considered in the EIA; minimum information requirements of the EIA; and the need for other assessments to be carried out to meet other regulatory requirements.

b. Scheme information: detail relating to its design, the approach to construction, design flexibility sought, and the alternatives considered in its development are to be provided.

c. Environmental Statement: detail relating to the use of tables to present key information; the assessment of any Associated Development; the baseline scenario; forecasting methods and evidence; environmental mitigation; climate and climate change; the presentation of confidential information; and references of all sources used in the EIA are to be provided.

d. Cumulative effects: detail relating to the identification and agreement of the list of other developments to be included within the cumulative assessment; and the definition of the zones of influence for each environmental topic considered in the EIA.

4.1.12. Chapters 5 – 14 outline the additional topic-specific matters raised in the Scoping Opinion [REF 4-6] to be accounted for as part of the ongoing consultation, surveys and assessments currently being undertaken within the EIA, and where agreement has been reached with the Inspectorate on the matters to be scoped out of the EIA.

4.1.13. The Scoping Opinion [REF 4-6] acknowledges the findings of the preliminary assessments of Transboundary Effects, Major Accidents and Disasters, and Heat and Radiation, and has identified that the Environmental Statement should detail and justify these conclusions.

4.1.14. The Environmental Statement will include a schedule of the responses contained within the Scoping Opinion [REF 4-6], which will detail how the matters raised have been addressed and where the information is presented within the document.

4.1.15. As the process of scoping is iterative, the Environmental Statement will also report how feedback received from the statutory consultation has been taken into account within the EIA (where this feedback has a bearing on the approach to, and detail of, the individual assessments being progressed).

Related Assessments

4.1.16. Information being gathered and assessed as part of the EIA is being used to inform the following related assessments required by the NPSNN [REF 4-1], which will form part of the DCO application:

a. **Habitats Regulations Assessment** – a screening exercise is being carried out due to the presence of European Sites (comprising designated sites of international importance) and their relationship to the Scheme. The exercise is using information gathered as part of the biodiversity assessment, the emerging conclusions of which indicate that no significant effects on European Sites are likely to occur from the Scheme.

b. **Flood Risk Assessment** – the modelling and assessment of flood risk will refer to information gathered as part of the road drainage and the water environment assessment.

c. **Water Framework Directive Assessment** – this assessment will refer to information gathered as part of the road drainage and the water environment assessment.

4.2. Existing Baseline and Future Conditions

Establishment of the Baseline Environment

4.2.1. The existing (baseline) environmental conditions that may be affected by the Scheme are being established as part of the EIA. This involves a review of information relating to known, or the likely presence of, environmental resources and receptors within defined study areas to determine their value, importance or sensitivity.

4.2.2. Resources comprise environmental aspects which support and are essential to natural or human systems. These can include, for example, areas of population, ecosystems, watercourses, air and climatic factors, landscape, and material assets.

4.2.3. Receptors comprise people, for example occupiers of dwellings and users of recreational areas, places of employment and community facilities, and elements within the environment, for example flora and fauna, that rely on environmental resources.

4.2.4. Environmental data, information and records have been, and will continue to be, obtained using a combination of the following sources:

a. Desk-based sources – these include: previously published studies and assessments undertaken as part of the Scheme; published literature; databases, records and schedules relating to environmental designations; national and local planning policy documents; historic and current mapping; and aerial photography.

b. Site-based surveys – to verify information gathered during the desk-based reviews and evaluate the relationships between environmental interests and their wider environmental value.

c. Consultation – engagement with statutory and non-statutory organisations to obtain factual information and records.

4.2.5. Establishing the environmental baseline involves identifying the current state of the environment and how this may evolve in the absence of the Scheme (referred to as the future baseline). A combination of predictive modelling and professional judgement are being used in the EIA to identify and take account of the following variables that may influence the future baseline:

a. Changes from natural events or trends (including human activities) – for example where ecological species move from their current location over time and populate different areas.

b. Changes in environmental and societal values – for example where the status of the environment alters due to protection through planning designation.

c. Changes to the problems being addressed by the Scheme – for example where existing traffic issues on the network alter as a consequence of other unrelated development projects being constructed, such as improvements to the local road network.

Study Areas and Assessment Timescales

4.2.6. The study areas of the assessments being undertaken within the EIA vary depending on the topic area being considered and reflect the geographical area over which environmental effects are likely to arise.

4.2.7. All topic study areas incorporate the land and features contained within the DCO site boundary as a minimum; however, whilst some topics have study areas that are relatively localised to the DCO site boundary, some extend outwards to capture the surrounding road network, distant communities, and environmentally sensitive areas.

4.2.8. Some assessments require the likely effects of the Scheme to be identified at defined points in time over its lifecycle, in order to establish how effects may alter over a period of time. For certain topics, the EIA is predicting the environmental conditions (both with and without the Scheme) that will likely exist at the following years:

a. Current baseline (2019) – reflective of the conditions which exist now whilst gathering baseline environmental data and undertaking the EIA.

b. Future baseline (2021) – reflective of the conditions that will be experienced in the future, immediately before the Scheme is constructed.

c. Construction (2021–2025) – reflective of the conditions that will be experienced during the Scheme's planned construction period.

d. Operation (2025) – reflective of the conditions that will be experienced once the Scheme is operational and open to traffic (this is also referred to as the Opening Year or the Year of Opening).

e. Future conditions (2040) – reflective of the conditions that will be experienced at a

point 15 years after Scheme opening (this is also referred to as the Design Year or Year 15).

4.2.9. For some assessments such as air quality and noise and vibration, the future baseline and future conditions with the Scheme in place are referred to as the "Do Minimum" and "Do Something" scenarios.

4.2.10. The Do Minimum represents the conditions that will exist at a given point in the future without the Scheme in place (but accounting for ongoing maintenance on the road network, the natural evolution of the environment, and the influence that other development projects will have on this).

4.2.11. The Do Something represents the same conditions, but with the Scheme in place and operational.

4.2.12. Both sets of terminology are used in this PEI Report, where required by the assessment guidance being applied within the relevant assessment topics.

Construction Traffic Flows

4.2.13. Calculations will be undertaken to identify the likely number of heavy goods vehicles and private vehicles that will be added to the road network during the Scheme's construction period. These will use information such as the phasing of the works, likely construction plant and equipment requirements, material quantities and anticipated worker numbers once defined.

4.2.14. The calculated totals will be used to inform the assessment of construction effects within the EIA, the final details of which will be reported within the Environmental Statement.

Operational Traffic Flows

4.2.15. A traffic model covering strategic and local roads has been developed to predict the amount of traffic (both with and without the Scheme) travelling on the network. As noted in Chapter 2, this has been used to inform a number of aspects including junction designs and the economic assessment of the Scheme.

4.2.16. The traffic model has used both strategic and local traffic information, and has taken account of other development projects in the area that are expected to influence future traffic flows on the road network.

4.2.17. Information on these developments has been obtained from sources including the local authorities within which the Scheme will be built, with each development categorised in terms of the confidence and certainty that it will be constructed (see Chapter 15).

4.2.18. Work is currently being undertaken to refine the traffic model alongside the EIA and the ongoing development of the Scheme's design. Once completed, the traffic model will be used to produce traffic flow information on which elements of the assessments of air quality, noise and vibration, road drainage and the water environment, and population and health will be based.

Other Modelling

4.2.19. Other forms of computer modelling are being undertaken within the topics of air quality, noise and vibration, and road drainage and the water environment.

4.2.20. These assessments are using a combination of traffic data, monitoring data and environmental factors (for example those relating to climate change) to model the conditions that will occur within the different assessment scenarios and years adopted.

4.3. Identifying Environmental Impacts and Effects

The Rochdale Envelope, Limits of Deviation and Design Uncertainty

4.3.1. Chapter 2 recognises that, subject to the granting of the DCO, some design refinement may be needed within defined Limits of Deviation (LoD).

4.3.2. Indicative LoDs for the Scheme have now been established. Accounting for design uncertainty and flexibility will be addressed within the EIA by adopting a precautionary approach. This will identify the likely significant effects of the Scheme through the establishment of a series of maximum development extents, which are known as a 'Rochdale Envelope'.

4.3.3. The Rochdale Envelope is named after a UK planning law case [REF 4-7]. It is an established principle on major infrastructure projects which allows a project description to be broadly defined within a number of parameters. Its adoption allows meaningful EIA to be undertaken by defining a 'realistic worst case' scenario that decision-makers can consider when determining the acceptability or otherwise of the environmental effects of a project.

4.3.4. The principle is founded on the assumption that as long as the technical and engineering parameters of a project fall within the limits of the envelope, and the EIA has considered the likely significant effects of that envelope, then flexibility within those parameters is deemed to be permissible within the terms of any consent granted for the project.

4.3.5. The realistic worst case scenario assumes that one or other of the parameters will have a more significant adverse effect than the alternative, and where a range of parameters is provided, the most environmentally detrimental parameter is assessed in the EIA. The worst case scenario can differ between the environmental topics being assessed, and the environmental resources or receptors potentially affected.

4.3.6. In line with this approach, a series of parameters will be established across aspects relating to the design and construction of the Scheme, the purpose of which will be to manage design uncertainty and provide flexibility for deviation where needed. These parameters will be presented within the Environmental Statement and in other documentation accompanying the DCO application.

4.3.7. This approach to managing uncertainty within defined parameters and limits will ensure that any design changes that may arise will not be of an order that renders the content of the Environmental Statement inadequate or invalid.

Impact Identification and Assessment

4.3.8. Impacts comprise the following changes to the baseline environment:

a. Direct impact – for example the loss of ecological habitat to accommodate a project.

b. Indirect impact – for example pollution downstream arising from silt deposition during earthworks.

c. Secondary impact – for example changes to ecological species as a result of water pollution.

d. Short-term (or temporary) impact – for example dust generated as a result of construction activities.

e. Medium-term impact – for example the cutting back of planting which is allowed to regenerate.

f. Long-term (or permanent) impact – for example the introduction of a new structure into an established view.

4.3.9. Within the EIA, these different types of impact are classified as being either:

a. beneficial (positive) – for example the transfer of traffic from an existing road onto a new road, leading to improved journey conditions for walkers and cyclists; or

b. adverse (negative) – for example loss of a valuable environmental feature.

4.3.10. Impacts are being defined in the EIA using standard terminology and methods that are used to predict the magnitude of impact (or change) resulting from the Scheme; these are set out in the DMRB [REF 4-3] and in IAN 125/15 [REF 4-4].

4.3.11. Different approaches are being used in the EIA to predict impacts, depending on the nature of the topic being assessed. For example, the assessment of noise and vibration uses computer modelling to calculate changes in noise levels resulting from the Scheme, whereas the assessment of landscape relies upon the experience, perception and expert opinion of the individual undertaking the assessment.

4.3.12. The impact assessments of the Scheme are currently ongoing, and will be finalised using the reference design (see Chapter 3). These will also take into account any works required to equipment belonging to statutory undertakers, which may need to be carried out prior to the main construction works starting.

4.3.13. Where uncertainty exists, or where assumptions are being used in the EIA when predicting impacts (for example where assessments may have taken their findings from incomplete data), these will be reported within the Environmental Statement.

4.3.14. Where high levels of uncertainty exist, the EIA is adopting a precautionary approach which assumes a worst case impact will occur as a result of the Scheme.

4.4. Mitigation Measures, Enhancements and the Significance of Effects

Mitigation Measures

4.4.1. Mitigation is the term which describes measures (including any process, activity or design) that are used to avoid or reduce the adverse environmental impacts or effects of a development project.

4.4.2. Through the process of ongoing environmental assessment and option development, Highways England has sought (and is continuing) to mitigate environmental impacts by designing-out potential issues between the Scheme and environmental resources and receptors. Chapter 3 summarises how the Scheme has evolved over time and how the early stages of the EIA process have influenced the development and selection of the preferred route described in Chapter 2.

4.4.3. Where impact avoidance has not been possible, measures within the following mitigation types have been identified to address the adverse impacts of the Scheme.

Embedded Mitigation Measures

4.4.4. A range of measures have already been embedded into the design of the preferred route, the effectiveness of which has been proven on other road schemes.

4.4.5. These measures include the placing of new sections of road in earthwork cuttings to reduce traffic-related noise, the incorporation of landscaping to visually screen and contain new or improved road components, and reducing the loss of habitats by minimising landtake.

4.4.6. Figure 2.4 within Volume 2 illustrates the Scheme and the preliminary mitigation measures that have been embedded into its design, the function and nature of which are described as part of the assessments presented in Chapters 5 to 14.

Standard Mitigation Measures

4.4.7. Standard mitigation measures, comprising management activities and techniques that will be implemented during construction of the Scheme, are being identified as part of the EIA.

4.4.8. These measures include, for example, applying construction site dust suppression techniques within working areas, which the Contractor will be required to implement as part of their working practices.

4.4.9. Standard mitigation measures which have been identified through ongoing EIA process as being required to address the adverse impacts of the Scheme are presented in Chapters 5 to 14. The final suite of measures will be described within the Environmental Statement, and fully detailed within an Outline Environmental Management Plan accompanying the DCO application.

Additional Mitigation Measures

4.4.10. Additional mitigation measures are measures that are over and above any embedded and standard mitigation measures.

4.4.11. These measures are being identified through the EIA process, where the assessments establish a need to further reduce the significance of an effect.

Environmental Compensation

4.4.12. Environmental compensation measures may be necessary should the EIA identify that mitigation at an affected location is not possible to avoid or reduce a significant effect.

4.4.13. Should the need for compensation measures be identified, these will be illustrated and described within the Environmental Statement.

Environmental Enhancement

4.4.14. Enhancements are measures that are over and above any mitigation (and where identified, compensation) measures required to address the adverse effects of the Scheme.

4.4.15. Where practicable, enhancements are being identified and incorporated into the design of the Scheme to deliver wider environmental benefits.

Biodiversity Offsetting

4.4.16. Highways England has committed to reducing the loss of biodiversity across the strategic road network, the objective being to deliver no net loss on land under their management by 2020 and a gain in biodiversity by 2040.

4.4.17. As part of the biodiversity assessment being undertaken within the EIA, calculations are being undertaken to establish the extent to which the environmental measures being incorporated into the design of the Scheme will offset the loss of ecological habitats and features, and potentially achieve a biodiversity net gain across the Scheme.

4.4.18. Figure 2.4 within Volume 2 illustrates the ecological measures that have been identified to date through the biodiversity assessment (see Chapter 8) and incorporated into the design of the Scheme, the final form of which will be presented within the Environmental

Statement alongside evidence to demonstrate whether a no net loss or net gain position is achievable.

Environmental Effects

4.4.19. Environmental effects are the consequence of impacts. By way of example, an impact arising from a new highway project could be the loss of mature woodland to a new road, the effect (or consequence) of which could be the opening of new views in which this road becomes visible.

4.4.20. In the EIA, effects are identified by considering the importance, value or sensitivity of an environmental resource or receptor, and the magnitude of impact (or change) that is predicted to occur. Criteria are being used to identify and report the significance of environmental effects.

4.4.21. Where embedded and standard mitigation measures form an integral part of the Scheme design and/or the approach to its construction, the assessments only report the significance of effects post-mitigation. Where additional mitigation measures are identified, the assessments report both the pre- and post-mitigation effects, the purpose being to demonstrate their role and effectiveness in further reducing the significance of effects.

4.4.22. Unlike mitigation and (where identified) compensation measures, enhancements are not factored into the determination of significances; however, the potential benefits of these measures are presented within the relevant topic assessments, in accordance with the NPSNN [REF 4-1].

4.4.23. The likely significant effects of the Scheme will be reported within the Environmental Statement, which will also set out any requirements for the monitoring of these effects after construction of the Scheme is completed.

4.4.24. This PEI Report presents the potential environmental effects of the Scheme and includes commentary on their likely significance, where this has been established through the ongoing EIA process.

Assessment Criteria

4.4.25. Assessment criteria contained in DMRB Volume 11 [REF 4-3] for sensitivity (or importance/value), magnitude of impact (or change) and significance of effect are being applied in the EIA across the identified topics to ensure the identified environmental effects are assessed in a comparable manner, except where other standards, thresholds and/or criteria have been followed or applied. In such instances, the deviation from the general criteria are presented within the Scoping Report [REF 4-5].

4.4.26. **Table 4-1** presents the general sensitivity (or importance/value) criteria that are being been applied in the EIA.

Table 4-1: Criteria for Determining the Sensitivity (or importance/value) of Environmental Resources and Receptors

Sensitivity (or importance/value)	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	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

4.4.27. **Table 4-2** presents the general magnitude of impact (or change) criteria that are being applied in the EIA.

Table 4-2: Criteria for Determining the Magnitude of Impact (or change) on Environmental Resources and Receptors

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

4.4.28. **Table 4-3** presents the general significance of effect criteria that are being applied in the EIA.

Table 4-3: Criteria for Determining the Significance of Effect on Environmental Resources and Receptors

Significance of effect	Typical descriptors
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process
Moderate	These beneficial or adverse effects are considered to be important in informing the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

4.4.29. Based on professional judgement, effects of very large, large or moderate significance are being considered to represent a 'significant' effect in the context of the EIA Regulations [REF 4-2], except where criteria or guidance adopted and described within Chapters 5 – 14 present a different threshold or approach to identifying and classifying significant effects.

4.5. Cumulative Effects

4.5.1. The individual effects of the Scheme may not be significant on their own; however, when combined with other effects these can become significant.

4.5.2. The EIA is identifying cumulative effects resulting from the combination of different activities within the Scheme, and from activities associated with other development plans and projects in the surrounding area.

4.5.3. Details of the approach to the identification and assessment of cumulative effects, and their significance, are presented in Chapter 15.

5. AIR QUALITY

5.1. Introduction

5.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on air quality.

5.1.2. Receptors that are sensitive to air quality include public exposure receptors (these being locations including residential properties or schools), and nationally and internationally designated ecological sites.

5.2. Approach to the Assessment

Scope and Methods

5.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the air quality assessment, and the approach and methods to be followed.

5.2.2. The Scoping Report [REF 5-1] 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 Scheme on air quality.

5.2.3. Following receipt of the Scoping Opinion [REF 5-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing air quality assessment:

a. Inclusion of a detailed assessment of impacts on designated ecological sites during construction, where significant effects are likely to occur.

b. Inclusion of full justification for the scoping out of effects relating to carbon monoxide (CO), 1-3 butadiene, benzene, lead and sulphur dioxide (SO_2), with specific references made to the information that supports this decision.

c. Inclusion of an assessment of the impacts associated with increased movements of heavy goods vehicles (HGVs) during construction, where there is potential for a likely significant effect.

d. An assessment of the impacts from the Scheme both to and within the Bar Hill to Impington Air Quality Management Area (AQMA) along the A14, with any impacts on the action plan for this AQMA also addressed.

e. An assessment of impacts associated with all relevant pollutants under the EU ambient air quality directive [REF 5-3], including increases in particulate matter ($PM_{2.5}$) resulting from the Scheme (where relevant), with account taken of the performance against relevant target/limit values.

f. Consideration of the potential effects on all sensitive receptors from construction activities, including residential properties.

5.2.1. Having had regard to the information presented within the Scoping Report [REF 5-1], The Inspectorate's Scoping Opinion [REF 5-2] has also confirmed Highways England's view that significant effects on air quality associated with the future maintenance of the Scheme are unlikely. Accordingly, this matter will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

5.2.2. The air quality assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 5-4].

5.2.3. Details of how the air quality assessment will meet the requirements of the NPSNN [REF 5-4] in relation to establishing existing air quality levels, forecasting changes to air quality (including carbon emissions), and the mitigation of impacts are presented within the Scoping Report [REF 5-1].

5.2.4. The Scoping Report [REF 5-1] also details how other legislation and policy relating to air quality is being taken account of in the assessment.

Consultation

5.2.5. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the air quality assessment, the results of which are presented within the Scoping Opinion [REF 5-2].

5.2.1. Consultation with the relevant local authorities will continue throughout the assessment process to further refine the assessment study areas, to discuss the magnitude of predicted impacts and the significance of effects on air quality, and to agree appropriate mitigation measures.

Limitations and Assumptions

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

5.2.3. At this stage details of the construction traffic, construction schedule, construction methodology and plant requirements are not yet confirmed. Therefore, this preliminary assessment provides a qualitative construction air quality assessment based on the application of best practicable means to minimise dust and emissions. A quantitative assessment of the impacts arising from construction works will be undertaken as part of the assessment and reported within the Environmental Statement.

5.2.4. Detailed modelling of the Scheme's potential air quality impacts has yet to be undertaken. This will be carried out once the detailed traffic data is available for the Scheme, and therefore this preliminary assessment of operational air quality impacts is qualitative.

5.2.5. The findings of this preliminary assessment may be subject to change as the design of the Scheme is developed and refined further through the assessment and consultation processes, following the modelling of impacts and effects using the detailed traffic data (once available).

5.2.6. The potential effects associated with nitrogen deposition on relevant designated ecological sites will be reported as part of the biodiversity assessment (see Chapter 8), and will rely on data provided by the air quality assessment.

Study Area

5.2.7. For construction phase air quality impacts, the assessment study area has been defined as the area within 200m of the Development Consent Order (DCO) site boundary, which includes the proposed locations of the construction compounds.

5.2.8. For the assessment of air quality effects associated with traffic, study areas are being defined on the basis of the anticipated changes in traffic conditions that are likely to

occur as a result of the Scheme, when compared to the conditions without the Scheme. The traffic conditions consider the flow, speed and composition of traffic.

5.2.9. The traffic change criteria contained in Volume 11 of the Design Manual for Roads and Bridges (DMRB) [REF 5-5] are being used to determine the Affected Road Network (ARN) for the assessments of both local and regional air quality, which in turn determines the extent of the study area.

5.2.10. The local air quality assessment study area comprises roads (or sections of road – referred to as links) within the ARN that have receptors within 200m of either side of the carriageway. All road links within 200m of these relevant receptors are being included in the assessment. The 200m distance is used because pollutant contributions from roads are indistinguishable from background pollutant concentrations beyond this distance.

5.2.11. The study area for the assessment of regional pollutant emissions is being defined using the regional air quality study area criteria as set out in the DMRB [REF 5-5].

5.3. Baseline Conditions

Information Sources

5.3.1. The following sources and types of information have been used in the assessment:

a. Ordnance Survey MasterMap and AddressBase data, to aid the identification and classification of receptors sensitive to changes in air quality.

b. AQMA boundary data, to identify their extent and relationship to the Scheme and the assessment study areas.

c. Pollution concentration and climate mapping produced by DEFRA, to aid the identification of pollutant levels.

d. Baseline air quality monitoring data collected by Highways England and local authorities, to establish existing air quality in the area.

e. Statutorily designated ecological sites, to identify their relationship to the Scheme and the assessment study areas.

Receptor Locations

5.3.2. There are a number of residential properties either side of the A1 to the north and south of Black Cat roundabout, as well as properties within the villages of Roxton, Chawston, Tempsford and Wyboston.

5.3.3. There are also settlements and isolated properties located alongside the existing A428 and in proximity to the proposed alignment of the new dual carriageway. These include Abbotsley, Eltisley, Croxton, various farms and individual properties.

5.3.4. There are several schools including St Neots Middlefield Community Primary School, Newton Community Primary School in Eltisley, Roxton Lower School located between the A1 and A421, and Cambourne Primary School.

Designated Ecological Sites

5.3.5. The assessment is currently identifying designated ecological sites that contain features that may be sensitive to air pollutants. These sites include, but are not limited to, the following:

a. Elsworth Wood Site of Special Scientific Interest (SSSI) – located 850m from the DCO site boundary, to the north east of Caxton Gibbet roundabout.

b. St Neots Common SSSI – located 900m from the DCO site boundary, to the north of Wyboston interchange.

c. Weaveley and Sand Woods SSSI – located 2.5 kilometres from the DCO site boundary, to the south east of Black Cat roundabout.

d. Eversden and Wimpole Woods Special Area of Conservation (SAC) and SSSI – located 7.3 kilometres from the DCO site boundary, to the south-east of Caxton Gibbet roundabout.

5.3.6. The designated ecological sites to be considered within the air quality assessment will be confirmed following completion of the detailed traffic modelling and will focus on identifying any change in annual mean oxides of nitrogen (NO_x) concentrations and rates of nitrogen deposition affecting the sensitive ecosystems, for designated ecological sites located within 200m of the ARN.

Air Quality Management Areas

5.3.7. AQMAs potentially affected by the Scheme have been identified as part of the assessment.

5.3.8. The nearest AQMAs to the Scheme that have been declared for exceedances of the nitrogen dioxide (NO_2) annual mean air quality objective are:

a. Sandy AQMA – located approximately 5 kilometres south of Black Cat roundabout (declared by Central Bedfordshire Council); and

b. St Neots High Street AQMA – located approximately 5.4 kilometres north of Black Cat roundabout (declared by Huntingdonshire District Council).

5.3.9. The locations of these AQMAs are illustrated on Figure 2.2 within Volume 2.

DEFRA Mapping

5.3.10. Information on areas exceeding EU limit value thresholds is available from DEFRA's Pollution Climate Mapping (PCM) model [REF 5-6], which provides 'road contributed' concentrations of pollutants. Based on 2017 roadside nitrogen dioxide concentrations modelled by the DEFRA PCM model [REF 5-6], no road links exceeding 40µg/m^3 are present within 10 kilometres of the Scheme.

5.3.11. Annual average background pollutant data for each 1 kilometre x 1 kilometre grid square within the study area have been obtained from the DEFRA 2015 background pollution maps [REF 5-7]. The contributions from motorways, trunk A-roads and A-roads were removed from each grid square (as these will be explicitly modelled as part of the air quality assessment). A review of the mean, maximum and minimum concentrations of NO_x, nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ up to the year 2030 for the grid squares that encompass the Scheme indicate that background pollutant concentrations throughout the study area are, and will continue to be, well below the national air quality objective values for the respective pollutants.

Local Authority Monitoring Data

5.3.12. Local authority air quality monitoring is carried out at a number of locations in the study area, the majority of which are on the western side of the study area within the Bedford and Huntingdonshire authority areas. The full details of all monitoring sites located within 200m of the ARN, including recent years' results, are provided in Scoping Report [REF 5-1].

5.3.13. Sites DT12, DT13 and DT21, located within the administrative area of Bedford Borough Council, are located adjacent to the A1 within the study area to the north of Black Cat

roundabout. The highest nitrogen dioxide concentrations in recent years have been measured at DT21, which is a roadside site, located approximately 175m from the nearest receptor. In 2012 to 2014 inclusive and 2016, annual mean nitrogen dioxide concentrations at this location exceeded the air quality objective value. The results for 2015 and 2017 indicated that the annual mean nitrogen dioxide air quality objective was achieved. Nitrogen dioxide concentrations at sites DT12 and DT13, which are located approximately 30m and 20m from the A1 respectively, were well below the air quality objective in all years between 2013 and 2017.

5.3.14. There are seven monitoring locations to the north of the study area within Huntingdonshire District Council's administrative area (St Neots 2, 8, 9; and Buckden 1, 2, 3, 4). Monitored nitrogen dioxide concentrations at these sites have been well below the annual mean nitrogen dioxide objective value in recent years. The highest monitored nitrogen dioxide concentrations at these locations in all years between 2013 and 2017 have been measured at site Buckden 3 (34 High Street (shop)), ranging between 32.2 µg/m^3 in 2013 and 2014 and 27.7 µg/m^3 in 2017.

5.3.15. The nearest continuous monitoring station measuring nitrogen dioxide and particulate matter is the Sandy Roadside site, which is part of DEFRA's Automatic Urban Network and is located within the Sandy AQMA in Central Bedfordshire. Measured pollutant concentrations at Sandy Roadside have been below the relevant objective values in recent years. The monitored nitrogen dioxide annual mean concentration in 2017 was 34 µg/m^3. During recent years, particulate matter concentrations at Sandy Roadside have been well below the annual mean and daily mean objective values.

5.3.16. There are no local authority monitoring locations in proximity to the proposed alignment of the new dual carriageway or in the eastern part of the study area (near to Caxton Gibbet roundabout). The nearest sites to the east of the Scheme are located approximately 7 kilometres away within South Cambridgeshire District, located close to and within the Bar Hill – Milton AQMA. The nearest roadside diffusion tube, site DT3 at Hill Farm Cottages, recorded a nitrogen dioxide concentration of 31 µg/m^3 in 2015. Nitrogen dioxide concentrations at monitoring sites in Fenstanton, approximately 4 kilometres north of Caxton Gibbet roundabout were also below the objective in 2016.

Highways England Monitoring Data

5.3.17. Monitoring as part of the Highways England monitoring network carried out for six months in 2016 at 25 locations within and around the study area. Two locations near to the northbound carriageway of the A1 north of Black Cat roundabout recorded nitrogen dioxide concentrations exceeding the annual mean air quality objective value.

5.3.18. Additional monitoring was carried out for a six month period from late-February to late-August 2018 at 35 locations which included areas not covered by local authority or Highways England monitoring (particularly in the east of the study area). This monitoring was carried out to provide information on current levels of nitrogen dioxide along the proposed alignment of the new dual carriageway, and where possible to be representative of residential exposure. Seven of the additional monitoring locations recorded nitrogen dioxide concentrations exceeding the annual mean air quality objective. Six of the exceedances were recorded along the existing A1, at locations to the north and south of Black Cat roundabout. The remaining exceedance was measured at a location alongside the A428 near Croxton.

5.4. Potential Impacts

5.4.1. The preliminary assessment has identified that the Scheme will potentially result in both adverse and beneficial impacts on air quality.

5.4.2. These impacts are associated with:

a. dust and emissions from vehicle movements and the operation of equipment and machinery during construction of the Scheme; and

b. increases and decreases in vehicle emissions, derived from changes in the flow and composition of traffic on the road network once the Scheme is operational.

Construction

5.4.3. During the construction phase, there is potential for adverse impacts from dust emissions from construction activities at sensitive human and ecological receptors within the vicinity of construction sites, working areas and access roads. The types of activities with the potential to generate dust during the construction phase are likely to include:

a. the movement of construction vehicles;

b. enabling works (comprising works undertaken in advance of the main construction activities, for example the clearance of road verges);

c. earthworks;

d. demolition works;

e. the excavation and installation of drains and communication ducts;

f. the construction of retaining walls;

g. carriageway surfacing works;

h. the installation of verge furniture and landscaping; and

i. the stockpiling, storage and movement of materials.

5.4.4. During the construction phase, it is also likely that there will be additional vehicle movements due to HGVs accessing construction sites from the surrounding road network, and potential vehicle movements on haul roads within construction sites. These additional vehicles have the potential to increase concentrations of pollutants, specifically NO_x, nitrogen dioxide and PM_{10}, at nearby receptors.

Operation

5.4.5. Traffic flow changes on the road network have the potential to produce changes in nitrogen dioxide and PM_{10} concentrations.

5.4.6. During the operational phase, the greatest potential air quality change is likely to occur at receptors in proximity to the new dual carriageway, which are predicted to experience increases in pollutant concentrations due to the absence of existing significant sources of air pollution in these areas.

5.4.7. Traffic flows reductions along the A428 are expected to reduce as a result the transfer of traffic onto the new dual carriageway, which is likely to result in a beneficial reduction in pollutant concentrations.

5.4.8. At receptors located within 200m of the ARN, the changes in traffic flows on nearby roads as a result of the Scheme are not certain at this point, and the likely changes in pollutant concentration are correspondingly uncertain. The degree to which the

predicted changes in operational traffic flows due to the Scheme will change pollutant concentrations will be assessed and reported in the Environmental Statement, using detailed traffic modelling data once available.

5.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

5.5.1. Potential air quality impacts are being taken into account as part of the design-development of the Scheme in order to reduce and/or avoid adverse effects through careful design. These considerations include:

a. the alignment of new sections of highway to reduce the proximity of new operational traffic flows on sensitive receptors; and

b. the siting of construction compounds to reduce the potential impact of construction activities on sensitive receptors, where possible.

Standard Mitigation Measures

5.5.2. The contractor will undertake construction works in line with measures as set out within their Construction Environmental Management Plan (CEMP). The CEMP will be based upon the framework of measures set out in the Outline Environmental Management Plan (OEMP), which will be prepared by Highways England and submitted as part of the DCO application.

5.5.3. The CEMP will include a range of industry standard and best practice measures to mitigate dust impacts and control emissions, based on the measures detailed in the Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction sites [REF 5-8].

5.5.4. Examples of these measures include the following:

a. Employment of dust suppression techniques, for example the sheeting of certain stockpiled materials to reduce fugitive emissions.

b. Reducing emissions from construction vehicles and equipment, for example by not having engines idling unnecessarily.

c. Imposing speed restrictions within working areas, for example through signposting speed limits on haul roads.

d. Adoption of working methods that reduce the potential for dust emissions, for example using manual techniques.

e. Monitoring of construction operations and weather conditions, for example to limit the exposure of dry materials during high winds.

5.5.5. The routes that construction vehicles will need to take will also be detailed within the CEMP, which will restrict such vehicles to the major roads in vicinity of the Scheme to reduce the potential for air quality impacts at nearby receptors.

Additional Mitigation Measures

5.5.6. Should the assessment of standard dust mitigation measures indicate that further measures are necessary to address potential air quality impacts, additional mitigation will be implemented by the contractor based on the measures containing in the IAQM guidance [REF 5-8].

5.5.7. Additional mitigation measures may be required in locations that are identified as being at a higher risk of construction-related air quality impacts, for example sensitive receptors located within 200m of any construction works.

5.5.8. The final selection of mitigation measures, including specific measures relating to construction phase HGV movements and traffic management, and/or the need for operational mitigation, will be considered as part of the assessment and reported in the Environmental Statement, informed by advice provided by Highways England's appointed buildability contractor.

5.6. Assessment of Effects

5.6.1. This preliminary air quality assessment has identified that:

a. existing air quality in the study area is generally good, with the exception of air quality at the properties immediately adjacent to the A1 north of Black Cat roundabout where monitored nitrogen dioxide concentrations in recent years have exceeded the annual mean air quality objective value; and

b. human and ecological receptors in the study area may experience changes in pollutant concentrations during the construction and operational phases of the Scheme, some of which could result in significant effects.

Construction

5.6.2. Receptors that could experience temporary construction effects are those located in villages of Roxton, Chawston, Tempsford Abbotsley, Eltisley, Croxton and Wyboston, along with settlements and properties that lie alongside the existing A428 and the new dual carriageway.

5.6.3. As a number of receptors are located within 200m of the construction works, the assessment has established that mitigation measures are likely to be required to reduce the risk of potential adverse impacts associated with dust.

5.6.4. An assessment of the impacts associated with construction related traffic will be undertaken and presented within the Environmental Statement. The level of assessment required will depend on the total construction vehicle requirements and associated management practices that contractor will undertake.

Operation

5.6.5. During the operational phase, the assessment has established that receptors alongside the new dual carriageway are likely to experience the greatest increases in pollutant concentrations, due to the transfer of traffic onto the road in an area where significant sources of air pollution are absent. Notwithstanding this, the assessment has identified that it is unlikely that air pollutant concentrations will increase sufficiently to exceed the air quality objective values for either NO_2 or PM_{10}. As such, it is considered unlikely that the Scheme will contribute to a significant worsening of air quality at sensitive receptors either locally or regionally.

5.6.6. The assessment has also identified that improvements in air pollutant concentrations are likely to occur at sensitive receptors in proximity to the A428 due to the transfer of traffic onto the new dual carriageway.

5.6.1. At receptors located within 200m of the ARN, the effects associated with changes in traffic flow on nearby roads from operation of the Scheme have yet to be established. As the Scheme will alleviate congestion around Black Cat roundabout and on the A1 approaches, and will improve journey times when travelling east-west, it is expected that there will be a decrease in pollutant concentrations at receptors near to Black Cat roundabout and the section of the A1 north of the roundabout.

5.6.2. These preliminary findings will be confirmed through detailed air quality modelling, and the likely significant effects of the Scheme on air quality will be reported within the Environmental Statement.

6. CULTURAL HERITAGE

6.1. Introduction

6.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on cultural heritage, which comprises archaeological remains, historic buildings and historic landscapes.

6.2. Approach to the Assessment

Scope and Methods

6.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the cultural heritage assessment, and the approach and methods to be followed.

6.2.2. The Scoping Report [REF 6-1] 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 Scheme on cultural heritage.

6.2.3. Following receipt of the Scoping Opinion [REF 6-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing cultural heritage assessment:

a. An assessment of the potential for cumulative impacts to heritage assets from the Scheme and other development.

b. Discussion and agreement with the relevant consultation bodies as to the other development to be addressed within the cumulative assessment.

6.2.4. Having had regard to the information presented within the Scoping Report [REF 6-1], The Inspectorate's Scoping Opinion [REF 6-2] has also confirmed Highways England's view that significant effects on cultural heritage associated with the future maintenance of the Scheme are unlikely. Accordingly, this matter will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

6.2.5. The cultural heritage assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 6-3].

6.2.6. Details of how the cultural heritage assessment will meet the requirements of the NPSNN [REF 9-3] in relation to the identification, assessment and mitigation of effects on cultural heritage assets (including their setting and conservation) are presented within the Scoping Report [REF 6-1].

6.2.7. The Scoping Report [REF 6-1] also details how other legislation and policy relating to cultural heritage is being taken account of in the assessment.

Consultation

6.2.8. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the cultural heritage assessment, the results of which are presented within the Scoping Opinion [REF 6-2].

6.2.9. Consultation has been carried out with the Historic Environment Record (HER) at Bedford Borough Council, Central Bedfordshire Council and Cambridgeshire County Council to obtain data and records referenced in the assessment.

6.2.10. Meetings have been held with Historic England on 26 January 2018 to discuss the likely effects of the Scheme on Brook Cottages. Meetings have also been held with the planning archaeologists at Bedford Borough Council and Cambridgeshire County Council on 18 September 2018 to discuss the scope of the cultural heritage impact assessment.

Limitations and Assumptions

6.2.11. 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 Scheme and the maximum likely extents of land required for its construction and operation.

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

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

6.2.14. The findings of this preliminary assessment may be subject to change as the design of the 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.

Study Area

6.2.15. The study area for the cultural heritage assessment is focused on land within the Development Consent Order (DCO) site boundary and outward to 1km, as illustrated on Figure 6.1 within Volume 2.

6.2.16. The extents of the study area have been informed by guidance contained in Volume 11 of the Design Manual for Roads and Bridges (DMRB) [REF 6-4], and following consultation with Cambridgeshire County Council, Central Bedfordshire Council and Bedford Borough Council.

6.2.17. Within this study area, the potential impacts and effects of the Scheme on designated sites and features (comprising scheduled monuments, listed buildings and conservation areas) of archaeological and heritage importance are being considered.

6.3. Baseline Conditions

Information Sources

6.3.1. The following sources and types of information have been used in the assessment:

a. The National Heritage List for England (NHLE).

b. HER data from Cambridgeshire County Council, Bedford Borough Council and Central Bedfordshire Council.

c. Analysis of aerial photography (historic and current).

d. Historic mapping and other archival sources, including the Cambridgeshire Record Office and the Bedfordshire Archives and Record Service.

e. Available reports of previous archaeological fieldwork undertaken within the DCO site boundary.

6.3.2. The cultural heritage assets described in the following sections are numbered with their NHLE or HER numbers, as issued by Bedford Borough Council, Central Bedfordshire Council and Cambridgeshire County Council. These reference numbers refer to the

assets illustrated on Figure 6.1 within Volume 2, and the schedule of all known heritage assets presented in Appendix 6.1.

Archaeological Remains

6.3.3. Designated archaeological remains include 12 scheduled monuments within the study area, comprising a Bronze Age bowl barrow (NHLE 1013521), eight medieval moated sites (NHLE 1019176; 1019638 1019177; 1010114; 1012076; 1013419; 1010864; 1010948), and three deserted medieval villages (NHLE 1006849; 1006815; 1006783).

6.3.4. There are no World Heritage Sites or registered battlefields recorded within the study area.

Palaeolithic (up to 10,000BC)

6.3.5. There are five assets of Palaeolithic date recorded within the study area. These consist of a flint core found at Roxton (MBD15855), a hand axe identified during field walking (MBD8801), the find spots of hand axes (MBD14666; MBD14668) and finds from Eaton Socon (MCB667).

Mesolithic (10,000 – 4000BC)

6.3.6. There are two assets of Mesolithic date recorded within the study area. This comprises a collection of flint implements from St Neots including 16 cores, 29 blades, five scrapers and three other implements (MCB670) and the find spot of Mesolithic flakes (MBD490).

Neolithic (4000 – 2500BC)

6.3.7. There are eight assets of Neolithic date recorded within the study area. Field walking to the east of St Neots revealed Neolithic evidence (ECB1524) and four further find spots recorded a Neolithic polished axe (MCB3137), axes (MBD14663 and MBD14668) and an unpolished axe (MCB16718). Neolithic pits have been recorded (MCB16709) at Colmworth Business Park, features of Neolithic date at Alpha Park (MCB18206), and a hearth at Little End (MCB484).

Bronze Age (2500 – 800BC)

6.3.8. There are 10 assets dated specifically to the Bronze Age in the study area. This includes one scheduled monument, namely the Round Hill bowl barrow (1013521). This monument measures approximately 21m in diameter and is approximately 1.7m high. Two flint scatters (MBD15020; MCB13974) and Bronze Age flints (MCB13973; ECB550) are also recorded.

6.3.9. A collection of at least eight ring ditches, pit alignments and linear features (MBD1776), set within a look of the River Ivel, have been recorded as cropmarks. Also recorded within the study area are, a rapier (MCB3009), a possible barrow (ECB1874), cropmarks of a ring ditch and possible enclosure (MBD17147), and evidence of agricultural activity identified through evaluation (ECB1482), are also recorded.

Iron Age (800BC – AD43)

6.3.10. There are nine assets dated specifically to the Iron Age within the study area. These consist of evidence of settlement activity (MCB15790 and MBD21912), drainage channels (ECB2482), a ditch (19765), two sites of pits (MCB24004; MCB3030), and find spots of coins (MCB15791; MBB20152) and a ring (MBD2025).

6.3.11. There is a larger amount of evidence dated to between the Iron Age and the Roman period within the study area. There are 18 assets which are dated to these periods. This includes several areas of settlement activity (MCB19825; MCB19542; MCB22309;

ECB1482; ECB3024), enclosure features (745; MCB24003; MCB6926; MCB22310; MCB19541; ECB1249), ditches and pits (2664; MCB19981), evidence of land division and drainage (MCB19660) and a single possible hearth feature (ECB762).

6.3.12. There are also 31 assets recorded as broadly prehistoric in date. The majority of these represent enclosure or linear features identified through analysis of cropmarks (16800; 16802; 14032; 16821; 13994; 1653; 1832; 1833; 15047; 16785; 15046; 1836; 1651; ECB1874; MBD480). There are also two records of ring ditches (1387; 1793), two sub-rectangular enclosures (16803; 16804), one site with unspecified features (ECB2417), and a number of flint finds including flakes (ECB2121; MCB4342; MCB4349; MCB2007), cores (MCB1680), scrapers (MCB4355; MCB4339), flint scatters (EBD1075; MBD14671); an arrowhead (MCB487), and a blade (MCB1697).

Roman (AD43 – 410)

6.3.13. There are 60 assets which are dated exclusively to the Roman period within the study area. Many of these comprise find spots, including pottery (MBD2025; ECB2017; MCB4320; MCB800; MCB1422; MCB20140; MCB2972; MCB3010; ECB3602; ECB172; EBD1103; MCB13868; MCB13866; MBD14673), coins (MBB19827; MBB19828; MBB19829; MBB20044; MBB20062; MBB20063; MBB20064; MBB20065; MBB20066; MBB20067; MCB1023; MCB799; MCB504; MCB10797; ECB3667; MBD15860), strap fittings (MBB19824; MBD16147), a brooch (MBD16135), a bronze bracelet (MCB16788), and a bronze knife handle (MCB11414).

6.3.14. Features from the study area of Roman date comprise a small enclosed settlement (ECB79), earthworks of a possible temporary camp (MCB3102), a cemetery site (MCB2971), a villa (MBD17144), a rural site (MCB16504), two Roman roads, possible remains of Ermine Street (MCB15034) and a section of the Sandy to Godmanchester Roman road (MCB17569), and evidence of field systems (ECB1463, MCB13867). Other features recorded in the study area include various enclosures (1671; 16799; 9072; ECB1874), a trackway (628), settlement activity (MBD482; MCB16505; MCB16710; MCB20473), and ditches and pits (MCB15602; MCB17255; MCB801; ECB3714; 19769; MBD21916; MBD1671).

Early Medieval (AD410 – 1066)

6.3.15. There are 15 assets of early medieval date recorded within the study area. The first comprises the site of St Pandonia's Well at Eltisley Abbey, which was the location of a 9th century Benedictine nunnery (MCB2999).

6.3.16. Evidence of Saxon occupation, primarily due to the identification of one probable structure, was found during trial trenching. It contained three roughly parallel gullies and 11 pits or post-holes, four of which may make a rectangular structure (13413). Domestic structures were also recorded during excavation to the north-west of the churchyard in Weald (MCB2979) and at Alpha Park (MCB18207). Further evidence of settlement was found at Tempsford Park, with a structured settlement comprising the rectilinear plots that underwent later development, thought to be late Saxon, was recorded (9726) along with inhumations, post-holes and pottery (19766). At Tempsford Hall, the remains of a site of tenement plots, a moated manor (EBD1565) and several possible boundary ditches (EBD158), thought to originate from the early medieval period have been identified. Evaluation work at Tempsford also revealed an extensive Saxon-Norman domestic settlement (EBD941), in addition to a medieval moat and prehistoric finds.

6.3.17. Find spots of an early medieval date have also been recorded, including strap ends (MBD15983; MBD21209), and a cast lead object possibly a gaming piece (MBB21181).

Medieval (AD1066 – 1500)

6.3.18. There are assets of medieval date recorded within the study area. These include 11 scheduled monuments consisting of eight moated sites and three deserted settlements. The moated sites comprise a 50m x 46m moat at Pond Farm (1019176), a 74m x 64m moat at Manor Farm, south-east of Eltisley (1019638), a 150m wide square moated site at Pastures Farm (1019177), a moated site with fishponds at Chawston Manor (1010114) and a moated enclosure with associated buildings at The Lane, Wyboston (1012076). The three deserted villages consist of a site at Wintringham which comprises earthworks in a rectangular pattern of sunken roads and house platforms (1006815), as well as further sites of settlements at Weald (1006849) and at Croxton (1006783).

6.3.19. There are also a large number of non-designated assets, including 14 further moated sites. Examples include Tempsford Park moat with a manor house (9726), Papley Grove in Eltisley along with the site of a manor house (MCB1325), and a trapezoidal moat at Jesus Farm, Eltisley, surrounded by a ditch (MCB1522).

6.3.20. Other sites which partially survive include a site at Eltisley Wood where the north and east sides of a large rectangular moat is visible (MCB1485), Wintringham Hall moated site, with well-defined north and eastern sides but mostly destroyed on the south and west sides (MCB1640), and Westbury Farm, Croxton, where a large moat may have surrounded the site. The north side remains, and the west side is masked by a depression but neither the east or south sides remain (MCB1474). A moat and medieval chapel site is also recorded at Wintringham (MCB1642), with only traces of the moated enclosure surviving. Swansley Wood Farm moated site, belonged to the St Neots Priory from the 11th century throughout the medieval period (MCB14724), although it is now the site of two modern cottages, and a further moated site is recorded at Manor Farm, Wyboston. This was shown on the 1799 enclosure map but has now been ploughed out (3407).

6.3.21. There are also four other possible moated sites, comprising Homestead Moat at Eynesbury Hardwicke, which is the possible site of the manor of Launcelynsbury (MCB1417), a possible moated site of uncertain origin (2831), a medieval/post-medieval moat identified during geophysical survey along the A428 (ECB1874) and the site of a probable moat at Mossbury Manor (3128).

6.3.22. Remains of medieval settlements have been recorded across the study area. Langford End is a linear settlement, running along both sides of Station Road, which has not expanded much from the medieval limits of the village (MBD17109). Little Barford is also a village which has not expanded beyond the medieval settlement (17148). The historic cores of the medieval settlements of Roxton (MBD17107) and Chawston (MBD17097) are also located within the study area, along with the medieval roadside settlement of Wyboston (MBD17102). There is also the deserted medieval settlement of Papley Grove, which was deserted by AD1100 (MCB1326) and an enclosure and ditch remains of a medieval settlement at Lansbury Farm (MCB19086). The site of the former Wyboston village green is located in the study area and was later enclosed in c.1799 (8621). The possible site of a manor/settlement has also been recorded at Cran Green (9734), recorded on the 1825 estate map.

6.3.23. The sites of medieval buildings have also been recorded, including a medieval church at Weald (MCB3060) and a great hall in Wintringham (MCB1421), the latter of which was excavated in 1972 and the building was thought to be occupied from the later part of the early medieval period to the 14th century.

6.3.24. There is a large number of areas of ridge and furrow within the study area, which indicates the agricultural nature of the area during this period (5136; 5209; 3538; MBD21767; 3204; MCB2961; MCB15017; MCB22622; MCB23487; MCB23488; MCB23489; MCB372; MCB4320; MCB14776; MCB16333; MCB17254; MCB23574; MCB3165; MCB24581; MCB18821; MCB7417; MCB19037; MCB24572; MCB18837; MCB19052; MCB18835; MCB18827; MCB18909; ECB765; ECB762; ECB550; ECB3669; ECB2331).

6.3.25. There are several further medieval features which have been identified including ditches and pits (MCB15602; ECB4508; ECB3714), two sites of medieval plough headlands (MCB19030; MCB15957), cropmarks of a trackway (16784) to the north of Ford Lane, and made ground deposits at Pond Farm in Eltisley (ECB5092). There are also several unspecified medieval features (MCB19980; MCB17211; MCB23451) and earthworks (MCB11884; MCB2962; MCB4233; 1848). Other features in the study area include a medieval ford across the River Ouse, shown on Ogilbys road map of 1675 (8803), Caxton Gibbet, the timbers of which are in fairly good condition (MCB3100), and a medieval deer park in Eltisley parish, which has been defined by an area of woodland and the boundary suggested by a large bank of the park pale (MCB2960).

6.3.26. Various find spots of this date have also been recorded, comprising a bronze seal die (MBD15983), a late medieval belt tag (MBD16147), a copper alloy strap fitting (MBB19387), a harness fitting (MBB20040), a spoon bowl (MBB21183) and several finds of pottery (MBD2025; ECB2017; ECB2121; MCB2963; MCB20140; MCB14116).

Post-Medieval (AD1500-1900)

6.3.27. The post-medieval archaeological remains primarily consist of sites of buildings which are now demolished. These include the post-medieval Old House and moat dated to 1612 (MCB3000), The site of Tempsford Hall (MBD9868) houses (7367; 7096; 5986), farms and associated barns and outbuildings (for example 9059; 8614; 8613; 8618; 9065; 15795), and a pound (9874), as well as industrial buildings including a 19th century kiln building (90700), the site of a gravel pit (3076), a blacksmiths workshop (MCB22621) and a brewery (MCB24750). There are also earthworks of an 18th century duck decoy pond (9725). The routes of former turnpike roads are recorded along the alignment of the A1 (20567) and the road from Tempsford Bridge to Godmanchester (20571).

6.3.28. Other sites of post-medieval date shown on historic mapping that are no longer extant include a pound (8799), gravel pits (8816; 8815, 8629), osier ground (9735) and mileposts (8809; 8810, MBD11439). Other evidence of the post-medieval period consists of documentary evidence of field and place-name information from this period (473; 8575; MCB3091) and the site of a probable windmill mound (MCB3190).

6.3.29. There are also several find spots of post-medieval date recorded within the study area. These assets include a 17th century coin (MBB20032), three 15th and 16th century silver French coins (MCB802), a 16th-17th century copper alloy decorative mount (MBB20036), a double-oval buckle (MBB20037), a hooking tag (MBB20038), a strap fitting (MBD23069), and a sword or dagger scabbard chape (MBB20039).

Modern (AD1900-present)

6.3.30. Modern archaeological remains consist of six sites relating to the Second World War. These are the site of anti-tank traps (18001), the site of a pill box (17966) and three sites of cropmarks, thought to represent structures (3578), a searchlight (MCB15131) and a series of bomb craters (627). An anti-aircraft battery is also recorded (MBD17958). A former gravel pit (8806) is also recorded.

Unknown

6.3.31. There are 82 assets of unknown date recorded within the study area. These mostly consist of assets identified as cropmarks or features recorded during geophysical surveys. These features include enclosures (for example ECB4675; MCB11831), an enclosure complex (MCB19055), ditches (for example MCB19032; MCB19031; MCB19038; MCB19040; MCB18823) and possible field boundaries (ECB3670).

Historical Buildings

6.3.32. Historic buildings within the study area consist of 127 listed buildings. The listed buildings mostly consist of post-medieval houses and cottages along with various barns and outbuildings, 19th century mile posts and medieval churches. There are two scheduled bridges, Blunham Bridge which is a 17th – 18th century bridge (NHLE 1004504), and Tempsford Bridge which is a 19th century bridge (NHLE 1005393). These bridges are also listed buildings.

6.3.33. There are 49 non-designated buildings within the study area. These consist of residential properties and farm buildings, as well as other amenity buildings such as public houses, schools and religious buildings.

Medieval (AD1066-1500)

6.3.34. There are 10 listed buildings with medieval origins. These include four medieval churches, all grade II* listed. These are Saint Pandonia and Saint John the Baptist Church in Eltisley with the nave and aisles dating to *c.*1200 (1127179), St Mary's Church built in the 14th – 15th century of brown cobblestones with ashlar dressings (1114927), the Church of St Peter, dated to the 14th and 15th centuries (1114096), and the Church of St Nicholas, which has a 1th century timber-framed tower (1330437). A Grade II listed medieval cross base and stump if also located in Tempsford Churchyard (1311917). There are also five Grade II listed buildings with 15th century origins, which were extended to in the post-medieval period. These are all houses/farm houses (1331397; 1309206; 1331396; 1127173; 1331398), all of timber frame construction.

6.3.35. Non-designated buildings include medieval features within Eltisley church (ECB2853), and a timber frame barn at Wyboston (MBB18908), although it is not clear if it is medieval or post-medieval in origin, or if it is still extant.

Post-Medieval (AD1500 – 1900)

6.3.36. Post-medieval buildings within the study area include two scheduled monuments and 122 listed buildings. The scheduled monuments are Tempsford Bridge, built 1814-20 of dressed sandstone (1005393), and Blunham Bridge (1004504), of 17th-19th century date, built of iron, limestone and ironstone. Both are also Grade II listed. There are two post-medieval Grade II* listed buildings. These are a thatched cottage style congregational chapel built in 1808 (1146376), and a 17th century timber framed house (1331024). The remaining listed buildings are Grade II listed and mostly consist of domestic buildings including houses, cottages and farm houses commonly built of timber-frames with plaster or colour washed roughcast (for example 1311931; 1138250; 1138264; 1114103; 1114102; 1321636; 1138262; 1114101; 1114100; 1311945; 1114097; 1138237). Other associated structures are located within the study area and include barns and dovecotes. Several 19th century mileposts (1331369; 1162760; 1331371; 1331394), village pumps (1127177; 1127174) and The Wheatsheaf (1114095) and Crown Inn (1146453) public houses have also been recorded.

6.3.37. Non-designated post-medieval assets include various extant buildings which consist of houses and outbuildings (for example 5992; 14474; 5980; 12475; 12468; MCB21798; 3008; 20526, MBD14473) and public buildings such as public houses (12953; 16395; MCB2928), a 19th century primary school (7180) and religious buildings (18225; MCB17175). Other extant structures include a kennels (MCB24565), a milestone (8808), a 19th century tombstone from Roxton churchyard (14447), a windmill at Eltisley (MCB2954) and Brickgate Bridge (MBD15179).

6.3.38. Wintringham Hall (MCB1641) and park (MCB14315) comprises a late 19th century building surrounded by a moat which may have replaced an earlier 16th century building on the site and surrounding landscape park.

Modern (AD1900 – Present)

6.3.39. Modern historic buildings consist of two Grade II listed buildings, both K6 telephone kiosks designed in 1935 (1114110; 1223662), as well as non-designated Lionhead standpipes (8446; 3526; 8587; 8589). Also of modern date is Tempsford Hall (MBD3077), which was built in 1903 in an Elizabethan style to replace an earlier hall which burned down in 1889 and the Stuart Memorial Hall and War Memorial (MBD18743) built in memory of those lost in the First World War.

Historic Landscapes

6.3.40. There are seven conservation areas within the study area. These are located in: Blunham; Tempsford; Great Barford and Green End; Great Barford Hill; St Neots; Croxton; and Eltisley. The conservation areas are made up predominately of post-medieval timber frame and thatched buildings.

6.3.41. There is one registered park and garden within the study area, namely Croxton Park which is a Grade II* registered park and garden. It is an early 16th century deer park which incorporates earthwork remains of 16th century garden features. Also within the park are a grade II* mid-18th century house (1127163), grade II garden house (1127166), garden bench (1127165), walled garden (1127164), well head (1309225) and an ice house (1127167). The area was enlarged and landscaped in the early 19th century. The scheduled deserted medieval village of Croxton is also recorded within the park (1006783).

6.3.42. There are three non-designated parks. Wintringham Hall Landscape Park (MCB14315) is 16th century in date. It surrounds the hall, located to the south of the Scheme. There are also two further non-designated parks of post-medieval date recorded within the study area. Tempsford Hall Landscape Park (7001) was laid out in the 18th – 19th century. It was associated with the 18th century Tempsford Hall. Roxton Park was a 19th century landscape park mostly comprising pasture with trees and a lodge (7009).

6.3.43. The remaining asset relates to the Second World War. This was RAF Caxton Gibbet, a Second World War military airfield used for training purposes, which also has an associated picket post and pillbox on the site (MCB15131).

6.4. Potential Impacts

6.4.1. The preliminary assessment has identified that construction and operation of the Scheme will potentially result in adverse and beneficial impacts on cultural heritage.

6.4.2. These impacts are associated with:

a. temporary impacts on heritage assets through the introduction of construction activity, equipment, machinery and vehicles into their setting.

b. permanent impacts on historic landscapes, historic buildings, and archaeological assets and deposits (both known and potential) as a result of the Scheme being constructed; and

c. impacts on the setting of heritage assets associated with changes to traffic movements, road noise and lighting once the Scheme is operational.

6.4.3. The cultural 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 impacts and effects of the Scheme.

6.4.4. Heritage assets that will not be impacted by the Scheme are not presented.

Construction

Archaeological Remains

6.4.5. 52 recorded archaeological assets have the potential to be subject to physical impacts or experience impacts to the significance of assets (caused by changes to their setting). These comprise four designated assets and 48 non-designated assets, as described below.

6.4.6. The bowl barrow, known as the "Round Hill" (NHLE 1013521), is Bronze Age in date and located approximately 440m west-north-west of College Farm. It is circular in plan, measuring approximately 21m in diameter, and survives to a height of approximately 1.7m, with steep sloping sides descending from a level area on the summit which measures approximately 10m across. The barrow, which is recorded as unexcavated, is thought to be an outlying example associated with a pattern of Bronze Age barrows located along the gravel terraces flanking the River Great Ouse. The barrow is a scheduled monument and of archaeological significance due to its outstanding level of preservation in relation surrounding barrows within the Great Ouse Valley, and in the potential it has to inform on Bronze Age funerary practices and their association with the surrounding prehistoric landscape. The setting of the asset, which contributes to its significance, encompasses the gravel terraces flanking the River Great Ouse and, within the wider area, includes some 200 poorly recorded monuments in the upper and middle sections of the Great Ouse Valley. The monument was designed to be visible on the landscape. Given its level of preservation, position within the landscape, and its designation, the Round Hill barrow is considered to be of high heritage value. There will be no physical impact from intrusive groundworks associated with the Scheme, with the barrow located approximately 100m to the west of the Scheme. Although the proposed expansion of the A421 immediately east of the asset will not result in further effects to its setting, the Black Cat junction and the new dual carriageway on the east side of the Great Ouse Valley will be visible from the asset. This is likely to slightly alter the setting of the scheduled monument and will therefore result in a minor magnitude of impact. Overall, the construction will likely result in a slight adverse effect.

6.4.7. The Moated Site at Pasture Farm (NHLE 1019177) is a medieval moated site located approximately 2 kilometres north-west of Caxton. It consists of a roughly square-shaped island surrounded by an approximate 9m wide and 1.5m deep moat and associated pond. Seven causeways connect the island to the surrounding landscape, some of which are likely post-medieval or modern in date. The site may hold the remains of the medieval manor of Brockholt. The moated site is a scheduled monument and of both archaeological and historical significance in its ability to inform on the development of settlement patterns in the medieval period, and for information on the distribution of wealth and status in the landscape. Evidence of occupation at the site will survive. The setting of the asset includes the surrounding farmlands that will have formed part of the estate and its connection to the surrounding medieval villages of Caxton and Eltisley, elements of which contribute to its significance. Given the scheduling of the asset and its state of preservation, it is considered of high heritage value. The Scheme abuts the north-west section of the moat. Although it is anticipated that the Scheme will have no direct impacts on the asset itself, and while it will be screened from the Scheme by dense vegetation, the Scheme has the potential to cause changes to its setting. The magnitude of the impact on the significance of the asset is considered to be no more than minor, which will result in a slight adverse effect on the asset.

6.4.8. The moated enclosure and associated building platforms The Lane, Wyboston is a scheduled monument situated approximately 80m west of the Scheme in Wyboston. The moated enclosure is `D' shaped in plan and measures approximately 85m along the straight southern edge of the moat. The surrounding moat is approximately 8m wide and about approximately 1.2m deep and is dry except for part of the east arm. Prominent external banks, surviving up to approximately 1m high, flank the west and east sides. The island is believed to be the site of a manor house and a number of deep hollows mark the position of former buildings. The asset is of archaeological and historical significance in its ability to inform on specific research themes, such as aspects of medieval settlement patterns, moated sites, and medieval manorial estates. The setting of the asset includes the remains of the medieval village of Wyboston and the surrounding fields, both of which contribute to its significance. Given the size of the moat and the excellent preservation of several features both within it and in the surrounding medieval settlement, it is considered to be of high heritage value. As part of the Scheme, a new link road will be constructed to the east of the asset, connecting The Lane to Chawston Lane, which will cause changes to the asset's setting. This will result in a negligible magnitude of impact to the significance of the asset. Construction will, therefore, cause a slight adverse effect on the asset.

6.4.9. The deserted medieval village at Croxton (1006783) contains the earthworks of the deserted village, overlain by post-medieval landscape features. The site has archaeological significance for the information it contains regarding settlement activity, as well as historic significance for information on both settlement development in the medieval period, and the later garden landscape. As a scheduled monument the asset is of high heritage value. The asset is bounded on the northern side by the A428, although it is screened by vegetation. The Scheme will be north of the A428, and as such it will slightly improve the setting of the asset. The magnitude of impact is considered to be minor beneficial, resulting in slight beneficial effect.

6.4.10. The following non-designated assets of a Roman date are located within the area of intrusive construction works associated with the Scheme:

a. 801 – Roman Villa. The site of a possible Roman villa has been identified from cropmarks to the east of the A1. West of the A1, within the affected area, evaluation

excavation revealed high status building material, although no evidence for a building was located. The asset is of archaeological significance for the information it contains about a high status Roman settlement. Its relationship with nearby Roman roads will provide information about settlement patterns. The asset is of medium value. While the asset will be affected by one of the proposed compound sites, only a very small part of the asset will be affected. In addition, it is located in an area subject to previous evaluation, and away from the location of the main building, which is likely to be located to the east of the existing A1. Therefore, the magnitude of impact is considered to be minor. This will result in a slight adverse effect.

b. 00616 – Roman coins found at Parkers Farm, one of Constantinus II or Constans, one dated to the 3rd century and the other indecipherable. This find spot is likely associated with related settlement activity in the vicinity of the Sandy to Godmanchester Roman road. As an isolated find spot of two objects dating to the Roman period, this asset is of archaeological significance only in its ability to indicate the presence of Roman activity in the vicinity. Since the artefacts have already been recovered, this asset is considered to be of negligible heritage value. While the find spot will be affected by the Scheme's construction, resulting in a major magnitude of impact, the effect on the asset wold be slight adverse.

c. CB15034 and 505 – These two assets consist of Ermine Street Roman road (CB15034), visible as a gravel track without agger, and the Sandy to Godmanchester Roman road (505), an approximate 5m wide surfaced road with rammed gravel dated to the 1st century. The heritage value of these two assets is considered medium, derived from their archaeological significance, stemming from the ability of the assets to provide information on the connections between places and transport infrastructure in the landscape of Roman Britain, as well as historic significance on the information regarding use of the Roman landscape. Given the overall length and preservation of both roads, and given that the Scheme is likely to only impact on small sections of the roads, the magnitude of impact on these assets is considered to be minor. Therefore, construction is considered to result in a slight adverse effect on these assets.

6.4.11. Evidence for Saxon (early medieval) occupation is attested by a single probable structure identified during trial trenching (13413) located within the centre of the Scheme. Although it has been subject to previous archaeological investigation, it is likely that associated archaeological activity will be located within the area of intrusive construction works associated with the Scheme. Due to the limited nature of the Saxon remains and its non-designated status, the asset is considered to be of low heritage value. The significance of the asset is archaeological in nature, with its heritage value derived from the ability of the asset to provide information on the settlement landscape of early medieval Britain. The magnitude of impact of any Scheme intrusive groundworks upon this asset is major, as the asset will be severely damaged or destroyed by the construction of the new dual carriageway in its current position, resulting in a change to most or all key archaeological materials. Therefore, construction will result in a slight adverse effect on this asset.

6.4.12. The following non-designated assets of a medieval date are located within the area of intrusive construction works associated with the Scheme:

a. 8621 – Wyboston Green, the site of a former medieval village green, enclosed c.1799. The Green was divided into six allotments, and by 1977 the eastern end had been developed and the remainder is now under pasture. The green is of local archaeological and historical interest in the information it may contain in regards to

medieval settlement patterns and the transition from the medieval to post-medieval period. The heritage value is therefore considered to be low. The Scheme will involve the construction of a new dual carriageway running through the centre of the asset, resulting in a magnitude of impact of moderate. The Scheme's construction phase will therefore cause a slight adverse effect on the asset.

b. 17149 – The medieval roadside settlement of Wyboston, located along the Great North Road and The Lane. This asset is of archaeological and historical significance in its ability to inform local and regional research framework aims, derived from the information it may contain regarding medieval settlement patterns. Due to the fact that the settlement still exists and has not been subject to extensive post-medieval and modern development, remains dating to the medieval period have a high potential to have survived. As such, the heritage value of the asset is considered to be medium. The Scheme will only affect the extreme south-east corner of the asset. In that area, the Scheme is likely to result in significant ground disturbance that will cause damage to the asset. However, overall the Scheme will result in a minor magnitude of impact. Construction will therefore result in a slight adverse effect on the asset.

6.4.13. The following non-designated assets of a post-medieval date are located within the area of intrusive construction works associated with the Scheme:

a. 17182 – The foundations of a 17th – 18th century wall, recovered during trenching for a gas pipeline, it is thought to be of agricultural (boundary) origin. This asset is of local archaeological and historical significance based on its ability to inform on past human activities relating to agricultural processes and land management. Such features are common in the region and England as a whole and therefore this asset is considered of negligible heritage value. Although its complete extent is unknown and may extend beyond the Scheme, the intrusive groundworks will likely result in the destruction of the asset. The construction phase will therefore result in a moderate magnitude of impact on the asset, but this will result in a neutral effect, given the negligible value of any surviving remains.

b. 20571 – A part of the post-medieval former turnpike road, which ran from Tempsford Bridge to Godmanchester. This asset is of archaeological and historical significance based on its ability to inform on past human activities relating to the post-medieval movement of people and growth of the transport infrastructure. Turnpike roads are common throughout England and well recorded through 19th century and later maps. Its heritage value of this asset is considered to be low. As part of the Scheme, a road bridge will carry the new dual carriageway. It is not considered that there will be more than a negligible magnitude of impact on the asset, given both the length of the asset and the minimal impact of the Scheme upon it and the ability to understand it within the landscape. This results in a neutral effect on this asset.

c. 9070, 02463, and 02541 – These post-medieval assets consist of the site of a 19th century kiln building and the site of a moated windmill mound. These assets are of archaeological and historical significance in their ability to inform on the development of late post-medieval industries in rural contexts, as guided by local research frameworks and are therefore considered to be of low heritage value. The assets lie wholly or partially within the Scheme. The magnitude of impact of any Scheme intrusive groundworks upon these assets is major, as the assets will be severely damaged or destroyed by construction, resulting in a change to most or all key archaeological materials. Therefore, construction will have a moderate adverse effect on these assets.

d. 8808, 8809, and 8810 – Former sites of destroyed post-medieval mileposts. Since the milestones are no longer extant and have been entirely removed from their original contexts, these assets are considered to be of negligible heritage value as they no longer hold any archaeological or historical interest. There will be no change to these assets due to the Scheme, and therefore the effect of construction on these assets will be neutral.

e. 11862 – The Great Northern Railway was originally proposed in 1827 and the London to Peterborough section opened in 1850. The service is currently in use and forms part of the East Coast Mainline to London. Although the Scheme crosses over the line, the line will not be impacted.

f. 8629 – Gravel Pit Close is marked on an enclosure map of 1799, and it forms place-name evidence for the presence of a post-medieval gravel extraction pit. This asset is considered of archaeological and historical interest in its ability to inform on the development of post-medieval industries. However, it has most likely been entirely destroyed by the construction of the A1 covering the entirety of the asset. As such, it is considered to be of negligible heritage value. As such, construction will result in no change to the asset, resulting in a neutral effect.

6.4.14. The following non-designated cropmarks are located within the Scheme and will be directly impacted by intrusive groundworks:

a. 745 – A linear block of linked sub-rectangular enclosures visible on aerial photographs, one or more contained circular structures, possibly of some status. It is likely to be of Iron Age/Roman date. Archaeological investigations just to the south of the cropmarks uncovered peripheral features relating to late Iron Age or Roman occupation, and several nearby copper alloy find spots (MBB19824; MBB19827; MBB19828; MBB 19829) have been found to date to the 3rd to 4th centuries. The cropmarks are of archaeological interest due to their ability to provide insights on agricultural process, land management, settlement patterns, and transition from the Iron Age to the Roman period. This asset is therefore considered to be of medium heritage value. The magnitude of impact of the Scheme upon this asset is major as the asset will be severely damaged or destroyed by the construction of the new dual carriageway, resulting in a change to most or all key archaeological materials. Therefore, construction will have a large adverse effect on this asset.

b. 15047 – Prehistoric cropmarks around Round Hill, consisting of an agglomeration of irregular enclosures with some outlying sub-rectangular and rectilinear features. Nearby excavations also revealed a small Roman enclosure system. Several copper alloy finds dating to the 3rd to 4th centuries (MBB20044; MBB20062; MBB20063; MBB20064; MBB20065; MBB20066; MBB20067) have been recorded within and around the cropmarks and are likely related to the Roman enclosure system. The cropmarks are of archaeological interest due to their ability to provide insights on agricultural process, land management, and settlement patterns dating to the prehistoric and Roman periods. For these reasons, the asset is of medium heritage value. Although the Scheme will cross the south-east corner of the asset, it is restricted to the width of the existing A421 and the verges immediately surrounding it. These areas have already been subject to extensive ground disturbance during the construction of the A421. The magnitude of impact of construction on the asset is therefore measured as negligible, resulting in a neutral effect on the asset.

c. 2664 – Cropmarks of a probable group of sub-rectangular enclosures. Ditches and pits of late Iron Age/Early Roman and later Roman date were found during investigation in advance of mineral extraction, along with two pits containing cremation burials dated to the Roman period. The archaeological evaluation revealed the asset as being of limited extent and likely to relate to small rural farmsteads. These features will be of medium heritage value given that they are of local and possibly regional archaeological interest in their ability to provide insights on agricultural process, land management, settlement patterns, and funerary practices dating to the late Iron Age and Roman periods. However, as the site has been excavated, it no longer survives, and there will be no effect upon it due to the Scheme.

d. 16800 and 1832 – Prehistoric cropmarks, consisting of rectilinear or sub-rectangular enclosures. These non-designated cropmarks have not been previously investigated and therefore retain the potential to inform both local and regional archaeological research frameworks. Specifically, they may contain valuable information on agricultural processes, land management, and settlement patterns dating to the prehistoric periods. They are therefore considered to be of medium heritage value. The position of the Scheme will result in a change to most or all key archaeological elements relating to this asset due to intrusive groundworks. The magnitude of impact caused by construction upon the asset is therefore considered to be major, resulting in a large adverse effect on the asset.

e. MCB21136 – Enclosures of an unknown date, located adjacent to Rectory Farm Cottages, Abbotsley. These enclosures have not been previously investigated and as such are of archaeological and possible historical interest in their ability to inform on past human activity. As such, given the scarcity of information available, this asset is considered of medium heritage value. The magnitude of impact of Scheme intrusive groundworks upon these cropmarks is considered to be major as the asset will be severely damaged or destroyed by the construction of the Scheme, resulting in a change to most or all key archaeological materials. Therefore, construction will have a large adverse effect on this asset.

f. 8818 – Cropmarks, North of Chawston comprising a ring ditch, linear features, and possible small rectangular enclosures. The asset is of archaeological, and possibly historical, significance due to the information it may reveal on past human activities. It is considered of medium heritage value. The Scheme covers a small section in the east of the field containing the cropmarks, and as such is likely to result in changes to key archaeological material such that the asset is slightly altered. The magnitude of impact is therefore considered to be minor, resulting in a slight adverse effect on the asset.

g. 1794 – Cropmarks of a probable trackway with attached enclosures. Metal finds recovered (presumably through metal detecting) are of Roman date. These non-designated cropmarks have not been previously investigated and therefore retain the potential to inform both local and regional archaeological research frameworks. Specifically, they may contain information on Roman settlement patterns. They are therefore considered to be of medium heritage value. The position of the Scheme will only clip the very edge of this asset, and thus result in only very minor changes to it. The magnitude of impact caused by construction upon the asset is therefore considered to be negligible, resulting in a neutral effect on the asset.

h. MCB18837, MBD21767, MCB16333, 05753, MCB17211, and MCB18835 – these six assets consist of medieval ridge and furrow agricultural features. They are of local archaeological and historical significance based on their ability to inform on

past human activities relating to agricultural processes and land management. Such features are very common throughout the region and England as a whole and are therefore of no more than low heritage value. Although intrusive groundworks will result in the complete destruction of these assets, the majority of the ridge and furrow areas lie beyond the Scheme and will therefore be preserved. The construction phase will therefore result in a moderate magnitude of impact on the assets, resulting in a slight adverse effect on these assets.

i. 1651, MCB18833, MCB18336, MCB18824, MCB19040, MCB24576, MCB24586, MCB24587, MCB24588, and MCB18829 – these assets consist of ditches, linear features and single enclosures of unknown date and of unknown use dispersed throughout the Scheme. They are of archaeological, and possibly of historical, significance due to their ability to inform on past human activities. Given their limited extent and non-designated status, they are considered of low heritage value. Given that construction is likely to result in changes to key archaeological materials, such that the assets are totally altered, the magnitude of impact is considered major. The Scheme effect on these assets is therefore assessed as slight adverse.

j. 1387– a small ring ditch and linear features, likely of prehistoric date, recorded from aerial photographs. After topsoil stripping for a pipeline in 1993, a total of 59 flint objects were recovered from the area, but no features were recorded. Most of the flints were flakes and are interpreted as indicating extraction and initial working rather than occupation; they ranged in date from the early Neolithic to the mid-Bronze Age. Since this asset has been investigated and found to consist of lithic scatters without associated features, it is considered to be of no further archaeological interest and therefore of negligible heritage value. The Scheme overlaps only a small section of the field within which these cropmarks and finds were recorded and as such construction is unlikely to impact any remaining features relating to this asset. The Scheme will therefore result in no change to the asset, and a neutral effect.

6.4.15. The Giants Parlour (473) is a field name shown on the 1840 Tithe Map. The Historic Environment Record suggests that this field name may relate to a local myth of a giant which is said to have stood on earthworks of the site of a Roman fort. A series of small sub-rectangular enclosures visible as cropmarks have been identified in the middle of the field (16821), although these lie beyond the Scheme. The connection to the archaeological remains is tenuous, and as such the significance of this asset is limited to local historical interest and therefore of negligible heritage value. The Scheme will pass through the western extent of this asset, which will have a moderate magnitude of impact on the asset. This will result in a neutral effect on the asset.

6.4.16. The sites of nine isolated find spots, from which were recorded either single pieces of lithic debitage or small scatters of prehistoric lithic material, are located within the Scheme's boundary and will be directly impacted by intrusive groundworks during the construction phase. The material recovered from these find spots includes flakes (03535 and 03539), cores (01307), blades (01319), scrapers (03532, 01562 and 03543), worked flint (14671) and a polished celt (02494). Only the polished celt was datable as belonging to the Neolithic period, while the rest of the material was prehistoric. These assets are of archaeological significance only in their ability to indicate the presence of either Neolithic or prehistoric activity in the vicinity. Since the artefacts have already been recovered, these assets are considered to be of negligible heritage value. While the find spots will be affected by the Scheme's construction, resulting in a major magnitude of impact, the effect on these assets is considered to be slight adverse.

Historic Buildings

6.4.17. There are four Grade II listed mileposts located within the Scheme. These comprise a milestone (1163534) located near the junction of the A428 and the B1040, a milepost to the east of Cambridge Road (1331394), a milepost south of Pembroke Farm (1162760) and a milepost near the junction with Elsworth Road (1331369). The mileposts are of medium value for their historical significance as pieces of 19th century street furniture, and it is assumed they are in their original locations. The settings of the mileposts are limited to their roadside location.

6.4.18. There will be a major magnitude of impact on milepost (1163534), and construction will potentially have a large adverse effect on this asset. The remaining three mileposts will be retained in their current locations and their relationships to the road will be maintained. There will be a negligible magnitude of impact, which at most will have a slight adverse effect on these assets.

6.4.19. Brook Cottages (12458) are Grade II listed consisting of a single storey with attics of 18th century date. They are of medium value for their architectural significance as typical example of vernacular architecture particularly through its timber fame construction with colour washed rough cast and half-hipped thatched roof, much of which appears to have been retained. Brook Cottages also possess historic significance as they illustrate aspects of the agricultural history of the area. The building is illustrative of farming and tenurial practices, social hierarchies, and building traditions and materials. The cottages will be demolished during construction; therefore, the magnitude of impact to the asset will be major and this will result in a large adverse effect.

6.4.20. Wintringham Hall (01270a) is a late 19th century non-designated building to the south of the A428. It is a brick-built building surrounded by a moat and set within formal grounds which are surrounded by vegetation. To the south of this are the associated Grade II listed barn and granary (1211324 & 1290056). The group is of medium heritage value. They possess architectural and historical significance as an illustration of post-medieval agricultural practice and an example of a hall with extant outbuildings. As the hall is located on the site of a previous Elizabethan manor it possesses historical significance for this association, and there may be limited archaeological significance. The barn is timber framed on brick sill and consists of nine bays, while the granary is constructed of gault brick and a hipped slate roof with three cart bays at the ground floor. The setting of the buildings is the farm complex in which they are located, surrounded by agricultural fields, and it is only this relationship that contributes to their significance. While construction activity to the west will be visible, the relationship with its agricultural setting will not be altered. The magnitude of impact on the buildings will be minor as the relationship between the hall and the landscape will still be tangible. This results in an effect of no more than slight adverse.

6.4.21. North Farmhouse (1210919) is a Grade II listed 18th century two storey building. The farmhouse is of medium heritage value for its architectural and historical significance as an example of post-medieval agricultural architecture. The building is constructed of local brick, originally painted or plaster rendered, with a thatched, hipped roof. The Scheme will run from east to west to the north of the farmhouse. The north and eastern views from the farm are screened by vegetation and outbuildings; however, the significant views to the west will be altered from its current setting of agricultural fields. The distance between the asset and the Scheme will limit the impact and an agricultural buffer will be retained, which maintains the understanding of the asset as an agricultural building. The magnitude of impact will therefore be minor, and the effect will be slight adverse.

6.4.22. Tempsford Bridge (1005393) is a scheduled monument and a Grade II listed building. It carries the current A1 over the River Great Ouse. Due to the scheduled status of the bridge, it is of high value. It possesses architectural significance as example of an early 19th century river bridge. The bridge is constructed mostly of dressed sandstone and consists of three broad segmental arches with projecting keystones, and plain parapets with octagonal piers on either end. Although the bridge will not be physically impacted by the Scheme, the bridge is located close to the Scheme. The setting of the bridge is the river landscape running north-south, which will not be affected. Views from the bridge towards the Scheme to the north are screened by vegetation, limiting the intrusion of the Scheme into its setting. Therefore, there will be no more than a negligible magnitude of impact to the asset, resulting in a slight adverse effect.

6.4.23. The Downs (1127171) is a Grade II listed mid-19th century villa, located just south of the A428. It is of medium heritage value as it possesses architectural value as it is an example of 19th century villa architecture. The building is of two storeys, of gault brick construction with a service wing to the rear. The front elevation consists of an asymmetrical façade with a Tuscan portico and two flanking, large recessed ground floor sash windows. The building is located to the south of the existing A428, and the Scheme will slightly improve the setting of the park. The magnitude of impact is considered to be minor beneficial, resulting in slight beneficial effect.

6.4.24. The cottage (12460) is located along Nagshead Road. It is a non-designated, 18th century building, L-shaped in plan, of part timber framed construction and part rendered brick with gabled thatched roofs. The cottage is of low heritage value and has limited architectural significance. The setting of this asset comprises wooded gardens, with agricultural fields to the west. It may be altered during construction of the Scheme to the west of the cottage, although the area is well screened. The magnitude of impact will be negligible, and the effect will be slight adverse.

Historic Landscapes

6.4.25. Wintringham Hall Park (12190) is located around Wintringham Hall to the south of the A428 and is of low heritage value. It is of historic significance for its association with the complex of farm buildings, and the development of the landscape. The grounds comprise lawns and trees and the boundary of the park is bordered by the site of the medieval moat and thick vegetation. The northern edge of the park is located close to the Scheme, although the park is entirely screened from the road. There will be a negligible magnitude of impact to the park, resulting in a slight adverse effect on this asset.

6.4.26. Croxton Park (12280) is an early 16th century deer park, which was enlarged and landscaped in the early 19th century. It retains areas of earthwork remains of 16th century garden features which are still visible. A Grade II* mid-18th century house (1127163), and Grade II listed garden house (1127166), garden bench (1127165), walled garden (1127164), well head (1309225) and ice house (1127167) are set within the park, which also may incorporate part of an earlier 16th century house. The gardens lie to the north of the house and consist of a lawn bordered by a curved ha-ha and informal paths through open shrub and woodland planting beyond. The park is a Grade II* registered park and garden and is of high heritage value for its archaeological and historical significance. The archaeological significance derives from the earthwork features overlain by the park, part of which is a scheduled monument (1006783), while the historical significance relates to the park's 16th century origins and its connections to the country house. The park is bounded on the northern side by the A428, although it is screened by vegetation. The Scheme will be north of the A428, and as such the

Scheme will slightly improve the setting of the park. The magnitude of impact is considered to be minor beneficial, resulting in slight beneficial effect.

Operation

Archaeological Remains

6.4.27. No operational effects upon the recorded or unrecorded archaeological resource are envisaged.

Historic Buildings

6.4.28. Operation of the Scheme has the potential to result in increased noise experienced from Wintringham Hall (01270a) and the Grade II listed barn and granary (1211324 & 1290056). This will have a minor adverse magnitude of impact on the ability to understand these assets, which will result in a slight adverse effect.

Historic Landscapes

6.4.29. The operation of the Scheme will likely result in reduced noise experienced from Croxton Park (12280). This will have a potential minor beneficial magnitude of impact, resulting in a slight beneficial effect.

6.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

6.5.1. Measures are being incorporated into the Scheme as part of the design-development process, the purpose being to avoid or reduce impacts on heritage assets. Such measures include the following:

a. Refinement of the alignment of the new dual carriageway to avoid assets, where possible.

b. Minimising overall landtake requirements to reduce the extent to which the Scheme could affect known and potential cultural heritage assets.

c. Adjustments to vertical alignment of the new dual carriageway to reduce its visual prominence.

d. The careful siting of signage and lighting to reduce visual intrusion.

e. The sympathetic use of landscaping, earthworks and barriers to reduce visual and noise effects on cultural heritage assets.

6.5.2. These measures will serve to reduce the operational impacts of the Scheme on cultural heritage, particularly those associated with the introduction of the Scheme (and associated traffic) into the setting of heritage assets.

Standard Mitigation Measures

6.5.3. It is predicted that it will be possible to mitigate the Scheme's impacts upon the buried archaeological resource through a staged programme of archaeological investigation and recording, the purpose of which will be to ensure that surviving remains are recorded prior to their destruction by construction activities.

6.5.4. This programme of investigation will include the completion of geophysical surveys that have now commenced within areas of the DCO site boundary, evaluation excavation (trial trenching) to identify the extent and survival of remains, followed (where required) by excavation to ensure they are fully understood and recorded.

6.5.5. Archaeological monitoring during the construction phase is also likely to be required to mitigate any impacts on unrecorded remains.

6.5.6. The development of mitigation is following guidance from the Chartered Institute for Archaeologists [REF 6-5]. Measures will be refined during the assessment process and agreed with stakeholders (including Historic England, Cambridgeshire County Council, Bedford Borough Council and Central Bedfordshire Council's Historic Environment Teams, and the relevant Conservation Officers).

6.6. Assessment of Effects

6.6.1. The preliminary assessment indicates that, prior to the implementation of mitigation measures, the following adverse and beneficial effects may arise on cultural heritage:

Construction

a. A slight adverse effect on three designated archaeological assets.

b. A slight beneficial effect on one designated archaeological asset.

c. Large adverse effects on four non-designated archaeological assets.

d. Moderate adverse effects on three non-designated assets.

e. Slight adverse effects on 31 non-designated assets.

f. Neutral effects on nine non-designated assets.

g. Large adverse effects on two historic buildings.

h. Slight adverse effects on seven historic buildings.

i. A slight beneficial effect on one listed building.

j. A slight adverse effect on Wintringham Hall Park.

k. A slight beneficial effect on Croxton Park.

Operation

a. A slight adverse effect on assets at Wintringham Hall.

b. A slight beneficial effect on Croxton Park.

6.6.2. Further work will be undertaken as part of the assessment to develop, refine and agree mitigation measures for cultural heritage to reduce the significance of these effects.

6.6.3. Once established and agreed with relevant statutory bodies, an assessment will be made of the role such measures will have in mitigating the above effects to reduce their significance. The final assessment findings and the significance of effects will be reported in the Environmental Statement.

7. LANDSCAPE

7.1. Introduction

7.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on landscape, which covers both landscape and visual impacts.

7.1.2. Landscape impacts relate to physical changes to the fabric or individual components of the landscape, for example landform, vegetation, and buildings. It also considers indirect changes to the wider patterns of land use, land cover and the arrangement of landscape features which determine the character and the aesthetic and perceptual qualities of the landscape. Landscape relates to both rural landscapes and urban landscapes (referred to as townscapes).

7.1.3. Visual impacts relate to changes in the visual environment, as experienced by individual receptors afforded views of the landscape or townscape. Visual receptors include local residents, users of public rights of way (PRoW) and users of public open space.

7.1.4. Due to the nature of the landscape assessment, some overlap exists with the assessment of cultural heritage (see Chapter 6), specifically impacts relating to the setting of assets and historic landscape character. Constraints relevant to the subject of cultural heritage are detailed within that assessment but are referenced within the landscape assessment where they contribute to landscape character and the visual environment.

7.2. Approach to the Assessment

Scope and Methods

7.2.1. A scoping exercise was completed in early 2019 to establish the form and nature of the landscape assessment, and the approach and methods to be followed.

7.2.2. The Scoping Report [REF 7-1] 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 Scheme on the landscape.

7.2.3. Following the receipt of the Scoping Opinion [REF 7-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which be taken into account of as part of the ongoing landscape assessment:

a. Inclusion of a description and assessment of the potential impacts of historic landscapes, where significant effects may occur, including information to illustrate the extent to which the Scheme will be seen from designated heritage assets (with appropriate cross-reference made to the cultural heritage assessment).

b. Inclusion of a description and assessment of the potential impacts on all visual receptors through the introduction of lighting associated with the Scheme, during both the construction and operational phases, including appropriate cross-reference to the biodiversity assessment in relation to mitigation proposed through landscaping strategies.

7.2.4. Having had regard to the information presented within the Scoping Report [REF 7-1], the Inspectorate's Scoping Opinion [REF 7-2] has also confirmed Highways England's view that significant effects on landscape and visual receptors associated with the future maintenance of the Scheme are unlikely. Accordingly, this matter will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

7.2.5. The landscape assessment is being completed in accordance with the National Policy Statement for National Networks (NPSNN) [REF 7-3].

7.2.6. Details of how the landscape assessment will meet the requirements of the NPSNN [REF 7-3] in relation to identifying the characteristics, value and importance of designated and undesignated landscapes, and assessing and mitigating the effects of the Scheme on areas of defined (and where relevant historic) landscape character and visually sensitive receptors, are presented within the Scoping Report [REF 7-1].

7.2.7. The Scoping Report [REF 7-1] also details how other legislation and policy relating to landscape is being taken account of in the assessment.

Consultation

7.2.8. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the landscape assessment, the results of which are presented within the Scoping Opinion [REF 7-2].

7.2.9. Consultation with the relevant local authorities was undertaken in June 2018 to identify and agree the landscape and visual receptors requiring consideration in the assessment, and to confirm the viewpoint locations from which verifiable photomontages will be prepared.

7.2.10. Further consultation is planned with the relevant local authorities to agree any additional viewpoints and receptors, following further development of the Scheme design.

7.2.11. Consultation will also be carried out with the relevant local authorities, and with Natural England, to inform the development of the planting strategy for the Scheme.

Limitations and Assumptions

7.2.12. 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 Scheme and the maximum likely extents of land required for its construction and operation.

7.2.13. Fieldwork was undertaken during the winter and summer of 2018. Access to some viewpoints and receptor groups was restricted, and where access was limited, fieldwork was undertaken from the nearest publicly accessible location.

7.2.14. The findings of this preliminary assessment may be subject to change as the design of the Scheme is developed and refined through the EIA and consultation processes, and as further surveys are undertaken to fully understand its potential effects.

Study Area

7.2.15. The study areas for the landscape assessment are focused on a detailed 2 kilometre study area and a wider 5 kilometre study area, as illustrated on Figure 7.1 and Figure 7.2 within Volume 2.

7.2.16. The extents of these study areas have been informed by a review of existing information, fieldwork observations, and the extents of the preliminary Zone of Theoretical Visibility (ZTV) which was generated as part of the scoping exercise and presented within the Scoping Report [REF 7-1]. The ZTV is a computer generated tool which helps guide the assessment by identifying the likely (or theoretical) extent of visibility of the Scheme within the landscape.

7.2.17. In defining the study areas, consideration was given to the following factors:

a. The scale and massing of the Scheme's infrastructure.

b. The operational elements of the Scheme, for example the movement of traffic.

c. Existing landform and vegetation.

d. The influence of settlements, including: Roxton, Tempsford, Chawston, Wyboston, St Neots, Little Barford, Croxton, Toseland, Yelling, Eltisley, Papworth Everard, and Cambourne.

7.2.18. Fieldwork indicated that the undulating landform and pattern of ridgelines, together with local features such as trees, hedgerows, embankments or buildings will limit the visibility and perception of the Scheme from most points beyond 2 kilometres (the exception being more extended views from isolated high points to the south-east of Black Cat junction from the Greensand Ridge area around Everton, which extend up to 5 kilometres from the Scheme).

7.2.19. The landform within both study areas is illustrated on Figure 7.3 within Volume 2.

7.2.20. The preliminary ZTV has been updated to take account of the current Scheme design and the extents of the Development Consent Order (DCO) site boundary, the coverage of which is illustrated on Figure 7.1 and Figure 7.2 within Volume 2.

7.3. Baseline Conditions

Information Sources

7.3.1. The following sources and types of information have been used in the assessment:

a. Information contained within published national, regional and local landscape character assessments, landscape management plans and tranquillity studies.

b. Photographic surveys undertaken as part of fieldwork carried out in 2018 and 2019 to verify existing information, confirm viewpoints and receptors, and to record seasonal changes in the landscape.

c. ZTV coverage.

d. Ordnance Survey mapping, aerial photography and other web-based information sources.

e. Relevant local authority policy documents concerning the status and protection of landscapes.

Landscape Designations

7.3.2. The location and extent of designated landscapes within the detailed and wider study areas are illustrated on Figure 7.4 within Volume 2.

7.3.3. There is one Registered Historic Park and Garden (RPG), located to the south of the A428 at Croxton Park.

7.3.4. The landscape contains historic features including listed buildings and scheduled monuments (see Chapter 6). Where these features contribute to the character of the landscape and the composition of existing views, these are described as part of the review of the landscape character.

7.3.5. A number of important tree groups and individual trees are protected by Tree Preservation Order (TPO). Some stands of ancient woodland and veteran trees are visually prominent and/or have amenity value.

7.3.6. Sites designated for their biodiversity value also contribute to the character of the landscape. These include:

a. Statutorily designated sites, for example Papworth Wood Site of Special Scientific Interest (SSSI) and Elsworth Wood SSSI.

b. County Wildlife Sites (CWS) at the River Great Ouse, Croxton Park and Eltisley Wood.

c. Ancient woodland, for example Eltisley Wood.

d. Woodlands listed on the National Forestry Inventory.

Landscape Character

7.3.7. The boundaries and extents of the defined Landscape Character Areas (LCAs) associated with both the detailed study area and the wider surroundings are illustrated on Figure 7.5 within Volume 2.

7.3.8. The following sections summarise the locations, extents and characteristics of the LCAs which have a relationship to the detailed study area.

National Landscape Character

7.3.9. At the national level, the landscape falls within Natural England's National Character Area (NCA) 88: Bedfordshire and Cambridgeshire Claylands [REF 7-4]. This summarises the area as "*a broad, gently undulating, lowland plateau dissected by shallow river valleys that gradually widen as they approach The Fens NCA in the east. Within it, but distinct from it, is the Bedfordshire Greensand Ridge, a contrasting narrow and elevated outcrop of Greensand, with its associated habitats on acidic soils such as grassland, heathland and woodland*".

7.3.10. NCA 88 [REF 7-4] also provides details of landscape change in the area, and notes that the A428, along with the A1, M1, and A421, have had an impact on landscape character.

Regional Landscape Character

7.3.11. At the regional level, the East of England Landscape Framework [REF 7-5] identifies two regional landscape character typologies relevant to the detailed study area and the wider surroundings:

a. Lowland Village Farms – described as "*this is well settled, low lying landscape which is often crossed by major river corridors. The high density of settlement, intensive agriculture and major transport infrastructure mean that this is often a busy, rural landscape*".

b. Wooded Village Farmlands – described as "*a gently rolling, elevated arable landscape within ancient woodland blocks and small, nuclear villages. Often an open landscape with long distance views, although woodland contains views particularly around settlements*".

7.3.12. These typologies have informed the detailed character assessments at the local level.

County Landscape Character

7.3.13. At a county level, the landscape character of Cambridgeshire has been assessed by Cambridgeshire County Council within the Cambridgeshire Landscape Guidelines – A Manual For Management and Change In The Rural Landscape [REF 7-6].

7.3.14. These guidelines [REF 7-6] identify two landscape areas relevant to the detailed study area: Western Claylands, and Ouse Valley.

7.3.15. Following publication of the guidelines [REF 7-6], the local LCAs now provide greater definition and granularity to these county level landscape areas. The characteristics of these two areas of landscape are therefore described as part of the review of local landscape character.

Local Landscape Character

7.3.16. At the local level, LCAs within the detailed study area have been defined within the following assessments:

a. Bedford Borough Landscape Character Assessment [REF 7-7].

b. Huntingdonshire Landscape and Townscape Assessment: Supplementary Planning Document [REF 7-8].

c. Central Bedfordshire Landscape Character Assessment [REF 7-9].

7.3.17. The individual LCAs identified within these assessments and the characteristics of those identified within the county level assessments [REF 7-6] are described in the following sections.

LCA1D: Thurleigh Clay Farmland

7.3.18. The nearest point of LCA1D: Thurleigh Clay Farmland lies approximately 0.3 kilometres to the north-west of the Scheme at Black Cat roundabout, and continues to extend across approximately 10 kilometres to the north-west.

LCA1E: Renhold Clay Farmland

7.3.19. LCA1E: Renhold Clay Farmland covers the western tie-in of the Scheme with the A421 to the west of Roxton Road and Black Cat roundabout for approximately 1 kilometre, and continues to extend approximately 12 kilometres to the west.

LCA4A: Great Ouse Clay Valley

7.3.20. Black Cat roundabout, the A1 corridor and land towards the River Great Ouse up to Wyboston and St Neots lie within LCA4A: Great Ouse Clay Valley. The area continues along the river in excess of 10 kilometres to the south-west and also to the south (along the A1).

LCA5F: Biggin Wood Clay Vale (inc. LCA1C: Alington Hill Clay Farmland)

7.3.21. The section of the Scheme between Little Barford Road and the south side of Alington Hill lie within LCA5F: Biggin Wood Clay Vale. This LCA continues to extend across approximately 5 kilometres to the south and east towards Sandy and the Greensand Ridge.

7.3.22. A sub-character area of LCA5F, was formerly defined as a separate LCA at LCA1C: Alington Hill Clay Farmland, within the now superseded 2007 published Bedford Borough Landscape Character Assessment [REF 7-10]. This area has been retained for the purposes of the landscape assessment as it explains the change in character within the detailed study area and provides a further level of detail in understanding the baseline.

7.3.23. The Alington Hill sections of the Scheme lie within the central sections of LCA1C: Alington Hill Clay Farmland, which continues to extend across approximately 1 kilometre to the east and west.

LCA4: Ouse Valley

7.3.24. The nearest point of LCA4: Ouse Valley lies approximately 1 kilometre to the west of the Scheme, west of the B1046/Potton Road junction, and continues to extend northwards through the central sections of St Neots.

LCA5: South East Claylands

7.3.25. The central sections of the Scheme, from the south side of the B1046/Potton Road junction to the B1040, to the north of Eltisley lie within LCA5: South East Claylands. This LCA continues to extend up to approximately 7 kilometres to the south-east and 10km to the north. South Cambridgeshire District landscape character assessment.

LCA3: Western Claylands

7.3.26. The Scheme crosses the western sections of LCA3: Western Claylands, which continues to extend in excess of 10 kilometres to the south-east and north-east.

Tranquillity

7.3.27. Tranquillity is a perceptual aspect of landscape. Fieldwork carried out as part of the assessment has identified that vehicles on the A428 and A1 are visible and audible from most parts of the detailed study area.

Vegetation and Land Use Patterns

7.3.28. Figure 7.4 within Volume 2 illustrates the mixed pattern of land cover and vegetation throughout the detailed study area.

7.3.29. To the west, woodland blocks are small and infrequent within the Ouse valley and west of the East Coast Main Line railway. These also occur as frequent scattered features in the central and eastern areas. Ancient woodland includes Sir John's Wood east of the Black Cat roundabout and Eltisley Wood, south of Eltisley village.

7.3.30. Significant strips of riparian woodland occur along the east bank of the River Great Ouse and along a small tributary immediately east of Black Cat roundabout. Riparian woodland also features intermittently along smaller watercourses such as Hen Brook and its tributaries Little Brook and College Dean Brook.

7.3.31. Larger areas of broad-leaved and mixed woodland also exist throughout the detailed study area, and trees subject to TPO are focused within the districts of Huntingdonshire and South Cambridgeshire.

7.3.32. The detailed study area includes extensive tracts of rural countryside with numerous agricultural fields and a network of rural lanes, tracks and footpaths.

7.3.33. The principal land use is agricultural, consisting overall of large scale arable fields with smaller pockets of pasture clustered around villages and some farmsteads. An extensive area of pasture exists at Croxton Park, which lies mostly to the south of the existing A428 and is associated with the historic parkland. Permanent pastures are scarce and infrequent.

7.3.34. Grassland areas include recreational land and flood meadows within the River Great Ouse Valley, golf courses, and parkland and meadows at Croxton Park.

7.3.35. A more industrial/post-industrial mixed land use pattern is focused along the A1/A428 corridor between the Black Cat roundabout and St Neots, which extends to the River

Great Ouse and the landscape to the east and west of the river valley. This area also includes former and current mineral extraction areas and infrastructure, including power lines and the East Coast Main Line railway.

7.3.36. Roxton is a small scale nucleated settlement south of the Black Cat roundabout, and Tempsford is a small scale linear settlement. The settlement of Little Barford is more dispersed and linear. To the north of the Black Cat roundabout, Chawston and Wyboston merge to the west of the A1 within a dispersed settlement pattern. Wyboston is split by the A1.

7.3.37. St Neots is the largest town in Cambridgeshire, concentrated to the north of the existing A428 and west of the East Coast Main Line railway. The eastern and southern parts of St Neots adjacent to the A428 comprise extensive areas of industry with several business and industrial parks. These buildings, particularly the prominent structures of the Little Barford power station, are visible from within the surrounding landscape due to their scale and form. Recent new residential development at Loves Farm has expanded St. Neots, and further development is being constructed in the Wintringham area.

7.3.38. To the east of St Neots, the landscape is less well settled, but small scale nucleated villages exist along the existing A428 at Croxton and Eltisley. To the north and east of the A428, there are further small linear settlements at Yelling and Toseland and larger nucleated settlements at Papworth Everard and Cambourne.

Public Rights of Way

7.3.39. Figure 7.6 within Volume 2 illustrates the network of PRoWs across the detailed study area.

7.3.40. PRoWs include byways open to all traffic and other public footpaths and permissive routes. They also include long distance trails including the Ouse Valley Way and the Greensand Ridge Walk. The Ouse Valley Way regional trail follows a meandering course roughly south-north along the river and valley floor west of Tempsford in the south.

Summary of Landscape Character

7.3.41. The review of published landscape character assessments, supported by field surveys, indicates that the immediate surroundings of the Scheme within the detailed study area exhibit a range of characteristics.

7.3.42. Some parts of the detailed study area have had modifications to their key characteristics since publication of these assessments. This includes the evolving land uses and extensions to the active, large scale quarrying, particularly adjacent to Black Cat junction and development of glasshouses and nurseries around Wyboston within LCA4A: Great Ouse Clay Valley.

Visual Environment

Visual Context

7.3.43. The existing visual context is informed by the features and components within the detailed and wider study areas, and the profile of the land.

7.3.44. Figure 7.3 within Volume 2 illustrates that the land rises gradually from west to east, from approximately 20m Above Ordnance Datum (AOD) across the low lying floodplain along the River Great Ouse, up to high points of approximately 60m AOD at Alington Hill, Croxton, Eltisley and Caxton Gibbet. Subtle variations in landform create a series of lowland plateaux areas divided by broad shallow valleys and ridge lines.

7.3.45. The combination of gently undulating topography, broad network of lanes and strong land cover and settlement patterns result in a sense of enclosure. This is apparent from within the lower lying areas, from settlement fringes and along local roads which are frequently lined by roadside vegetation. Views from PRoW that traverse the open fields or higher ground along with residents of scattered properties at similar locations are wider and more open due to the large scale fields and degraded field boundaries.

7.3.46. Across the western areas there are views of nearby settlements, industry and road infrastructure. In contrast, in the remote areas to the east the views are more rural.

7.3.47. From a number of areas around Black Cat roundabout and to the east of St Neots, the presence of nearby settlement, industry and road infrastructure is evident in views. In more remote areas to the east of the East Coast Main Line railway across Alington Hill, views are more rural.

7.3.48. Lighting related to road infrastructure and urban development, principally from St Neots and the A1 corridor including the Black Cat roundabout, Everton to the south, the A1198 between Papworth Everard and Royston and Cambourne, are noted for their glow in night-time views.

Receptors and Viewpoints

7.3.49. Analysis of the ZTV has identified the following types of visual receptor and receptor groups:

a. Residents within surrounding residential properties on the peripheries of settlements including Roxton, Tempsford, Chawston, Wyboston, St Neots, Little Barford, Croxton, Toseland, Yelling, Eltisley, Papworth Everard and Cambourne.

b. Residents within properties scattered throughout the open countryside.

c. Users of PRoWs that cross the landscape.

d. People travelling on the A428, the A1 and A421 routes and on surrounding roads.

e. Users of public open spaces.

f. People occupying workplaces and educational establishments.

7.3.50. A total of 18 viewpoints have been identified, the locations of which have been agreed with the relevant local authorities and are illustrated on Figure 7.6 within Volume 2. These viewpoints cover a range of views from the receptors identified within the ZTV, the details of which are presented with in **Table 7-1**.

Table 7-1: Viewpoints and Visual Receptor Groups

Viewpoint No.	Viewpoint Location	Key Visual Receptor Group
1	Roxton Road (south side of No.10)	Recreational Users of PRoW including walkers and cyclists on the National Cycle Network
2	Little Barford Road north of The Barns	Users of roads
3	A1 Tempsford footbridge, east side	Recreational Users of PRoW
4	PRoW east of Station Farm/west of Cold Arbour	Recreational Users of PRoW including walkers, cyclists and equestrian users
5	PRoW north of B1046	Recreational Users of PRoW
6	B1428, Cambridge Road at Greyholme,	Users of local roads
7	B1046, east side of railway crossing	Road Users
8	PRoW Hail Lane –east of Lower Wintringham Farm	Recreational Users of PRoW including walkers, cyclists and equestrian users
9	PRoW north of existing A428 and Croxton Park RPG	Recreational Users of PRoW
10	PRoW from Eltisley, north side of the existing A428	Recreational Users of PRoW including walkers, cyclists and equestrian users
11	PRoW from Eltisley	Recreational Users of PRoW including walkers, cyclists and equestrian users
12	B1040 south of Broadview	Road Users
13	PRoW, west of Ermine St	Recreational Users of PRoW
14	PRoW, Croxton to Weald Medieval Village	Recreational Users of PRoW
15	Greensand Ridge Walk, Everton	Recreational Users of PRoW and long-distance footway
16	PRoW – NE Loves Farm-Monks Hardwick	Recreational Users of PRoW
17	PRoW – south of Toseland	Recreational Users of PRoW including walkers, cyclists and equestrian users
18	PRoW, The Lane, Wyboston	Recreational Users of PRoW including walkers, cyclists

7.4. Potential Impacts

Construction

7.4.1. Clearance of vegetation during construction will potentially alter the baseline conditions. For example, the removal of existing vegetation may lead to the opening up of views from visual receptors towards construction works, and the presence of construction plant and equipment in the landscape may temporarily alter local landscape character.

7.4.2. Potential landscape and visual impacts during construction of the Scheme are likely to be associated with the following:

a. Vegetation removal and soil stripping.

b. Movement of construction plant.

c. Use of cranes and other machinery during demolition and construction of bridges and other structures.

d. Contractors' compounds, particularly when lit.

e. Vehicle haul routes.

f. Any temporary lighting needed for the works.

g. Stockpiled soil and other materials.

h. Areas of mineral and fill extraction to provide construction materials.

i. Excavation of flood compensation areas and other drainage features.

j. Demolition and removal of buildings and structures.

k. Temporary facilities including vehicle recovery areas.

Operation

7.4.3. Potential landscape and visual impacts during operation of the Scheme may be associated with the following:

Landscape

a. Loss of existing vegetation and extensive changes in natural landforms along with the introduction of embankments and bunds, altering the topography of the area and causing severance in the landscape and fragmentation of existing landscape elements such as woodlands and hedgerows.

b. The introduction of major highway infrastructure including junctions and structures in the rural landscape.

c. Dominant vertical elements such as new sign gantries, variable message signs (VMS), closed circuit television (CCTV) cameras and masts, and lighting columns.

d. Increased light spill and impacts on character of the landscape during darkness in localised areas around junctions.

e. Changes to landscape character, land use and landscape features throughout the scheme, with increased influence and dominance of traffic moving at speed through the landscape resulting in reduced tranquillity.

Visual

a. Views of major highway infrastructure including junctions and bridges, new sign gantries, VMS, CCTV cameras/masts and lighting columns.

b. Views of other elements including environmental bunds, noise barriers, drainage lagoons, lakes in borrow pits and ecological mitigation areas and ponds.

c. Views of lighting columns/light spill in localised areas around junctions.

d. Views of traffic moving at speed through the landscape.

e. Screening reducing the extent of existing views.

7.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

7.5.1. The design of the Scheme is being developed to maximise the opportunities for landscape integration and enhancement as well as to mitigate adverse impacts.

7.5.2. The Preliminary Environmental Masterplan illustrated on Figure 2.4 within Volume 2 presents the form and location of the landscaping measures that have been incorporated into the design of the Scheme to mitigate landscape and visual impacts.

7.5.3. The functions and objectives of the landscaping measures contained within the Preliminary Environmental Masterplan are to:

a. integrate the Scheme into the existing landscape pattern as far as possible by retaining and following existing features;

b. replace vegetation lost as a consequence of Scheme construction;

c. filter and screen more prominent components in existing views from visual receptors and enhance views where possible; and

d. provide visual interest to people travelling along the Scheme and the existing network of local roads and PRoWs.

7.5.4. The development of the landscaping strategy for the Scheme has taken account of the following design principles:

a. A strategic, green infrastructure approach to design which considers the multiple benefits that the Scheme can deliver, both within the footprint and through connections to the wider landscape.

b. Sensitive design of earthworks, balancing ponds and other drainage features to fit with surrounding landform and land cover patterns.

c. Sensitive location of signage, lighting and gantries to limit visual intrusion.

d. Application of the recommendations contained within relevant landscape guidelines.

e. The use of a range of species to reflect the distinctive local character and to protect against the effects of climate change and reinforce biosecurity.

f. Areas of species rich grassland at locations where conditions are suitable for their establishment, to provide seasonal interest and to provide valuable habitats which increase local biodiversity.

g. The use of different types of native tree and shrub planting on and adjacent to highway earthworks to create woodlands, copses and shelterbelts in order to fit with the surrounding landscape character patterns. This will also help to break up the scale of the road, screen structures, traffic and lighting.

h. Retention of views to local landmarks through breaks in the planting to help create a sense of place and interest for vehicle travellers, where possible.

i. Rounding of crests and toes of embankments and cuttings to achieve better integration with the surrounding landform, where space and materials are available.

j. The use of hedgerows on the highway boundary, where appropriate, to link into existing field boundaries, provide screening and integration into the local pattern, and to connect and extend existing wildlife corridors.

k. Sensitive lighting design, such as the use of horizontally mounted flat glass lanterns.

Standard Mitigation Measures

7.5.5. An Outline Environmental Management Plan (OEMP) will be developed for the Scheme, which will include a series of measures that the construction contractor will use as the framework for the development of their Construction Environmental Management Plan.

7.5.6. The OEMP will set out working practices and measures to avoid and reduce impacts on landscape character and the visual environment, examples of which are expected to include the following:

a. Keeping construction sites and compounds tidy and in good order, for example by keeping stockpiled material to a minimum and arranging goods deliveries on an 'as and when' basis.

b. Keeping night-time works to a minimum.

c. Ensure low level and directional lighting is used to illuminate construction compounds and working areas, where possible.

d. Undertaking an arboricultural impact assessment in line with BS 5837:2012 [REF 7-11] for the protection of retained trees and vegetation during the construction period.

e. Siting compounds and other construction areas sympathetically within the landscape.

f. Rendering temporary construction buildings, fencing and facilities in tonal colours to reflect the landscape.

g. Form earthworks bunds early in the construction programme, where possible, to visually screen and contain construction works.

h. Establish advanced planting to soften and filter views of the construction phase, as well as part of the wider visual mitigation if land is not required for other construction activities.

i. Reinstatement and return of land used temporarily for construction to its previous condition and use, as soon as practicable.

j. Utilise existing structures associated with construction and demolition works as a visual screen.

7.6. Assessment of Effects

Construction

Landscape Character

7.6.1. The assessment has identified that construction of the Scheme is likely to result in changes to local landscape character and the composition of existing views available to receptors.

7.6.2. Alongside the introduction of construction activity and the presence and operation of compounds, the removal of (or changes to) existing components and features within the DCO site boundary that currently frame local landscape character will be a key contributor to the effects of construction. Additionally, earthworks across the undulating valley and excavation of cuttings through hillsides are likely to disrupt the pattern and tranquillity of the rural landscape.

7.6.3. The assessment has identified that temporary significant effects are likely to occur within the following LCAs:

a. LCA4: Ouse Valley.

b. LCA5F: Biggin Wood Clay Vale.

c. LCA1C: Alington Hill Clay Farmland.

d. LCA5: South East Claylands.

e. LCA3 Western Claylands.

Visual Environment

7.6.4. Construction of the Scheme will also likely result in some temporary significant adverse effects on visual receptors and receptor groups. These effects are likely to affect the following receptors in locations where the works become a prominent or dominant feature in existing views:

a. Residents of isolated properties in the open countryside.

b. Residents within nearby settlements at Roxton, Tempsford, Chawston, Wyboston, St Neots, Little Barford, Croxton, Eltisley, Papworth Everard and Cambourne and the fringes of Toseland, Yelling; and

c. PRoW users on some existing routes.

Operation

Landscape Character

7.6.5. The assessment has identified that operation of the Scheme is likely to result in significant adverse effects on the landscape character of LCA4: Ouse Valley as a result of the scale of new infrastructure, particularly the introduction of the new Black Cat junction and the River Great Ouse viaduct and embankments. Effects will be most significant within the northern sections of this LCA between Roxton, Tempsford and Wyboston. The lowering of the A1 corridor through this area in cutting will also represent a significant change in the local landscape, and the introduction of the new Black Cat junction will also result in the loss of built form.

7.6.6. Significant adverse effects on landscape features and character are also likely where the Scheme diverts from the route of the existing A428. The new grade-separated junctions, viaducts, bridges and the new dual carriageway will introduce substantial earthworks and structures into the local landscape, which are likely to appear out of character with the surrounding topography and land cover patterns in the short to medium term, until landscaping has established. LCAs which may experience such effects are LCA5F: Biggin Wood Clay Vale, LCA1C: Alington Hill Clay Farmland, and to a lesser extent LCA5: South East Claylands (LCA5) and LCA3: Western Claylands (LCA3).

7.6.7. Other adverse effects are likely to be associated with the following changes:

a. Where the new dual carriageway will pass through more remote areas at Alington Hill and the section on embankment across the valley of Hen Brook east of St Neots, this is likely to be visually prominent in the wider landscape and will sever existing landscape patterns.

b. A reduction in tranquillity in more rural areas along and surrounding the new dual carriageway, principally between Little Barton Road and B1046, around Potton Road, and within LCA1C: Alington Hill Clay Farmland.

7.6.8. Along the existing A428, tranquillity is likely to be improved through the transfer of traffic onto the new dual carriageway. Beneficial effects on tranquillity are expected along the existing A428 around St Neots, and between the east of St Neots and Caxton Gibbet.

7.6.9. Beneficial effects are also likely from improvements to PRoWs and the wider landscape setting to the north of Croxton Park RPG.

Visual Environment

7.6.10. The assessment has identified that there are likely to be adverse effects on the views and visual amenity of residents on the fringes of settlements and scattered rural properties in the open countryside, and on people using PRoWs in proximity to the Scheme.

7.6.11. Significant adverse visual effects are likely to affect residential and PRoW receptors in close proximity to the new Black Cat, Cambridge Road and Caxton Gibbet junctions due to the scale and height of these structures and an awareness of traffic moving on them.

7.6.12. Other adverse effects on visual amenity are likely to be associated with the following:

a. Lighting, for example the illumination of junctions and roundabouts which could result in a concentration of light spill in existing views.

b. The loss of elements and features that currently provide visual screening, for example existing vegetation.

c. The introduction of new road infrastructure where none currently exists in views, or where new road infrastructure will be located closer to visual receptors.

7.6.13. Some beneficial effects on visual amenity are likely to result from the following:

a. Reductions in traffic visible on existing roads, for example the A428, where this is a detracting element in existing views.

b. The establishment of planting, which would improve the character and the balance of components within certain views.

7.6.14. Photomontages for the identified representative viewpoints will be produced to illustrate the effects of the Scheme in the year of its opening, and fifteen years after opening (to account for the establishment of landscaping. These images will be presented within the Environmental Statement and will inform the identification of likely significant effects on landscape character and visual amenity.

8. BIODIVERSITY

8.1. Introduction

8.1.1. This chapter presents the findings of the preliminary assessment of the potential effects of the Scheme on biodiversity, a term used to describe all plant and animal life in a particular area (habitat).

8.1.2. The content of this chapter is supported by Figure 2.4 and Figure 8.1 within Volume 2.

8.2. Approach to the Assessment

Scope and Methods

8.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the biodiversity assessment, and the approach and methods to be followed.

8.2.2. The Scoping Report [REF 8-1] 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 Scheme on biodiversity.

8.2.3. Following receipt of the Scoping Opinion [REF 8-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing biodiversity assessment:

a. Impacts on designated sites will be assessed, and should any likely significant effects be identified, these will be reported.

b. Referencing will be made between the biodiversity and landscape assessments in relation to the proposed landscape mitigation strategies.

8.2.4. Having had regard to the information presented within the Scoping Report [REF 8-1], The Inspectorate's Scoping Opinion [REF 8-2] has also confirmed Highways England's view that:

a. significant effects on Hazel Dormouse (*Muscardinus avellanarius*) are unlikely; and

b. significant effects on biodiversity associated with the future maintenance of the Scheme are unlikely.

8.2.5. Accordingly, these matters will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

8.2.6. The biodiversity assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 8-3].

8.2.7. Details of how the biodiversity assessment will meet the requirements of the NPSNN [REF 8-3] in relation to the assessment of likely significant effects on designated sites, habitats, protected species and ecosystems are presented within the Scoping Report [REF 8-1].

8.2.8. The Scoping Report [REF 8-1] also details how other legislation and policy relating to the protection and conservation biodiversity interests are being taken account of in the assessment.

Consultation

8.2.9. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the biodiversity assessment, the results of which are presented within the Scoping Opinion [REF 8-2].

8.2.10. The following bodies and organisations will be contacted to further inform the impact assessment process and the development of biodiversity mitigation and enhancement measures:

a. Cambridgeshire County Council.
b. Bedfordshire County Council.
c. South Cambridgeshire District Council.
d. Huntingdonshire District Council.
e. Bedford Borough Council.
f. Environment Agency.
g. Natural England.
h. Wildlife Trust for Bedfordshire, Cambridgeshire & Northamptonshire.
i. Bedfordshire Local Nature Partnership.
j. Natural Cambridgeshire Local Nature Partnership.
k. Woodland Trust.
l. Bedfordshire Natural History Society.
m. Huntingdonshire Fauna & Flora Society.
n. Cambridge Natural History Society.
o. Royal Society for the Protection of Birds (RSPB).
p. Cambridgeshire Mammal Group.
q. Bedfordshire Bat Group.
r. Cambridgeshire Bat Group.
s. Bedfordshire Amphibian and Reptile Group.
t. Cambridgeshire and Peterborough Amphibian and Reptile Group.
u. Hen and Abbotsley Brook Catchment Facilitated Group.
v. Croxton Park Partnership.
w. St Neots & District Fish Preservation & Angling Society.

Limitations and Assumptions

8.2.11. The information presented in this chapter reflects that obtained and evaluated at the time of reporting, and has referenced published data, records and web-based information obtained to date.

8.2.12. Habitat and species information referenced in the assessment has been collected from site surveys undertaken on land within the Development Consent Order (DCO) site boundary between 2016 and 2019, where permission to access the land has been obtained from landowners. Certain surveys will continue through 2019 and into 2020 within appropriate seasonal windows.

8.2.13. Where survey data are currently incomplete or limited, and further work is required to inform the assessment, this is presented within **Table 8-2**.

8.2.14. The assessment has taken account of the biodiversity measures incorporated into the design of the Scheme to mitigate its potential impacts and effects, as illustrated on the Preliminary Environmental Masterplan on Figure 2.4 within Volume 2. The development of the Preliminary Environmental Masterplan has adopted a hierarchy of first avoiding impacts where possible, and then incorporating mitigation and measures for those that cannot be avoided, and then incorporating opportunities for biodiversity enhancement where feasible.

Study Area

8.2.15. Study areas have been defined by determining zones of influence (ZoIs) for relevant biodiversity features that could experience potentially significant effects from construction and/or operation of the Scheme.

8.2.16. The ZoIs represent the areas within which direct or indirect effects could occur on biodiversity receptors (comprising designated sites, habitats and species), and include:

a. areas likely to be lost to, or temporarily affected by, construction (for example land that will be permanently occupied by components of the Scheme);

b. areas likely to be affected by the permanent presence and operation of the Scheme (for example where the connectivity of features and habitats are severed);

c. areas likely to be affected by hydrological disruption (for example watercourses crossed by the Scheme); and

d. areas where there is a risk of pollution or disturbance (for example from road lighting and noise).

8.2.17. Based on the outcomes of the scoping exercise, and considering the above factors, the following ZoIs are being applied in the biodiversity assessment:

a. International statutorily designated sites (for example Special Areas of Conservation (SAC)): within 5 kilometres of the Development Consent Order (DCO) site boundary.

b. International statutorily designated sites (where bats are a primary reason for designation and/or there are potential pathways present: within 30 kilometres of the DCO site boundary.

c. National statutorily designated sites (for example Sites of Special Scientific Interest (SSSI)): within 1 kilometre of the DCO site boundary.

d. Non-statutorily designated sites (for example County Wildlife Sites (CWS), ancient woodlands and Protected Road Verges): within 1km of the DCO site boundary.

e. Legally protected and notable species (including invasive non-native species) recorded within the last ten years up to 1 kilometre from the DCO site boundary (extending to 2 kilometres for bats).

f. Habitats and habitat connections relevant to the interpretation of planning policy and assessment of potential protected and notable species constraints: up to 1 kilometre from the DCO site boundary.

g. Designated green corridors, wildlife networks and other ecological features: up to 1 kilometre from the DCO site boundary.

h. Local Biodiversity Action Plan Priority Habitats and Species, and Species of Principal Importance: up to 1 kilometre from the DCO site boundary.

8.2.18. The extents of the adopted ZoIs vary depending on the nature of the features under consideration and the potential effects upon them. These ZoIs may be subject to refinement as part of ongoing consultation with relevant bodies and organisations.

8.3. Baseline Conditions

Information Sources

Desk Studies

8.3.1. The following data, information and records relating to biodiversity features within the identified ZoIs have been obtained as part of a desk study, and are referenced in the assessment:

a. Natural England data – for information on statutorily designated sites, national character areas and the grades of agricultural land.

b. Environment Agency data – for information on the locations and condition of aquatic habitats.

c. Environmental records centres and local groups – for information and records on notable plant and animal species, and non-statutorily designated sites of biodiversity value.

d. Multi-Agency Geographical Information for the Countryside – for other information on designated sites of relevance to the assessment, such as ancient woodlands and notable habitats.

e. Published Biodiversity Action Plans (BAPs) – for Bedfordshire and Cambridgeshire.

f. Various published texts – concerning habitats and species recorded within Cambridgeshire and Bedfordshire (and Huntingdonshire, as was).

g. Ordnance Survey mapping and aerial photography – for information on waterbodies, watercourses and habitat connections.

8.3.2. Information contained within the Highways England Biodiversity Action Plan (BAP) [REF 8-4] has been used to inform the development of biodiversity mitigation and enhancement measures.

8.3.3. Once available, the outputs from the air quality modelling of the Scheme's likely operational effects (see Chapter 5) will be used to identify any potential effects on designated sites in relation to changes in NO_x and/or nitrogen deposition.

Field Surveys

8.3.4. Field surveys were undertaken during the optioneering stages of the Scheme between 2016 and 2018. Further surveys have been undertaken prior to and following announcement of the preferred route for the Scheme in 2019.

National Character Areas

8.3.5. The desk study has confirmed that the Scheme is located within the Bedfordshire and Cambridgeshire Claylands National Character Area (NCA) 88 [REF 8-5].

8.3.6. Natural England describes the biodiversity of this National Character Area *as "under pressure from land use change, development and infrastructure improvements, and demand for resources (especially water). However, there are also opportunities to benefit biodiversity and recreation by creating new green infrastructure. The*

management and extension of semi-natural habitats within the National Character Area will bring benefits for biodiversity, soil and water quality, climate regulation and recreation".

8.3.7. Although only a small proportion of NCA 88 [REF 8-5] is designated for its biodiversity interest, it contains a diverse range of habitats of importance which in turn support a range of species, some rare and scarce.

Designated Sites

8.3.8. The location of sites designated for their biodiversity value are illustrated on Figure 8.1 within Volume 2.

8.3.9. Within the 30 kilometres ZoI (for European sites for which bats are a special feature), the desk study has identified that Eversden and Wimpole Woods Special Area of Conservation (SAC) is located 7.3 kilometres from the DCO site boundary. This site is designated primarily for a species of bat, Barbastelle, and is also designated as a Site of Special Scientific Interest (SSSI).

8.3.10. The desk study has confirmed that there are no internationally designated sites located within the 5 kilometre ZoI.

8.3.11. The following statutorily designated sites have been identified within the 1 kilometre ZoI:

a. Elsworth Wood SSSI (also an ancient woodland) located approximately 850m from the DCO site boundary, to the north east of Caxton Gibbet roundabout.

b. St Neots Common SSSI located approximately 900m from the DCO site boundary, to the north of Wyboston interchange.

8.3.12. No designated National or Local Nature Reserves are located within the 1 kilometre ZoI.

8.3.13. The desk study has identified that the Scheme passes over the River Great Ouse County Wildlife Site (CWS) and that there are nine other CWSs (three of which are also ancient woodland) and one Protected Road Verge (PRV) within the 1 kilometre ZoI.

Habitats

Desk Study

8.3.14. The DCO site boundary is located in parts of Cambridgeshire and Bedfordshire that are predominantly managed under intensive arable cultivation.

8.3.15. A large part of the DCO site boundary is classified within the Agricultural Land Classification (ALC) [REF 8-6] as being Grade 2 Very Good land. Apart from the River Great Ouse corridor, soils are of a single type: lime-rich loamy and clayey with impeded drainage. The soil along the river corridor is freely draining, slightly acid and sandy [REF 8-7].

8.3.16. To the south and west of the DCO site boundary is a chalky clay boulder clay plateau known as the West Cambridgeshire Hundreds, where woodland has likely not comprised more than 5% of the total land surface since Anglo-Saxon times [REF 8-8] (the British average woodland cover being 11%). Although relatively sparse and privately managed, most of the larger woodlands have a high biodiversity value, are ancient woodland, and designated either as SSSIs or CWSs.

8.3.17. The River Great Ouse passes through the DCO site boundary. It is designated as a CWS and is identified as a botanical hotspot in Bedfordshire [REF 8-9]. Downstream,

there are a number of CWSs (including one designated as a SSSI), all of which are closely linked to the river.

8.3.18. Tributaries of the River Great Ouse that coincide with the DCO site boundary are Hen Brook (known as Abbotsley Brook in its upstream), Fox Brook and Gallows Brook, none of which is designated for their biodiversity value.

8.3.19. Croxton Park is a landscape scale CWS located adjacent to the DCO site boundary, comprising parkland habitat with meadows showing evidence of ridge and furrow, woodland and veteran trees. A botanical survey of the parish, of which the Park is a substantial part, recorded over 400 plant species, most of which were relatively common [REF 8-10]. In 1966, Oxlip (*Primula elatior*) (a nationally scarce species) was found in Turtlow Plantation at Croxton Park, the most westerly location for Oxlip in Cambridgeshire [REF 8-11].

8.3.20. A number of Cambridgeshire BAP [REF 8-12] Priority Habitats and Bedfordshire BAP Priority Habitats [REF 8-9] may occur within or in proximity to the DCO site boundary, including: farmland (arable); deciduous woodland; wet woodland; grazing marsh; wood pasture and parkland; traditional orchards; lowland dry acid grassland; lowland calcareous grassland; lowland heathland; hedgerows; ponds; reedbeds; and rivers and streams.

Field Surveys

8.3.21. An extended Phase 1 Habitat survey was initially undertaken in 2016 as part of the assessment of Scheme options (see Chapter 3). In conjunction with analysis of recent aerial photography and other more recent field surveys, a range of habitats have been identified within 500m of the DCO site boundary.

8.3.22. The majority of habitat coverage comprises arable fields (72.5% of the land within the DCO site boundary) with small and localised blocks of semi-natural and plantation woodland (<0.1% (combined woodland habitat types), as presented in **Table 8-1**. Most field boundaries support hedgerows, some of which include mature trees including in one case a veteran tree. There are also streams, ditches and over 70 ponds and other waterbodies recorded within 500m of the DCO site boundary.

8.3.23. Some of the habitats present within 500m of the DCO site boundary are listed as priority habitats under the UK Post-2010 Biodiversity Framework [REF 8-13].

8.3.24. The extended Phase 1 Habitat survey has been added to through focussed habitat surveys including surveys of arable field boundaries, hedgerows and streams, as well as observations made when other surveys were undertaken, such as riparian mammals and Great Crested Newt (GCN) surveys.

Table 8-1: Extent of Habitats Within the DCO Site Boundary (excludes area of land temporarily lost to construction phase) (Source: Phase 1 habitat surveys 2016-2019)

Habitat	Area (ha)	%
Woodland: Broad leaved semi-natural woodland	1.95	0.5
Woodland: Broad leaved plantation woodland	0.35	0.1
Woodland: Scrub dense continuous	0.44	0.1
Woodland: Scrub scattered	9.47	2.6
Woodland: Broad-leaved parkland	0.17	<0.1
Grassland: Unimproved neutral grassland	2.05	0.6
Grassland: Semi-improved neutral grassland	7.53	2.1
Grassland: Poor Semi Imported grassland	20.95	5.8
Grassland: Amenity grassland	8.99	2.5
Tall ruderal	1.71	0.5
Wetland: Standing water	0.49	0.1
Quarry	16.66	4.6
Arable	263.27	72.5
Built Environment: Buildings	0.32	0.1
Built Environment: Hard surface	26.18	7.2
Built Environment: Gardens (lawn and planting)	0.63	0.2
Bare ground	1.71	0.5
Total	**362.89**	

Species

Desk Study

8.3.25. Bedfordshire and Luton Biodiversity Recording and Monitoring Centre [REF 8-14] and the Bedfordshire Bat Group [REF 8-15] have provided data relating to the presence of several notable animal and plant species. This identified:

a. 44 species listed on Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 [REF 8-16];

b. 52 species listed under the Wildlife and Countryside Act 1981 [REF 8-17] (as amended), including 11 species listed on the Conservation of Habitats and Species Regulations 2017 [REF 8-18];

c. 43 species listed under the UK Biodiversity Action Plan [REF 8-19];

d. three local species; and

e. 27 birds listed under Annex 1 of the Birds Directive [REF 8-20].

8.3.26. In addition, two European protected species mitigation licences have been granted for GCN, as identified within NCA 88 [REF 8-5].

8.3.27. A review is currently being undertaken of the published accounts of the habitats, flora and fauna within the counties of Cambridgeshire, Bedfordshire and (up to 1973) Huntingdonshire.

Field Surveys

8.3.28. Field surveys have confirmed that the area within and surrounding the DCO site boundary supports habitats that are suitable for a range of protected and notable species and species groups, including invasive non-native species of plants and animals.

8.3.29. **Table 8-2** presents details of the coverage, date and status of the field surveys undertaken to date, and further planned surveys to be carried out as part of the biodiversity assessment.

Table 8-2: Summary of Field Surveys

Survey	Study Area	Date of Survey Period*	Future Updates
Phase 1 Habitat	Main habitats within a 1.2km wide corridor.	27 June and 22 July 2016 May – June 2019	Further surveys on-going in 2019.
Terrestrial habitats and associated vegetation	The areas of terrestrial habitat surveyed were identified from the initial Phase 1 habitat survey and desk study information. The study area is the DCO site boundary plus a 100m buffer, where access is available. Within the study area, there are 11 woodlands, 47 hedgerows and arable fields (where accessible). Habitats were surveyed and coverage will be updated as necessary.	2 – 4 May 2018 May – June 2019	Surveys are ongoing and will be updated where necessary.
Aquatic habitats	Aquatic habitats were identified for survey within the study area based on a review of Ordnance Survey maps, aerial photography, the Environment Agency online catchment data explorer [REF 8-21], site walkovers and Phase 1 Habitat Survey mapping, and subsequent surveys (notably amphibian surveys). A Habitat Walkover Survey identified 20 ponds and Hen Brook for comprehensive surveys.	July 2017 and July 2017 26th – 28th September 2018 May-June 2019	Surveys are ongoing and will be updated where necessary.
Bats	A preliminary roost appraisal survey was carried out on all relevant features identified within the DCO site boundary, access permitting. Presence/absence surveys and roost characterisation were undertaken within the DCO site boundary using: - aerial tree climbing; - bat emergence/re-entry surveys; and - bat activity surveys.	25, 26 April and 2, 3 May 2018 18 – 25 July 2017 5 – 26 July and 1 – 31 August 2018 April – October 2018 May – September 2019	Surveys are ongoing **

Survey	Study Area	Date of Survey Period*	Future Updates
Badger	Features indicating the presence of badger including setts were investigated 250m from the DCO site boundary and this search was extended to 500m where appropriate, and included territory analysis. Data was obtained on where badgers had been killed on the roads in the study area.	November 2017 – November 2018 February – March 2019	None – surveys complete
Riparian mammals (including invasive non-native species)	Watercourses over which the Scheme crossed were surveyed 500m up and downstream of the crossing point and, for Otter, all bridges 5km up and downstream of the crossing.	March, July, August, October and November 2018 January, April and May 2019	Completed pending data review**
Dormouse and any other mammals	Desk study of 2km from the DCO site boundary and for the modern counties of Cambridgeshire and Bedfordshire.	November 2017 – May 2018	Completed pending data review**
Wintering birds	DCO site boundary and a 100m survey buffer	October 2017 – March 2018	Completed pending data review**
Breeding birds	DCO site boundary and a 100m survey buffer	26 March – 8 June 2018	Completed pending data review**
Barn Owl	All accessible areas within the DCO site boundary, plus 250m buffer. Further surveys ongoing in 2019 with the buffer extended to 1.5km from DCO site boundary.	Dates in July 2017 to August 2018 April – August 2019	Completed pending data review**
Reptiles	All accessible areas of potentially suitable habitat within the DCO site boundary plus 100m	September – October 2018	Completed pending data review**
Amphibians including Great Crested Newt	All accessible areas of potentially suitable habitat within the DCO site boundary plus 500m comprising: - Habitat Suitability Index calculated for 51 sites; - eDNA samples taken and analysed for 26 ponds; and - standard field survey techniques used for 26 ponds	Feb – May 2018 Apr – May 2018 March – June 2019	Completed (ongoing review)** **Further surveys on-going in 2019.**
Fish	Based on a review of Environment Agency data, only Hen Brook was surveyed using electric fishing at the section crossed by the DCO site boundary.	11 October 2018	Completed pending data review**
Terrestrial invertebrates (including	Target areas were selected within the DCO site boundary on the basis of a scoping survey. These were the	May, June, July and August 2018	Completed pending data review**

Survey	Study Area	Date of Survey Period*	Future Updates
invasive non-native species)	areas identified as having the greatest potential to support scarce invertebrates or invertebrate assemblages.	May and June 2019 (including assessment of Elm Zig-zag Sawfly invasion)	
Aquatic macro-invertebrates (including invasive non-native species)	Waterbodies and watercourses within the DCO site boundary plus 100m (the River Great Ouse was not included).	26 – 28 September 11 October 2018 May and June 2019	Completed pending data review**
Plants (invasive non-native species)	In 2016, invasive habitats were mapped as part of the Phase 1 Habitat survey. In 2018, the study area as the DCO site boundary plus a 100m buffer with a focus on areas/habitats identified from the initial Phase 1 Habitat survey and desk study information.	27 June and 22 July 2016 2 – 4 May 2018	Completed pending data review**
* = indicative dates ** = desk study using the Local Environmental Record Centres' data and reviewing any recent publications			

8.3.30. Information gathered regarding Brown Hare and Hedgehog indicates that they are common in both Cambridgeshire and Bedfordshire. Harvest Mouse is found in scattered locations in both counties and Polecat records have increased recent years, but probably from unauthorised releases of captive-bred specimens rather than natural spread from the west. Based on this information, the assessment has assumed that these four species are present within the DCO site boundary and its environs.

8.3.31. Despite significant effort in surveying for Hazel Dormouse in both Cambridgeshire and Bedfordshire for many years, this species is known at only one location in Cambridgeshire (Brampton Wood, located approximately 7.5 kilometres north of the DCO site boundary) and at a cluster of three or four sites in south Bedfordshire, a situation which has pertained for many years. On this basis and given the relatively poor quality of habitat for this species within and surrounding the DCO site boundary, the assessment has concluded that this species is not present within the DCO site boundary.

8.3.32. The invasive non-native mammal species American Mink (*Mustela vison*) was included in the surveys for Otter and Water Vole, and Reeve's Muntjac has been assumed (along with other species of deer) to be present within and surrounding the DCO site boundary. Other non-native species which might be encountered are illustrated by the report of three species of exotica found in Bedfordshire: Wild Boar and Patagonian Mara in 1997, and chipmunks in 1996 [REF 8-22].

8.3.33. The description of NCA 88 [REF 8-5] draws attention to the butterflies of ancient woodland including White Admiral, Purple Hairstreak and Black Hairstreak. These insects along with other species listed under the NERC Act 2006 [REF 8-16] have been included in the terrestrial and aquatic invertebrate surveys.

8.3.34. Surveys for invertebrates have included invasive non-native species. One species has been found within the DCO site boundary, Zig-zag Elm Sawfly, the larvae of which feeds on elm trees. Surveys to establish the extent of this species are being undertaken by the Highways England Area Maintenance Team.

8.3.35. Plant species of biodiversity significance that have formed a focus for habitat surveys are arable weeds and those species associated with ancient woodland that might be found in relict ancient woodland habitat, for example old hedgerows. Although stoneworts (*charophytes*) are specifically mentioned in the description of NCA 88 [REF 8-5], this refers to that part of Bedfordshire where there are many water-filled brick pits which have been colonised by a variety of the stonewort species. Common Stonewort was found in two of the ponds surveyed for amphibians.

8.3.36. Eleven species of invasive non-native plants have been found within or in close proximity to the DCO site boundary; these comprise five terrestrial species and six aquatic species.

8.3.37. At the time of undertaking this preliminary assessment, the evaluation of the geographic scale of importance of certain species has yet to be completed. This will be undertaken as part of the ongoing review of the baseline conditions and reported within the Environmental Statement, following the completion of the remaining field surveys.

8.4. Potential Impacts

8.4.1. The preliminary assessment has identified that construction and operation of the Scheme will potentially result in both adverse and beneficial impacts on designated sites, habitats and species within the respective ZoIs.

8.4.2. These impacts are associated with:

a. direct loss of wildlife habitats;

b. fragmentation and isolation of habitats;

c. disturbance to species from noise, light or other visual stimuli;

d. changes to key habitat features; and

e. changes to the local hydrology, water quality and/or air quality.

Construction

Designated Sites

8.4.3. The preliminary assessment of potential impacts associated with construction of the Scheme on the identified internationally, nationally or locally designated sites of biodiversity value has identified that, apart from the River Great Ouse CWS, there will be no direct impacts on these sites due to their distance from the Scheme and the lack of ecological connectivity.

8.4.4. For the River Great Ouse CWS, the assessment has identified that although the site will be crossed by the Scheme, construction of the bridge spanning the river will be clear span and will therefore not require the installation of pillars within the river. Accordingly, the potential for direct impacts on this site will be limited.

8.4.5. The River Great Ouse is also the core of the Lower Great Ouse River Valley, a Green Infrastructure Network Area within the Bedford Green Infrastructure Plan [REF 8-23]. The Scheme does not cross or adjoin any green infrastructure in Cambridgeshire [REF 8-24].

Habitats and Species

8.4.6. Addressing the habitats identified in the description of NCA 88 [REF 8-5], floodplain grazing marsh, fen, wood pasture, traditional orchards and parkland with ancient and veteran trees all occur within the DCO site boundary. The preliminary assessment has concluded that there will be no direct or indirect impact on any of these habitats.

8.4.7. Ancient woodland habitats support a range of species, some of which are identified in NCA 88 [REF 8-5] as being rare and scarce including butterflies such as the White Admiral, Purple Hairstreak, Black Hairstreak and other specialist invertebrates, as well as Dormouse and Barbastelle. The preliminary assessment has concluded that construction of the Scheme will not directly impact on any ancient woodland habitats.

8.4.8. Riparian and wetland habitats that may be impacted by construction of the Scheme provide valuable habitat connectivity within the landscape and support populations of breeding and overwintering birds, Water Vole, Otter and GCN.

8.4.9. Further information regarding the potential for Scheme construction phase impacts on habitats and species is presented in **Table 8-3**.

Table 8-3: Potential Impacts on Habitats and Species during Scheme Construction

Habitat or Species	Construction Impacts
Terrestrial habitats and associated vegetation	There will be loss of habitat, the majority of which comprise arable land. Priority habitats that will be lost include some hedgerows as well as some trees, ponds, a small area lowland mixed deciduous woodland (Pillar Plantation) and arable field margins, and potentially a small area of reedbed (balancing ditch to east of Caxton Gibbet roundabout). There will be habitat creation as part of the Scheme landscape design, including strips of woodland, scrub, grassland and wetland. The aim is to achieve an overall net gain in habitat/biodiversity.
Aquatic habitats	The Scheme crosses: Hen Brook, Fox Brook, an unnamed brook and Gallow Brook. These watercourses are of low biodiversity value due to factors such as realignment and drying out especially in their upper reaches. Avoidance measures will be taken to minimise further impacts and measures have been identified to mitigate and potentially enhance these watercourses. River Great Ouse: Construction design and techniques will ensure that there will be no impact to the river as an ecosystem and likewise for constituent species. Ponds and other waterbodies/wetlands: Where avoidance is not feasible, mitigation will be implemented using opportunities to create new wetland areas. The aim is to achieve an overall net gain in habitat/biodiversity.

Habitat or Species	Construction Impacts
Bats (roosting)	Direct impacts on at least one roosting species, Common Pipistrelle, and the potential for further direct and indirect effects to the roosts of the other two species recorded using features within the DCO site boundary for roosting (Brown Long-eared bat and Soprano Pipistrelle). Confirmed roosts comprise non-breeding day or feeding roosts of small numbers of bats in three buildings and two trees, classified as of Local importance. Possible common and/or soprano pipistrelle roosts were identified in a copse by the River Ouse and a hedgerow tree which will be investigated further in 2019. A possible Barbastelle roost was also identified within 250m of the Scheme.
Bats (foraging and commuting)	Significant disturbance to foraging and commuting habitats during construction for up to 12 species of bats (including Common Pipistrelle, Soprano Pipistrelle, Noctule, Myotis species (including Daubenton's Bat, Natterer's Bat and Whiskered/Brandt's Bat). The Scheme may potentially fragment the habitats, creating barriers for commuting/foraging, particularly for bats moving from roosts both within and close to the site. Foraging and commuting areas with the highest relative bat activity were present in the quarry area to the west of the River Great Ouse, the main east-west hedge, which links woodland to the east to habitats along the railway line and woodland to the west; hedges and larger blocks of woodland. The site was assessed as between Local and Regional Importance to foraging and commuting bats (depending on the species).
Badger	A total of 31 Badger setts were recorded within 500m of the Scheme, 12 of which have been identified as being potentially within or sufficiently close to the Scheme that they may be impacted by construction works. The Scheme could impact Badger through the need to destroy a sett(s) and disrupt movement for feeding. Data from ongoing bait marking surveying will inform where mitigation is needed and the form it should take, for example fencing and/or establishing a new sett(s).
Riparian mammals (including invasive non-native species)	No evidence of Water Vole was found along any of the watercourses surveyed. Evidence of Otter was found along five watercourses with two potential holts being found on the River Great Ouse and one on Hen Brook. The Scheme could impact Otter by disrupting its movement along these watercourses.
Dormouse and other mammals	The desk study of the Scheme and a 5km radius concluded that Dormouse is not present. Brown Hare, Harvest Mouse, Rabbit and Reeve's Muntjac were found to be widespread and are assumed to be present.

Habitat or Species	Construction Impacts
Wintering birds	The Scheme has the potential to negatively impact wintering bird assemblage through habitat loss and cause disturbance from construction-related activities – this includes waterbodies east of the Black Cat roundabout which support species associated with wetland features, for example Mallard (and other waterfowl), gulls, Green Sandpiper, Lapwing and Ringed Plover (assemblages of these species did not meet the criteria for national or county importance). Scrub and hedgerows, some of which will be lost due to Scheme construction support species such as Yellowhammer, Dunnock, Song Thrush and Bullfinch. Where fruiting species of tree or scrub were found, Fieldfare and Redwing also occur. Large, open field compartments of arable farmland, including areas of game cover crops, support wintering flocks of Golden Plover and Lapwing as well as seed-eating passerines in the margins and cover crops, including Skylark, Yellowhammer and Linnet. Where field margins and cover crops will be lost due to Scheme construction, there will be negative impacts on the wintering bird assemblage. Construction related impacts (visual and noise disturbance) have the potential to disturb species associated with these habitats outside of the DCO site boundary.
Breeding birds	Habitat loss and increase in habitat fragmentation associated with the Scheme will impact upon the breeding bird assemblage throughout the Scheme. Habitat loss will include hedgerows/scrub, woodland edge, arable farmland and the waterbodies around the quarry which supports breeding species associated with wetland features (such as Shelduck, Mallard, Tufted Duck (and other waterfowl)) and with wetland margins (including Little Ringed Plover (Schedule 1 species), Lapwing and Ringed Plover). Arable farmland supports breeding species of conservation concern, including Skylark, Yellow Wagtail, Yellowhammer and Linnet, found throughout. Scrub and hedgerows support breeding species such as Hobby (Schedule 1 species) and other notable species such as Yellowhammer, Dunnock, Song Thrush and Bullfinch. Small parcels of woodland and individual trees scattered throughout the Scheme support breeding species, such as Green Woodpecker, as well as species often found in scrub/hedgerows. The majority of species recorded within the woodland blocks will not be negatively impacted by the Scheme where these features will be retained. There is the potential for the Scheme to result in the displacement and/or loss of breeding populations due to exposure to pollution such as in highway surface water runoff, exposure to increases in temporary lighting (affecting species such as Tawny Owl), and exposure to construction noise and visual disturbance.
Barn Owl	The Scheme has the potential to result in the loss of breeding and non-breeding Barn Owl roosts, and of suitable potential feeding and dispersal habitat. Six temporary rest sites have been found, although no breeding roosts have been identified.
Reptiles	A maximum peak count was recorded of one Grass Snake and of four Common Lizards in the same location, the latter on four separate occasions. Common Lizard was also recorded in low populations across the Scheme. Construction of the Scheme could destroy reptile habitat and put any reptiles present at risk of injury or being killed.

Habitat or Species	Construction Impacts
Amphibians including Great Crested Newt	84 ponds were identified within 500m of the Scheme with 51 of these being accessed to survey for amphibians, primarily GCN. 22 ponds were identified as having GCN (16 ponds were identified through traditional survey technique, providing a population size class estimate, whilst six ponds where identified as being eDNA positive). Construction of the Scheme could destroy amphibian habitat and put any GCN or other amphibians present at risk of injury or being killed.
Fish	A total of 45 individual fish were caught over a 100m section of Hen Brook with four different species recorded. Fish data from the Environment Agency show eight common fish species. All species are typical of a lowland tributary, with no invasive non-native or protected species present. Measures will be taken to protect the fish of the Hen Brook (and other brooks) during Scheme construction.
Terrestrial invertebrates (including invasive non-native species)	The Scheme has the potential to result in the loss of terrestrial invertebrate habitat, and in particular hedgerow habitat and small areas of rabbit-grazed short sward grassland which support a number of Nationally Scarce and Red Data Book species. If Elm Zig-zag Sawfly is still present, biosecurity measures will be required to minimise the likelihood of establishment of this non-native invasive species within the Scheme.
Aquatic macro-invertebrates (including invasive non-native species)	The status of the aquatic macroinvertebrates will be confirmed following completion of surveys being undertaken in 2019.
Plants (invasive non-native species)	Eleven species of invasive non-native plants were found (six aquatic and five terrestrial). The majority of the records and observations were from the River Great Ouse corridor and its tributaries. Implementing a biosecurity protocol during Scheme construction will avoid the risk of any of these species being spread from outside the DCO site boundary.

Operation

Designated Sites

8.4.10. The preliminary assessment of potential impacts associated with Scheme operation on identified internationally, nationally or locally designated sites of biodiversity value has identified that there will be no direct impacts on these sites due to their distance from the Scheme and the lack of ecological connectivity.

Habitats and Species

8.4.11. The proposed landscape design for the Scheme incorporates substantial areas of new habitat, the majority of which comprises grassland, scrub and woodland along with smaller areas of tree planting. These habitats will develop and increase in biodiversity value over time, including strengthening the connectivity between habitat within and adjacent to the Scheme.

8.4.12. Wetland habitats incorporated into the Scheme landscape design will also develop over time and increase in biodiversity value, and will include the riparian zone of the brooks over which the Scheme passes and wet grassland.

8.4.13. No adverse impacts are predicted to occur on habitats adjacent to the Scheme associated with noise, air pollution and or water pollution once the Scheme operational,

although this will be reviewed following the completion of the detailed noise, air quality and water environment assessments.

8.4.14. The Scheme drainage design will avoid any negative impacts to the hydrology and geomorphology of the watercourses crossed by the Scheme during the operational phase.

8.4.15. Habitats created as part of the Scheme landscape design will develop and increase in value for the following species:

a. Badger, bats, native riparian mammals, Dormouse and other mammals, including increased connectivity and carrying capacity.

b. Wintering birds and breeding birds including Barn Owl (for example carrying capacity including food and roosting resources).

c. Reptiles and amphibians including GCN.

d. Fish.

e. Notable terrestrial and aquatic macroinvertebrates.

8.4.16. A biosecurity protocol will be followed during the Scheme operational phase and as part of the future maintenance programme to avoid the transfer/introduction of invasive non-native plants.

8.4.17. A programme of monitoring key biodiversity features and any species as specified in licences obtained from Natural England will be undertaken during the Scheme operational phase in order to inform species management and habitat maintenance.

8.4.18. Information regarding the potential for operational phase impacts on habitats and species is presented in **Table 8-4**.

Table 8-4: Potential Impacts on Habitats and Species during Scheme Operation

Habitat or Species	Operational Impacts
Terrestrial habitats and associated vegetation	Scheme operation has to potential to result in disturbance due to traffic movements, surface water runoff and from salt spray on habitats within the Scheme and habitats adjacent to the Scheme. This will require further assessment and will be reported in the Environmental Statement Habitats created as part of the Scheme landscape design will develop and increase in biodiversity value. No significant negative impacts are expected with respect to habitats adjacent to the Scheme.
Aquatic habitats	Scheme operation has to potential to result in surface water runoff and damage from salt spray on brooks and other waterbodies passing through or adjacent to the Scheme. This will require further assessment and will be reported in the Environmental Statement. Habitats created as part of the Scheme landscape design will develop and increase in biodiversity value. Significant positive impacts are expected with respect to aquatic habitats over which the Scheme will pass.
Bats	Scheme operation has to potential to result in harm to bats through accidental collisions with motor vehicles and the impact of lighting on roosts and foraging and commuting corridors. Habitats created as part of the Scheme landscape design will be used to mitigate potential impacts on bats and, as habitats develop and increase in value, benefit bats.

Habitat or Species	Operational Impacts
Badger	Scheme operation has to potential to result in harm to badger through accidental collisions with motor vehicles and the impact of lighting on foraging. Habitats created as part of the Scheme landscape design will develop and increase in value to benefit Badger. Measures will be implemented to provide artificial replacement for any main setts that will be lost, damaged or otherwise compromised, whilst green corridors to allow badger movement across the wider landscape, where applicable. Mammal crossings will be provided under the proposed new carriageway and deterrents provided to prevent or discourage Badgers crossing the new dual carriageway.
Riparian mammals (including invasive non-native species)	Scheme operation has to potential to impact upon riparian mammals due to collision with motor vehicles or becoming trapped in drain outfalls. Habitats created as part of the Scheme landscape design will be of benefit native riparian mammals which will develop and increase in value to these species. Measures will be implemented to allow mammal movement across the wider landscape and, where applicable, mammal crossings provided under the proposed new carriageway and deterrents to prevent or discourage Otters from crossing the new dual carriageway.
Dormouse and other mammals	Habitats created as part of the Scheme's landscape design will be of benefit to Dormouse and other mammals which will develop and increase in value to these species. Measures will be implemented to avoid and prevent Muntjac (*Muntiacus reevesi*) and other deer crossing the new dual carriageway.
Wintering birds	Scheme operation has to potential to result in mortality of wintering birds due to accidental collisions with traffic, especially in vicinity of waterbodies/wetland area at western end of the Scheme. In addition, Scheme operation has to potential to result a reduced population size due to traffic noise and visual disturbance. Habitats created as part of the Scheme landscape design will be benefit to wintering birds, which will develop and increase in value to these species.
Breeding birds	Scheme operation has to potential to result in mortality of breeding birds due to accidental collisions with traffic as well as result in reduced population size and breeding success due to traffic noise and visual disturbance. Habitats created as part of the Scheme landscape design will be of benefit to breeding birds, which will develop and increase in value to these species.
Barn Owl	Scheme operation has to potential to result in mortality of Barn Owl due to accidental collisions with traffic as well as result in reduced population size and breeding success due to traffic noise and visual disturbance. Habitats created as part of the Scheme landscape design will be of benefit to Barn Owl which will develop and increase in value to this species. Measures will be implemented to avoid and discourage Barn Owl crossing the new dual carriageway.
Reptiles	Scheme operation has to potential to result in reptile injury and death due to road traffic. Habitats created as part of the Scheme landscape design will be of benefit to reptiles and which will develop and increase in value to these species.

Habitat or Species	Operational Impacts
Amphibians including GCN	Scheme operation has to potential to result in amphibian injury and death due to road traffic. Habitats created as part of the Scheme landscape design will be of benefit amphibians, including GCN. These habitats will develop and increase in value to these species. Measures will be implemented to avoid and prevent amphibians crossing the new dual carriageway.
Fish	Scheme operation has to potential to result in pollution of brooks and other watercourses as a result of spills such as diesel on the carriageway. Riparian and in-stream habitat created as part of the Scheme design will be to benefit native fish species and which will develop and increase in value to these species in all the watercourses crossed by the Scheme.
Terrestrial invertebrates (including invasive non-native species)	Habitats created as part of the Scheme landscape design will be of benefit to notable terrestrial invertebrates, and which will develop and increase in value to these species. If Elm Zig-zag Sawfly is still present, biosecurity measures will be required to minimise the likelihood of establishment of this non-native invasive species within the Scheme.
Aquatic macro-invertebrates (including invasive non-native species)	Scheme operation has to potential to result in pollution of brooks and other watercourses as a result of spills such as diesel on the carriageway. Habitats created as part of the Scheme landscape design will be of benefit to notable aquatic invertebrates which will develop and increase in value to notable aquatic macroinvertebrate species.
Plants (invasive non-native species)	A biosecurity protocol will be followed as part of the maintenance programme to avoid invasive non-native plants being brought onto the Scheme. If the Scheme is invaded by any species, an Invasive Species Management Plan will be implemented including a rapid response.

8.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

8.5.1. The Preliminary Environmental Masterplan on Figure 2.4 within Volume 2 illustrates the form and location of the measures that have been incorporated into the Scheme design to mitigate the identified impacts on biodiversity.

8.5.2. These measures are focused on the creation of new habitats and where appropriate the enhancement of remaining habitats. These areas comprise substantial areas of grassland, scrub and woodland (including smaller areas of tree planting).

8.5.3. Measures have also been identified as part of the Scheme design to facilitate the movement and connectivity of species. These include features to allow mammals (including bats), Badger, Otter, Water Vole and amphibians to pass under the new dual carriageway in appropriately sized tunnels, and other measures to prevent and/or discourage certain species from crossing the new dual carriageway.

Standard Mitigation Measures

8.5.4. An Outline Environmental Management Plan (OEMP) will be developed for the Scheme, which will include a series of measures that the construction contractor will use as the framework for their Construction Environmental Management Plan. The OEMP will:

a. detail the sensitive working practices and measures to be implemented during Scheme construction to mitigate potential impacts relating to biodiversity aspects

(including the disturbance of species, pollution control and prevention, and habitat degradation); and

b. set out any requirements for pre-construction surveys to assess any changes in the distribution of species, and any requirements for the translocation of species, in order to minimise the risk of harm.

8.5.5. Two key aspects of the OEMP will be ecological connectivity and coherence throughout the Scheme and, linked to this, measures associated with working in and over watercourses.

8.5.6. As a new highway, the Scheme will disrupt the ecological connectivity within the surrounding landscape in a number of places necessitating strategically designed means for animals to cross over or under the new carriageway.

8.5.7. Watercourses are a specific example of a habitat that can be disrupted, not just in terms of connectivity, but through avoidable disturbance and accidental spillages and siltation. The OEMP will provide a valuable vehicle to maintain and where appropriate enhance connectivity and to ensure that the habitat is ecologically coherent, for example, having the appropriate hydromorphology and vegetation.

Biodiversity Enhancements

8.5.8. Potential enhancement measures remain under development, the form and nature of which are being informed by the opportunities identified by Natural England for Bedfordshire and Cambridgeshire Claylands NCA 88 [REF 8-5] and in particular *"enhancing and expanding the network of semi-natural habitats through targeted environmental enhancements, including ponds, hedgerows, hedgerow trees and species-rich grasslands (such as areas found along road verges, green lanes and field margins) to support biodiversity"*.

8.5.9. Potential enhancements are being investigated for the watercourses over which the Scheme will pass, notably in the nature of the riparian zones. A key aim of the mitigation strategy is to achieve an overall net gain in biodiversity across the Scheme.

8.6. Assessment of Effects

8.6.1. Based on the implementation of the embedded and standard mitigation measures as detailed in herein, this preliminary assessment of biodiversity effects for the Scheme has concluded that:

a. construction or operation of the Scheme is unlikely to have a significant effect on any international, national or local sites designated for their biodiversity value;

b. there will be a loss of habitats, predominantly those within arable land, as a result of Scheme construction, which will be mitigated to the extent that no significant effects are likely; and

c. there will be adverse effects on some species as a result of construction, which will be mitigated to the extent that no significant effects are likely.

8.6.2. Given the mitigation measures which will aim to improve the ecological connectivity of the Scheme, it is anticipated that overall the Scheme will not have an adverse effect on biodiversity in the medium to long term and will achieve Highway England's no net loss to biodiversity objective. This will be confirmed and reported in the Environmental Statement, taking into account the findings of the ecological surveys being undertaken.

8.6.3. A Habitats Regulations Assessment screening exercise is currently being undertaken for the Eversden and Wimpole SAC to identify whether the Scheme is likely to result in

adverse effects upon this European site. The emerging findings of this exercise indicate that there will likely be no impact on this site, and therefore no significant effects.

8.6.4. The final outcomes of the likely significant effects of the Scheme on biodiversity will be reported within the Environmental Statement.

9. GEOLOGY AND SOILS

9.1. Introduction

9.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on geological and soils resources.

9.1.2. The assessment also considers the potential effects on other receptors comprising groundwater, contaminated land and designated geological sites.

9.2. Approach to the Assessment

Scope and Methods

9.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the geology and soils assessment, and the approach and methods to be followed.

9.2.2. The Scoping Report [REF 9-1] 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 Scheme in relation to geology and soils.

9.2.3. Following receipt of the Scoping Opinion [REF 9-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing geology and soils assessment:

a. An assessment of the impact of the drainage design on soils and geology, with cross reference to the assessment of Road Drainage and the Water Environment.

9.2.4. Having had regard to the information presented within the Scoping Report [REF 9-1], The Inspectorate's Scoping Opinion [REF 9-2] has also confirmed Highways England's view that significant effects on geological and soil resources (including impacts on human health as the potential pathway for contamination from soils) associated with both operation and future maintenance of the Scheme are unlikely. Accordingly, these matters will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

9.2.5. The geology and soils assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 9-3].

9.2.6. Details of how the geology and soils assessment will meet the requirements of the NPSNN [REF 9-3] in relation to identifying, assessing and mitigating impacts on geological sites and soil quality, and the risks posed by contaminated land to human health and groundwater, are presented within the Scoping Report [REF 9-1].

9.2.7. The Scoping Report [REF 9-1] also details how other legislation and policy relating to geology and soils is being taken account of in the assessment.

Consultation

9.2.8. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the geology and soils assessment, the results of which are presented within the Scoping Opinion [REF 9-2].

9.2.9. Consultation may be undertaken with the relevant local authorities and the Environment Agency prior to undertaking the ground investigation for the Scheme, the findings of which will be referenced (where available) in the assessment.

9.2.10. Due to the extent of permanent landtake required by the Scheme, consultation will be undertaken with Natural England in respect of the loss of best and most versatile agricultural land and soils.

Limitations and Assumptions

9.2.11. 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 Scheme and the maximum likely extents of land required for its construction and operation.

9.2.12. No ground investigations or soil surveys have been completed to date. These surveys will be undertaken to establish the existing ground conditions and soil types within the Development Consent Order (DCO) site boundary, the findings of which will inform the identification and assessment of potential constraints relating to geology and soils. Accordingly, the information used to establish the baseline conditions of the receiving environment within this preliminary assessment have been based on available published information and records.

9.2.13. The findings of this preliminary assessment may be subject to change as the design of the 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.

9.2.14. The potential effects of the Scheme on agricultural land and farm viability are currently being evaluated as part of the Population and Health assessment (see Chapter 12), which reflects the approach presented within the Scoping Report [REF 9-1]. Upon completion of both assessments, all matters relating to agricultural impacts and effects will be reported within the Geology and Soils assessment.

Study Area

9.2.15. The study area for the geology and soils assessment is focused on land within the DCO site boundary and outward to 500m, as illustrated on Figure 9.1 and Figure 9.2 within Volume 2.

9.2.16. As further work is undertaken as part of the assessment, extensions to this study area will be made, if required, to identify and assess any impacts and effects associated with possible contamination migration.

9.3. Baseline Conditions

Information Sources

9.3.1. The following sources and types of information have been used in the assessment:

a. British Geological Survey (BGS) 1:50,000 scale mapping – Sheet 187 (Huntingdon) [REF 9-4] and Sheet 204 (Biggleswade) [REF 9-5], to identify existing geology.

b. BGS Hydrogeology Map 1:100,000 scale – Hydrogeology of the area between Cambridge and Maidenhead [REF 9-6], to identify existing hydrogeology.

c. Unexploded Ordnance risk maps from Zetica UK for Cambridgeshire and Bedfordshire [REF 9-7], to identify areas of regional WWII bombing densities and the potential risk of encountering unexploded ordnance.

d. Natural England's Agricultural Land Classification (ALC) mapping [REF 9-8], to establish the distribution and grade of agricultural soils.

e. Department for Environment Food & Rural Affairs (DEFRA) MAGIC online interactive mapping [REF 9-9], to identify geological sites.

f. Cranfield University Soil and AgriFood Institute: Soilscape viewer information [REF 9-10], to identify existing soil profiles and types.

g. Environment Agency (2018) website [REF 9-11], to identify existing groundwater conditions.

h. BGS interactive online borehole log viewer (Geoindex) [REF 9-12], to obtain records of previous ground investigations.

i. Preliminary Sources Study Report [REF 9-13], comprising ground and geotechnical information gathered as part of desk studies.

j. Landmark Envirocheck Report [REF 9-14], containing environmental data covering potential sources of contamination, previous industrial land use and sensitive land uses.

Designated Geological Sites

9.3.2. In relation to designated sites, no geological Sites of Special Scientific Interest (SSSI) are located within the study area.

9.3.3. The nearest geological SSSI is associated with the Weaveley and Sand Woods SSSI, located 2.5 kilometres from the DCO site boundary, to the south east of Black Cat roundabout. The location of this SSSI is illustrated on Figure 9.2 within Volume 2. This SSSI is of relevance due to the range of its underlying geology. The site straddles poorly-drained boulder clay and Jurassic clays and the free-draining Lower Greensand (Woburn Sands).

9.3.4. No regionally important geological/geomorphological sites (RIGS) are located within the study area.

Superficial Deposits and Bedrock

9.3.5. Figure 9.1 and Figure 9.2 within Volume 2 illustrate the distribution of superficial and drift geology within the study area respectively.

9.3.6. The geology associated with the study area has been interpreted from available mapping [REF 9-4; REF 9-5]. Both the drift and bedrock geology beneath the study area comprise sedimentary rocks.

9.3.7. The Oadby Formation is the main superficial (drift) deposit covering most of the study area. Alluvium, Head and River Terrace Deposits are present only in the western extents of the area near Black Cat roundabout, particularly in the floodplain of the River Great Ouse, Hen Brook and Abbotsley Brook that flow through the area.

9.3.8. The bedrock geology beneath the entire study area consists of Jurassic age strata. The western extents of the study area are underlain by the Oxford Clay Formation, while the eastern extents are underlain predominantly by the West Walton Formation and Ampthill Clay Formation. The Woburn Sands Formation is not present beneath the study area. The general dip of the strata is to the south.

9.3.9. The bedrock is overlain by superficial deposits, particularly in the eastern parts of the study area. In the central and western parts, the superficial deposits are thin or absent – here the bedrock crops out or is partially covered by the drift deposits principally within the riverbeds and floodplain of watercourses (for example the River Great Ouse and its tributaries).

9.3.10. A summary of the geology within and surrounding the study area is provided in **Table 9-1**.

Table 9-1: Summary of the Geology Within and Surrounding the Study Area

Geology	Formation	Description	Estimated Thickness (meters)	Relationship to the Study Area
Drift (Superficial)	Alluvium	Normally soft to firm consolidated, compressible silty clay with occasional layers of silt, sand, peat and basal gravel	1 – 10m	Present only in the western and central areas in floodplains
Drift (Superficial)	River Terrace Deposits	Sand and gravel, locally with lenses of silt, clay or peat	2 – 3m	Present only in the western and central areas in floodplains
Drift (Superficial)	Oadby Member – Diamicton	Clay, brown to blue-grey and silty clay, with chalk and flint fragments. Contains lenses of sand and gravel, clay and silt. Often referred to as 'Chalky Boulder Clay'	1 – 12m	Present mainly in the east and west of the area.
Drift (Superficial)	Glaciofluvial Deposits	Sand and gravel	1 – 3m	Present only in a small portion of the western area
Solid (Bedrock)	Woburn Sands Formation	Mainly fine to coarse grain sands	7 – 70m	Present beyond the south eastern boundary of the area.
Solid (Bedrock)	West Walton Formation and Ampthill Clay Formation	Undifferentiated mudstone and limestone	0 – 25m	Present mainly in the east of the area.
Solid (Bedrock)	Oxford Clay Formation – Mudstone	Silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules.	23 – 60m	Present beneath much of the area.

Soil

9.3.11. Soil distribution is illustrated on Figure 9.3 within Volume 2.

9.3.12. A review of the distribution of soils [REF 9-8] identified that the study area comprises principally ALC Grade 2 (very good) quality agricultural soils. In some localised areas, predominantly in the west of the study area, the soil is classified as Grade 1 (excellent) and Grade 3 (good).

9.3.13. A review of Soilscape data [REF 9-10] confirms that the predominant soil type within the study area comprises No.9: Lime-rich loamy and clayey soils with impeded drainage, which are soils generally suited to cropping due to their high fertility.

9.3.14. Other soil types comprising No. 20: Loamy and clayey floodplain soils with naturally high groundwater, and No. 6: Freely draining slightly acid loamy soils, are associated with the River Great Ouse and its surrounding floodplain, which have moderate to low fertility.

Hydrogeology (Groundwater)

9.3.15. A review of the hydrogeology of the area [REF 9-6] indicates that groundwater occurrence in the drift deposits within the study area is mainly in the granular units of the alluvium and in the river terrace deposits, which are found only in the river floodplains.

9.3.16. The Oadby drift deposit that covers a large part of the study area generally acts as a low permeability cover to the bedrock. The superficial deposits are defined as secondary aquifers of limited groundwater potential. It is likely that groundwater in the granular bands of the superficial deposits is in hydraulic continuity with and provides baseflow discharge to the surface watercourses.

9.3.17. The Oxford Clay and West Walton Formations, which are primarily the bedrock geology beneath the study area, have a very low intergranular permeability which inhibits groundwater flow. These strata contain very limited groundwater, and the units are defined as unproductive aquifers with negligible importance for groundwater.

9.3.18. The aquifer within Woburn Sands is designated as a principal aquifer and forms an important aquifer that supports significant groundwater abstractions in the region. There are no Source Protection Zones for abstractions from the Woburn Sands aquifer.

9.3.19. A summary of the aquifer classification of the geological strata within and surrounding the study area is provided in **Table 9-2**.

Table 9-2: Aquifer Classification of Strata Within and Surrounding the Study Area

Geology	Geological Strata	Aquifer Classification
Superficial	Alluvium	Secondary A
Superficial	River Terrace	Secondary A
Superficial	Oadby Member	Secondary undifferentiated aquifer
Superficial	Head Deposits	Secondary A
Bedrock	Woburn Sands	Principal
Bedrock	West Walton	Unproductive
Bedrock	Oxford Clay Formation	Unproductive

9.3.20. Further details of the hydrogeology and groundwater beneath the study area are presented within Chapter 13.

Contamination Sources

9.3.21. The following potentially contaminative historical and recent activities have been identified within and surrounding the study area, as illustrated on Figure 9.1 within Volume 2:

a. A fuel and power station (Little Barford Power Station) near Gallow Hill – located approximately 1 kilometre south of Eynesbury.

b. An authorised landfill site near Caxton – located approximately 2.5 kilometres west of Caxton Gibbet roundabout.

c. Nine historical landfill sites – concentrated around Wyboston and the Wyboston Leisure Park area.

9.3.22. Due to large areas of land within the study area being agriculturally managed, potential exists for soil contamination to be present (associated with the use of fertilisers and other agricultural chemicals).

Unexploded Ordnance

9.3.23. The study area is located within a low-risk zone (which equates to up to 10 bombs per 1000 acres) for unexploded ordnance.

9.4. Potential Impacts

9.4.1. The preliminary assessment has identified that construction of the Scheme will potentially result in adverse and beneficial impacts on geology and soils.

9.4.2. These impacts are associated with:

a. Impacts on geological and soils resources through disturbance of the existing conditions.

b. Impacts from contamination on the re-usability/suitability of soils and aggregates derived from onsite sources and imported from offsite.

c. Impacts associated with contamination on human health, controlled waters and buildings/structures through disturbance of the baseline ground and groundwater conditions.

d. Loss or downgrading of agriculturally viable soils.

e. Soil compaction and de-vegetation impacting water flows, quality and surface runoff.

9.4.3. During the construction phase, in the event of a disturbance of contaminated soils/groundwater as a result of excavation activities, there is the possibility that construction may affect human, ecological or controlled waters receptors. Potential also exists for the ground conditions to impact on the design of the Scheme and the materials used in its construction.

9.4.4. Most excavated material arising from construction is expected to comprise inert Oadby Formation (Oadby Member Diamicton) with no potential contamination. Accordingly, the main risks relate to excavations for cuttings through the topsoil and in areas of historic landfilling and agricultural land, where fertilisers have been widely used.

9.4.5. Construction activities may also result in physical damage to soil, which may arise during the excavation and temporary storage of excavated materials, soil compaction (as a result of heavy construction vehicle movements), and the exacerbation of soil erosion through the handling and storage of soils.

9.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

9.5.1. Measures are being incorporated into the Scheme as part of the design-development process, the purpose being to control and limit potential pathways between contaminant sources and receptors relating to human health and groundwater.

9.5.2. These measures include, for example, the careful alignment of the new dual carriageway to avoid or minimise the potential for interacting with known contaminated land where possible, and minimising the extent of land required to construct the Scheme to reduce the loss of soils.

Standard Mitigation Measures

9.5.3. An Outline Environmental Management Plan (OEMP) will be prepared for the Scheme, which will outline measures to be undertaken during construction of the Scheme to mitigate impacts on receptors. These measures are likely to focus on the following:

a. Management of construction activities with the potential for generating for contamination through runoff/accidental spillage or by disturbance of in-situ materials.

b. Management of excavated materials arising from construction.

c. Management of human receptors associated with the construction workforce.

9.5.4. Construction of the Scheme will be subject to detailed measures and procedures defined within the contractor's Construction Environmental Management Plan (CEMP).

9.5.5. The CEMP will develop the framework of measures contained within the OEMP to ensure compliance with relevant standards and legislation. The CEMP will contain full details of all construction mitigation requirements and any project level expectations on how the Scheme should be constructed, for example how material shall be excavated, segregated and stockpiled to minimise the possibility for runoff, soil quality degradation and wind dispersal.

9.5.6. Measures contained within the CEMP will be designed to limit the possibility for dispersal and accidental releases of potential contaminants, soil derived dusts and uncontrolled runoff to occur during construction. The CEMP will also establish procedures for dealing with unexpected soil or groundwater contamination that may be encountered.

9.6. Assessment of Effects

9.6.1. Based on the current understanding of the background conditions and the findings of this preliminary assessment, it is considered that adverse effects associated with construction of the Scheme will be limited.

9.6.2. The following sections summarise the likely effects on geological and soils receptors.

Designated Geological Sites

9.6.3. As there are no RIGS or geological SSSIs within the study area, the assessment has concluded that there are unlikely to be any significant effects on geologically designated sites arising from construction of the Scheme.

Ground Stability

9.6.4. Earthworks including excavations and any potential foundations associated with bridge structures, together with any dewatering that may be required, could adversely affect ground stability and, subsequently, any proposed and surrounding structures through uncontrolled settlement.

9.6.5. There may be a requirement to provide temporary support for site excavations. Such support may include benching of pits, shoring or the construction of retaining walls (such as sheet piles) or struts to mitigate the risk of settlement or excessive spalling. The need for such control measures will be established are part of the Scheme design and where specified and implemented, these are considered to be sufficient to mitigate any potential impacts.

9.6.6. Accordingly, any potential effect on land stability resulting from construction activities is unlikely to be significant.

Soil

9.6.7. The assessment has identified that construction of the Scheme will result in the unavoidable loss of soil resources, some of which are of high agricultural value.

9.6.8. At this stage of the assessment, the effect of the permanent loss or potential downgrading of ALC Grade 1 soils (through handling, movement and restoration activities) has been assessed as being potentially significant. Similar effects are also predicted in relation to the loss of ALC Grade 2 and Grade 3 soils; however, the assessment has concluded these are unlikely to be significant.

Hydrogeology (Groundwater)

9.6.9. The assessment of the effects of construction on groundwater receptors is described in Chapter 13. This section considers potential impacts and effects on groundwater receptors in relation to geology and soils.

9.6.10. Groundwater beneath the Scheme has the potential to be impacted as a result of excavation of contaminated soil that is hydraulically connected with groundwater or surface water receptors, which may result in the release of pollutants. Other potential effects upon groundwater include the triggering of ground instability, such as subsidence, and the alteration of groundwater levels and flow. Piling and other temporary support structures, foundations associated with bridge construction may also cause horizontal barriers to groundwater flow, causing groundwater levels immediately up hydraulic gradient of the works areas to rise above their natural levels.

9.6.11. Based on the design of the Scheme and the implementation of standard mitigation measures to be included in the CEMP, such effects upon groundwater resources are unlikely to be significant.

9.6.12. Any ground contamination encountered during Scheme construction will be removed, treated and/or mitigated as part of the construction process and prior to the construction of any foundations. Accordingly, there is the potential for a beneficial effect to be realised should land contamination be removed or remediated as part of the construction process.

Contamination and Human Health

9.6.13. There will be a requirement for the contractor to undertake adequate risk assessments prior to the commencement of any construction activities, in accordance with the Health and Safety at Work etc. Act 1974 [REF 9-15], to restrict and manage any potential worker exposure to harmful substances.

9.6.14. Any potential effects specific to construction workers will be mitigated through the appropriate specification and use of personal protective equipment, and through the implementation of site controls and procedures as required under the Construction (Design and Management) Regulations 2015 [REF 9-16].

9.6.15. Given these protection measures, construction of the Scheme is unlikely to result in significant effects upon the health of construction workers.

9.6.16. Should contaminated soil or contaminated groundwater be encountered during excavation and construction activities, these materials have the potential to impact on nearby human receptors. Possible exposure pathways include the release of contaminated dust to the air and the uncontrolled runoff of contaminated waters.

9.6.17. The adoption and implementation of best practice construction practices in accordance with the CEMP will assist in managing and controlling any potential effects upon the health of neighbouring site users, occupiers and the public during construction. Accordingly, construction of the Scheme is unlikely to result in significant effects.

Construction Materials

9.6.18. In relation to the potential degradation of buried concrete due to ground conditions, any risks to the Scheme will be adequately mitigated through the adoption of an appropriate design of concrete class specified under the Building Research Establishment's Special Digest 1 [REF 9-17].

9.6.19. Based on the adoption of the above, the assessment has concluded that any potential effect of geology and soils on construction materials and below ground infrastructure unlikely to be significant.

Unexploded Ordnance

9.6.20. Based on the wartime history of the region and the presence of former military land, it is considered that there is a risk of unexploded ordnance being encountered during construction of the Scheme.

9.6.21. The final outcomes of the likely significant effects of the Scheme on geology and soils will be reported within the Environmental Statement.

10. MATERIAL ASSETS AND WASTE

10.1. Introduction

10.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on material assets and the generation and management of waste, which for the purposes of this chapter comprise:

a. The use of material resources; and

b. The generation and management of waste.

10.1.1. Material resources are defined by Interim Advice Note (IAN) 153/11 [REF 10-1] as "*the materials and construction products required for the construction, improvement and maintenance of the trunk road network. Material resources include primary raw materials such as aggregates and minerals, and manufactured construction products*".

10.1.2. Waste is defined as per the Waste Framework Directive (2008/98/EC) [REF 10-2] as "*any substance or object which the holder discards or intends or is required to discard*."

10.1.3. The Scheme aims to prioritise waste prevention, followed by preparing for waste reuse, recycling and recovery and lastly disposal to landfill, in accordance with the waste hierarchy.

10.2. Approach to the Assessment

Scope and Methods

10.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the material assets and waste assessment, and the approach and methods to be followed.

10.2.2. The Scoping Report [REF 10-3] 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 Scheme on material assets and waste.

10.2.3. Following receipt of the Scoping Opinion [REF 10-4] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing material assets and waste assessment:

a. A formal study area for waste management, linked to the relevant local authority waste management area(s), will be described and justified.

b. The nature and quantity of materials to be used, and the waste that will be generated, will be described and will include justification of any key assumptions made.

10.2.4. Having had regard to the information presented within the Scoping Report [REF 10-3], The Inspectorate's Scoping Opinion [REF 10-4] has also confirmed Highways England's view that:

a. impacts relating to the extraction or raw materials and the manufacturing of products as occurring offsite (and possibly outside the UK) cannot be accurately predicted and assessed; and

b. significant effects on material assets and waste associated with both the operational and future maintenance of the Scheme are unlikely.

10.2.5. Accordingly, these matters will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

10.2.6. The material assets and waste assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 10-5].

10.2.7. Details of how the material assets and waste assessment will meet the requirements of the NPSNN [REF 10-5] in relation to the management, transportation, disposal and recovery of waste are presented within the Scoping Report [REF 10-3].

10.2.8. The Scoping Report [REF 10-3] also details how other legislation and policy relating to material resources and waste management is being taken account of in the assessment.

Consultation

10.2.9. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the material assets and waste assessment, the results of which are presented within the Scoping Opinion [REF 10-4].

10.2.10. No further consultation is planned to be undertaken as part of the material assets and waste assessment.

Limitations and Assumptions

10.2.11. The information presented in this chapter reflects that obtained and evaluated at the time of reporting. This has referenced published data and information obtained from the sources identified in Section 10.3.

10.2.1. The assessment does not consider the environmental impacts associated with the extraction of raw materials and the manufacture of products, nor the impact of the management of waste at waste management facilities. It is assumed that any such issues will have been subject to the applicable environmental assessment and/or permitting and planning approval for the relevant facilities.

10.2.2. Data on the quantity of materials required to construct the Scheme and waste generated by the Scheme are not currently available. This information will be generated as the Scheme design continues to develop.

10.2.3. A buildability contractor appointed by Highways England will provide information to support the assessment. This is expected to include information on the generation, use and management of materials (including excavated materials and other major materials), demolition material arisings (including their use and management), and construction waste arisings and management.

10.2.4. It is anticipated that some of the information required for the assessment may not be known during the assessment, for example the exact sources and origins of materials. Accordingly, the assessment will be undertaken based on the information available at the time of reporting.

10.2.5. Information on the current permitted landfill capacity in the waste management study area is provided in **Table 10-2**. There is no available information on any potential changes to this permitted capacity prior to construction of the Scheme.

Study Area

10.2.6. The study area for material resources and waste has been defined by the DCO site boundary, the extents of which are illustrated on Figure 1.1 within Volume 2. This covers:

a. material resources used in the construction of the Scheme;

b. assessment of potential sterilisation of active and allocated mineral extraction sites, mineral safeguard areas and peat resources;

c. waste arising from the construction of the Scheme; and

d. direct impacts on waste management facilities and areas for waste management facilities.

10.2.7. The study area for waste management facilities comprises the wider region within which waste management infrastructure, specifically landfill capacity, is located. At present it is anticipated that this will include the East of England region, as defined in the Environment Agency's Waste Management data for England 2017 [REF 10-6] and comprising the sub-regions of Bedfordshire (including Bedford and Central Bedfordshire), Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk, together with the adjacent sub-regions of Northamptonshire and Buckinghamshire, due to their proximity to the Scheme.

10.3. Baseline Conditions

Material Resources

10.3.1. The baseline target for the recovery of non-hazardous construction and demolition waste is at least 70% by weight by 2020, as set out in the EU Waste Framework Directive [REF 10-2], as transposed by the Waste (England and Wales) Regulations 2011 [REF 10-7] (as amended), and the Waste Management Plan for England [REF 10-8]. Uncontaminated excavated soil and stones (European Waste Code 17 05 04) [REF 10-9] are specifically excluded from this target.

10.3.2. The baseline target for the use of alternative aggregate materials (comprising secondary aggregates recovered from industrial and mining operations, and recycled aggregates produced from inert waste) are set out in the National and Regional Guidelines for Aggregates Provision in England 2005 to 2020 [REF 10-10] and are summarised in **Table 10-2**. The relevant target for the Scheme is the 31% guideline set for the East of England region.

Table 10-1: National and Regional Guidelines for Aggregates Provision

Region	Total aggregate provision (million tonnes)	Alternative materials targets (secondary and recycled aggregates)
South East	502	26%
London	197	48%
East	382	31%
East Midlands	784	14%
West Midlands	370	27%
South West	656	22%
North West	392	30%
Yorkshire & the Humber	431	31%
North East	193	26%
England (total)	3,908	25%

10.3.3. The Mineral Products Association [REF 10-11] estimated that sales of aggregates in Great Britain in 2017 totalled 250.5 million tonnes, of which 74.4 million tonnes (30%) were recycled and secondary aggregates.

10.3.4. The Bedford Borough, Central Bedfordshire and Luton Borough Council Minerals and Waste Local Plan: Strategic Sites and Policies [REF 10-12] and accompanying policies map identify a Mineral Safeguard Area for sand and gravel along the River Great Ouse Valley. At the western end of the Scheme, the DCO site boundary is located within this Mineral Safeguard Area.

10.3.5. The plan [REF 10-12] also identifies Black Cat permitted mineral site, strategic site and permitted mineral processing plant within the DCO site boundary. Mineral extraction at the Black Cat site is operational and includes a concrete batching plant. Planning consent to extend the extraction of sand and gravel into the strategic site areas was granted in April 2016 (see Chapter 15).

10.3.6. The plan [REF 10-12] also identifies the Blunham/Roxton strategic site in proximity to the DCO site boundary.

10.3.7. The Cambridgeshire and Peterborough adopted Minerals and Waste Plan [REF 10-13] and the Cambridgeshire and Peterborough emerging Minerals and Waste Local Plan [REF 10-14] identify Mineral Safeguard Areas for sand and gravel along the River Great Ouse Valley and Hen Brook. The DCO site boundary lies adjacent to these Mineral Safeguard Areas and overlaps them to a limited extent.

10.3.8. The British Geological Survey's Geoindex Onshore [REF 10-15] does not identify any peat resources located within the DCO site boundary.

Waste

10.3.9. Baseline waste management capacity data has been collated from publicly available sources, comprising data on regional and sub-regional landfill capacity published by the Environment Agency [REF 10-6] for the defined study area – details are presented in **Table 10-2**.

Table 10-2: Baseline remaining permitted landfill capacity in 2017 ('000s m^3)

Landfill type	East of England region[2]	Sub-regions		Study area total[3]	England total
		Buckinghamshire	Northamptonshire		
Hazardous Merchant	0	0	948	948	18,759
Hazardous Restricted	0	0	0	0	708
Non-Hazardous with SNRHW cell[1]	5,904	21,212	1,729	28,845	82,855
Non-Hazardous	25,798	10,099	509	36,406	168,597
Non-Hazardous Restricted	1,500	0	0	1,500	25,784
Inert	18,459	2,095	1,261	21,815	125,182
Total	**51,661**	**33,406**	**4,447**	**89,514**	**421,884**

1. Some non-hazardous sites can accept some Stable Non-Reactive Hazardous Wastes (SNRHW) into a dedicated cell, but this is usually a small part of the overall capacity of the site.
2. Comprising the sub-regions of Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk.
3. East of England region and the sub-regions of Northamptonshire and Buckinghamshire.

10.3.10. Information on active and allocated waste management facilities and areas for waste management facilities within the DCO site boundary will be sourced from local minerals and waste plans and other publicly available sources, as appropriate.

10.3.11. No strategic sites for waste management are located within the DCO site boundary.

10.4. Potential Impacts

10.4.1. The preliminary assessment has identified that construction of the Scheme will potentially result in adverse impacts relating to material resources and waste.

10.4.2. These impacts are associated with:

a. impacts on the availability and use of primary non-recycled) material resources and reused, recycled and secondary aggregate materials used for construction; and

b. impacts from onsite generated materials, for example excavated materials and soils, and waste arisings on the existing capacity of landfill infrastructure.

Construction

10.4.3. **Table 10-3** summarises the likely types of material resources used and wastes that may potentially be generated during construction of the Scheme.

10.4.4. Further design-development will be undertaken to enable the quantification of material resource requirements and waste material arising from the Scheme.

Table 10-3: Potential Material Resources Use and Waste Arisings from Construction

Project Activity	Material Resources Used	Potential Waste Arisings
Site remediation/preparation/earthworks	• Fill material for construction purposes. • Primary/secondary/recycled aggregates for ground stabilisation. • Topsoil and subsoil for landscaping and restoration.	• Surplus excavated materials. • Surplus topsoil and subsoil. • Unsuitable and contaminated soils and excavated materials. • Vegetation/wood from site clearance. • Clearance of redundant highway infrastructure.
Demolition	• Materials are not required for demolition works	• Waste arisings from the demolition of any existing buildings or structures

Project Activity	Material Resources Used	Potential Waste Arisings
Site construction	Construction materials including: • aggregates; • asphalt and bituminous materials; • in-situ cast concrete; • precast concrete products; • structural steelwork; • steel reinforcing bar; • timber and timber products; • geotextile; • drainage systems; • fencing and barriers.	• Packaging from materials delivered to site. • Excess, offcuts and broken/damaged construction materials. • Existing highway infrastructure and technology removed during works. • Construction worker wastes from offices and rest areas/canteens. • Waste oils from construction plant.

10.4.1. For most highway schemes the largest quantities of material resources used and waste arisings are often associated with the management and use of excavated materials, especially in those cases where a balance between excavation (cut) and material placement (fill) cannot be achieved.

10.4.2. The cut-fill balance for the Scheme is estimated to produce a deficit of earthworks materials. Therefore, there is not expected to be a large surplus of excavated materials requiring off site management.

10.4.3. Mineral Safeguard Areas and strategic sites for minerals are located within and adjacent to the DCO site boundary. As such, the assessment will consider the effects on mineral sterilisation.

10.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

10.5.1. The following mitigation measures are being considered as part of the design-development of the Scheme:

a. Waste prevention by designing this out where possible.

b. Opportunities to reuse material resources within the design are being sought where practicable, such as the reuse of excavated materials and the recycling of demolition materials across the Scheme.

c. Seeking to identify opportunities to reduce the deficit of earthworks materials and optimise the cut-fill balance.

d. Approaches for sourcing suitable materials through the use of borrow pits and the importation of reused, recycled, secondary or primary materials.

Standard Mitigation Measures

10.5.2. An Outline Environmental Management Plan (OEMP) will be developed for the Scheme, which will include a series of measures that the Contractor will use as the framework for their Construction Environmental Management Plan (CEMP).

10.5.3. The content of the OEMP will be developed in parallel with the development of the Scheme design and the construction methodology. The OEMP will include measures relating to materials and waste, examples of which include:

a. seeking opportunities to support the circular economy, including using other recycled and secondary materials during construction where practicable; and

b. managing waste arisings in line with the waste hierarchy, where prevention or reuse are not possible.

10.5.4. The CEMP will be produced by the contractor prior to the commencement of construction and will include the implementation of industry standard practice and control measures for environmental impacts arising during construction. Examples of these measures include:

a. all hazardous materials including fuels, chemicals, cleaning agents, solvents and solvent containing products to be properly sealed in containers at the end of each day, prior to storage in appropriately protected and bunded storage areas;

b. the segregation of waste at source, where practical, to facilitate a high proportion and high quality of recycling;

c. reviewing material quantity requirements to avoid over-ordering and the generation of waste materials due to surplus;

d. implementing agreements with material suppliers to reduce the amount of packaging, or to participate in a packaging take-back scheme; and

e. materials requiring removal from the site to be transported using licensed carriers, and records kept detailing the types and quantities of waste moved and the destinations of this waste.

10.5.5. The CEMP will also include secondary management plans, for example a Site Waste Management Plan.

10.6. Assessment of Effects

10.6.1. Further work will be undertaken as part of the assessment to quantify, where applicable, the use of material resources and the generation and management of waste and to assess the significance of potential effects.

10.6.1. The preliminary assessment of material assets and waste effects has concluded that although the quantities of material used for construction are not yet available, it is anticipated that these quantities will represent only a very small proportion of the overall UK demand for construction materials. Accordingly, it is considered unlikely that the Scheme will result in a significant reduction in the availability of construction materials within the regional or national market.

10.6.2. As construction of the Scheme is not expected to produce a large surplus of excavated materials potentially requiring offsite management, the Scheme is not expected to have a significant effect on waste infrastructure capacity.

10.6.3. The final outcomes of the likely significant effects of the Scheme on material assets and waste will be reported within the Environmental Statement. This will include an assessment of the Scheme's effects on Mineral Safeguard Areas and, if required, a Mineral Resource Assessment.

11. NOISE AND VIBRATION

11.1. Introduction

11.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on noise and vibration.

11.1.2. Receptors that are sensitive to noise predominantly comprise residential properties, but also include educational buildings, hospitals and places of worship.

11.2. Approach to the Assessment

Scope and Methods

11.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the noise and vibration assessment, and the approach and methods to be followed.

11.2.2. The Scoping Report [REF 11-1] 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 Scheme in relation to noise and vibration.

11.2.3. Following receipt of the Scoping Opinion [REF 11-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing noise and vibration assessment:

a. Inclusion of details relating to the location and height of any acoustic barriers incorporated into the design of the Scheme.

b. Inclusion of further details relating to the construction phase (specifically haulage routes and vehicle movements) to identify potential ground-borne vibration, with any likely significant effects reported.

c. Inclusion of a description of the construction activities likely to result in vibration impacts, where significant effects are likely.

d. Modification of the noise monitoring study area from the 1 kilometre distance currently being adopted, to reflect the extent of likely impacts and significant effects, and the inclusion of plans and descriptions to identify the location of all monitoring sites.

e. Seeking agreement on the location of noise monitoring locations with the relevant consultation bodies.

f. An assessment of the impacts associated with construction traffic, where significant effects are likely to occur.

g. Seeking agreement from the relevant consultation bodies on the construction noise limits to be used in the assessment.

h. Explanation and justification of any professional judgement applied.

11.2.4. Having had regard to the information presented within the Scoping Report [REF 11-1], The Inspectorate's Scoping Opinion [REF 11-2] has also confirmed Highways England's view that significant effects on noise and vibration associated with the future maintenance of the Scheme are unlikely. Accordingly, this matter will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

11.2.5. The noise and vibration assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 11-3].

11.2.6. Details of how the noise and vibration assessment will meet the requirements of the NPSNN [REF 11-3] in relation to avoiding, mitigating, minimising and controlling significant adverse impacts on (and where possible contributing to improving) health and quality of life are presented within the Scoping Report [REF 11-1].

11.2.7. The Scoping Report [REF 11-1] also details how other legislation and policy relating to noise and vibration is being taken account of in the assessment.

Consultation

11.2.8. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the noise and vibration assessment, the results of which are presented within the Scoping Opinion [REF 11-2].

11.2.9. Consultation is ongoing with the environmental health officers within the relevant local authorities, the purpose of which is to agree the scope of future noise monitoring required to inform both the assessment and the development of appropriate measures to mitigate effects on receptors.

Limitations and Assumptions

11.2.10. 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 Scheme and the maximum likely extents of landtake required for its construction and operation.

11.2.11. At this stage details of the construction traffic, construction schedule, construction methodology and plant requirements are not yet confirmed. Therefore, this preliminary assessment provides a qualitative construction noise and vibration assessment based on the application of best practicable means to minimise noise and vibration levels. A quantitative assessment of the impacts arising from construction works will be undertaken as part of the assessment and reported within the Environmental Statement.

11.2.12. The potential increases and decreases in traffic noise levels described in this assessment are based on early traffic data which was generated to inform the development and selection of Scheme options. A detailed assessment of the operational effects of the Scheme will be presented in the Environmental Statement, based on detailed traffic data which is currently being refined (see Chapter 4).

11.2.13. The findings of this preliminary assessment may be subject to change as the design of the Scheme is developed and refined further through the assessment and consultation processes, following the modelling of impacts and effects using the final traffic data once available.

11.2.14. Potential effects on quiet areas and tranquillity are being considered as part of the landscape assessment (see Chapter 7), and potential noise and vibration effects on ecologically sensitive receptors are being considered as part of the biodiversity assessment (see Chapter 8).

Study Area

11.2.15. The study areas adopted within the noise and vibration assessment have been defined in accordance with the guidance presented in Volume 11 of the Design Manual for Roads and Bridges (DMRB) [REF 11-4], which provides advice on how to identify and evaluate the effects of highway schemes.

11.2.16. The study area for the qualitative assessment of construction phase noise and vibration impacts has focussed upon the closest identified receptors to the various construction works.

11.2.17. The study area for the assessment of operational phase noise impacts comprises an area extending to 1 kilometre outwards from the new dual carriageway and the existing A428 between Wyboston interchange and Caxton Gibbet roundabout, the existing A1 between Black Cat roundabout and Wyboston interchange, and the existing A421 between the Black Cat roundabout and west of Roxton (the latter three being the principal existing routes that will be bypassed or improved as part of the Scheme).

11.2.18. The location of the Scheme, the 1 kilometre study area and receptors within the study area are illustrated on Figure 11.1 within Volume 2.

11.3. Baseline Conditions

Information Sources

11.3.1. The following sources and types of information have been used in the assessment:

a. Ordnance Survey MasterMap and AddressBase data, to aid the identification and modelling of receptors.

b. Traffic data, to enable the modelling of traffic-related effects on receptors.

c. Baseline noise monitoring, to establish the existing noise climate.

d. Information on existing and proposed road noise surfacing and any existing noise barriers, to identify and model how these influence baseline noise levels.

e. Information on existing and proposed ground heights, to assist the noise modelling process.

Noise Monitoring

11.3.2. A baseline noise survey was carried out in late 2017 to establish existing noise levels at representative locations along the Scheme.

11.3.3. Further baseline noise surveys will be carried out in mid-2019 to characterise the noise climate in the study area and verify that the calculated noise levels from the noise model are representative.

11.3.4. The full details of all noise monitoring carried out as part of the assessment will be reported within the Environmental Statement.

Existing Noise Sources

11.3.5. Information collected as part of the assessment has identified that the existing noise climate is dominated by road traffic noise, predominantly from the A1, A428, A1198, A421 and associated junctions. Other sources of road traffic noise which contribute to existing noise levels include the B1428, B1043, B1046, and B1040, and a number of minor roads, in particular those in St Neots.

11.3.6. Rail noise from the East Coast Main Line railway, which runs along the eastern edge of St Neots, influences the noise climate in some locations. Recreational aircraft flying out of Bourn (approximately 3.9 kilometres from the Scheme), Gransden Lodge (approximately 4.8 kilometres from the Scheme) and Little Gransden airfields (approximately 6.9 kilometres from the Scheme) are also intermittent contributors to the noise environment. Other noise sources include general urban and rural activities, for example those associated with agricultural operations.

Noise Important Areas

11.3.7. Under the Environmental Noise Directive (2002/49/EC) [REF 11-5], strategic noise mapping of major roads, railways, airports and agglomerations has been completed across England. This includes the A421, A1 and A428 routes.

11.3.8. The following Noise Important Areas (NIAs) (comprising areas that are most exposed to noise) have been identified through this strategic noise mapping within the 1 kilometre study area:

a. Three NIAs located on the A1 between Black Cat roundabout and Wyboston interchange.

b. One NIA located in the locality of Church End on the A1 south of Black Cat roundabout.

c. One NIA located on the A421 north of Roxton.

d. Two NIAs located on the A428 at Wintringham and east of Caxton Gibbet.

11.3.9. The locations and extents of these NIAs are illustrated on Figure 11.1 within Volume 2:

Noise Sensitive Receptors

11.3.10. Receptors identified within the study area that are sensitive to changes in noise include the following:

a. Residential properties in the settlements of St Neots, Tempsford, Roxton, Chawston and Wyboston, Little Barford, Croxton and Eltisley.

b. Residential properties located along Rookery Road.

c. Individual dwellings located within the rural environment, for example properties located to south-east of St Neots.

11.3.11. Other receptors include a number of schools and nurseries, medical facilities, a range of community facilities (comprising mainly places of worship and village halls), numerous public rights of way and a number of scheduled monuments.

11.4. Potential Impacts

11.4.1. The preliminary assessment has identified that the Scheme will potentially result in both adverse and beneficial noise and vibration impacts.

11.4.2. These impacts are associated with:

a. noise and vibration from vehicle movements and the operation of equipment and machinery during construction of the Scheme; and

b. increases and decreases in noise and vibration, derived from changes in the flow and composition of traffic on the road network once the Scheme is operational.

Construction

11.4.3. During construction, the Scheme has the potential to directly affect noise and vibration levels currently experienced at receptors in proximity to the works for a temporary period.

11.4.4. Construction noise impacts may potentially occur on the existing road network, depending on the location of construction haul routes and the quantity and type of construction-related traffic. Impacts may also occur as a result of construction activities within working areas and site compounds, for example earthworks and road construction works.

11.4.5. The potential for temporary construction vibration impacts will be dependent on the need for certain types of construction activities and operations that can be a source of vibration, for example piling and ground improvement works, or the use of vibratory rollers.

Operation

11.4.6. Operational traffic using the Scheme and the surrounding road network has the potential to result in both beneficial and adverse permanent noise impacts, depending on the forecast changes to traffic flows and whether traffic is brought in closer proximity to, or taken further away from, receptors.

11.4.7. The introduction of the new dual carriageway into areas which are reasonably remote from existing roads, for example the rural areas to the south-east of St Neots, has the potential to result in increases in traffic noise levels.

11.4.8. Conversely the transfer of traffic from the existing A428 onto the new dual carriageway has the potential to result in decreases in traffic noise levels at receptors in proximity to the existing road.

11.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

11.5.1. Measures are being identified as part of the development of the Scheme to avoid and reduce potential adverse impacts, the form and location of which are being informed by the ongoing modelling of road traffic noise.

11.5.2. A thin surfacing system, which generates less noise than a standard hot rolled asphalt road surface, is proposed along the new dual carriageway to reduce road traffic noise.

11.5.3. Other measures which are being investigated and evaluated include adjustments to the vertical and horizontal alignment of the new dual carriageway, and the use of barriers along the new dual carriageway. Where required, these measures are being developed in conjunction with other mitigation measures, for example the landscaping strategy, to help integrate these elements into the surrounding area and provide visual screening of new and improved sections of road.

11.5.4. Areas where noise mitigation is necessary will be presented in the Environmental Statement, following completion the operational phase noise modelling and assessment.

Standard Mitigation Measures

11.5.5. The preferred approach for controlling construction noise and vibration is to reduce levels at source where possible, but with due regard to practicality. Sometimes a greater noise level may be acceptable if the overall construction time, and therefore length of disruption, is reduced.

11.5.6. The contractor will undertake construction works in line with measures as set out within their Construction Environmental Management Plan (CEMP). The CEMP will be based upon the framework of measures set out in the Outline Environmental Management Plan, which will be prepared by Highways England and submitted as part of the Development Consent Order application.

11.5.7. The CEMP will include a range of industry standard and best practice measures to mitigate noise and vibration impacts, examples of which are expected to include:

a. the selection of quiet and low vibration equipment;

b. a review of construction programme and methodology to consider low noise/low vibration methods, including non-vibratory compaction plant and low vibration piling methods where required;

c. the optimal location of equipment on site to minimise noise disturbance;

d. the provision of acoustic enclosures to static plant, where necessary;

e. the use of less intrusive alarms, such as broadband vehicle reversing warnings;

f. the local screening of equipment and employment of perimeter hoarding; and

g. the implementation of a construction traffic management plan to mitigate traffic impacts during construction, for example, through the choice of routes, the varying of routes and timing of construction traffic.

11.5.8. A communications strategy will be implemented as part of the Scheme, which will minimise the likelihood of complaints and will provide residents with a point of contact for any queries or complaints regarding the works.

11.5.9. During the construction phase, appropriate mechanisms to liaise with residents will be established to highlight potential periods of disruption. These are likely to be communicated through methods such as newsletters, newspapers and radio announcements. A page on the Highways England website will also be provided and kept up to date with details regarding the status and progress of the construction works, areas that will be affected by construction, mitigation being put in place to reduce adverse effects, information regarding planned construction works, and works recently completed.

Additional Mitigation Measures

11.5.10. Any requirement for noise insulation of individual properties to protect their internal noise environment will be established through the assessment process.

11.5.11. A preliminary indication of any properties which may qualify for insulation under the Noise Insulation Regulations [REF 11-6] will be provided in the Environmental Statement. A full assessment will be completed once the detailed design of the Scheme is finalised, and in accordance with the timescales set out in the Regulations [REF 11-6].

11.6. Assessment of Effects

Construction

11.6.1. The assessment has identified that construction of the Scheme will result in temporary noise and vibration impacts on receptors, for which standard mitigation measures will be employed by the contractor. Some of these impacts are likely to result in temporary effects on receptors in proximity to certain works and operations.

11.6.2. Construction traffic, including the operation of any required diversion routes, may have an adverse effect on receptors located along existing roads used by these vehicles. The significance of these effects will be influenced by the volume of construction vehicles travelling on these routes and the duration of construction works.

11.6.3. Many of the works during the construction phase will be of very limited duration or relatively fast-moving, for example the installation of signage and drainage, and the laying of carriageway surfacing. These works are likely to result in short term adverse effects at any one receptor or group of receptors, for limited periods of time.

11.6.4. Some works may result in significant adverse effects on receptors, for example earthworks, due to their duration and extent. Similarly, potential exists for significant

adverse effects on receptors close to any piling works, for example during construction of the Black Cat and Cambridge Road junctions where receptors are located in relatively close proximity to the works.

Operation

11.6.5. The assessment has identified that operation of the Scheme will result in both beneficial and adverse permanent noise effects on receptors, some of which have the potential to be significant.

11.6.6. In summary, the findings from the preliminary modelling and assessment indicate the following:

a. Increases in road traffic noise levels are anticipated at a number of receptors located close to the new dual carriageway between the A1 and Caxton Gibbet roundabout, due to this introducing a new source of noise at these locations.

b. Reductions in traffic noise level are anticipated at receptors located on Barford Road, due to the removal of traffic from this route onto the new dual carriageway.

c. Reductions in traffic noise through the centre of St Neots are anticipated as traffic from the existing A428 will transfer to the new dual carriageway to the south-east of the town. The diversion of traffic from the existing A428 onto the new dual carriageway is also anticipated to result in a reduction in noise levels at receptors in villages to the east of St Neots, including at Croxton and Eltisley.

d. Traffic on the new Black Cat junction has the potential to result in increases in noise levels at a small number of receptors located in close proximity to it, associated with traffic on the A1 and A421 being able pass through the junction on free-flow links at higher speeds.

11.6.7. The significance of these effects arising from these changes will be influenced by a range of factors, including: the flow, composition and speed of traffic; the type of road surfacing; local ground topography; the presence of intervening buildings and structures between the noise source and receptors; the distance from the noise source; and the type of noise mitigation measures incorporated into the Scheme design.

11.6.8. The final outcomes of the likely significant effects of the Scheme on noise and vibration will be reported within the Environmental Statement.

12. POPULATION AND HEALTH

12.1. Introduction

12.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on population and health.

12.1.2. The following receptors are considered in the assessment:

a. Walkers, cyclists and horse riders (WCH) travelling on the local road and public rights of way (PRoW) networks, including journeys made between communities and facilities.

b. Occupiers of agricultural, community and development land.

c. Owners and users of private and commercial property.

d. Users of community facilities (comprising education and healthcare services, sport and recreation facilities).

e. People making journeys by vehicle on the strategic and local road networks.

f. Local resident's health and wellbeing (including interactions with other aspects such as air quality, noise and vibration, landscape and climate).

12.2. Approach to the Assessment

Scope and Methods

12.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the population and health assessment, and the approach and methods to be followed.

12.2.2. The Scoping Report [REF 12-1] 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 Scheme in relation to population and health.

12.2.3. Following receipt of the Scoping Opinion [REF 12-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing population and health assessment:

a. Identification of the locations of best and most versatile agricultural land, and quantification of the total anticipated loss of this land, to inform the assessment of likely significant effects.

b. An assessment of the impacts to population and health receptors from changes in traffic conditions, congestion on then local highway network, severance, driver delay and accidents during both the construction and operational phases of the Scheme.

12.2.4. Having had regard to the information presented within the Scoping Report [REF 12-1], The Inspectorate's Scoping Opinion [REF 12-2] has also confirmed Highways England's view that significant effects on population and health associated with the future maintenance of the Scheme are unlikely. Accordingly, this matter will remain scoped out of consideration in the Environmental Statement.

Legislation and Policy

12.2.5. The population and health assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 12-3].

12.2.6. Details of how the population and health assessment will meet the requirements of the NPSNN [REF 12-3] in relation to journeys made on the national road network, effects on communities and accessibility, and land use impacts are presented within the Scoping Report [REF 12-1].

12.2.7. The Scoping Report [REF 12-1] also details how other legislation and policy relating to population and health is being taken account of in the assessment.

Consultation

12.2.8. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the population and health assessment, the results of which are presented within the Scoping Opinion [REF 12-2].

12.2.9. Interviews will be undertaken with agricultural landowners affected by the Scheme to obtain baseline information to inform the assessment of effects on agricultural interests.

12.2.10. Engagement with affected owners of private properties and agricultural holdings will also be undertaken as part of the design-development process, which will inform the development and incorporation of mitigation measures into the design of the Scheme.

Limitations and Assumptions

12.2.11. 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 Scheme and the maximum likely extents of landtake required for its construction and operation.

12.2.1. At this stage of the assessment, the final outputs from the traffic modelling process are not available. Data from the traffic modelling will be used to inform the assessment of driver-related stress and traffic-related severance.

12.2.2. Pedestrian surveys have yet to be carried out as part of the assessment on PRoW and roads to obtain information on journeys made by WCHs along these routes.

12.2.3. Accordingly, this preliminary assessment is necessarily qualitative, the findings of which may be subject to change as the design of the Scheme is refines through the design-development and consultation processes, and as further research and investigative surveys are completed to fully understand its likely effects.

12.2.4. Potential effects relating to agricultural soils are being considered as part of the Geology and Soils assessment (see Chapter 9).

Study Area

12.2.5. The study areas adopted within the population and health assessment vary depending on the aspect under consideration and the type of receptor that may affected. Accordingly, the following study areas apply in the assessment.

<u>Vehicle Users</u>

12.2.6. The views from the road, driver stress and vehicle user severance assessments for the Scheme are being informed by the distances and thresholds presented within Volume 11 of the Design Manual for Roads and Bridges (DMRB) [REF 12-4].

12.2.7. The study area is 1 kilometre around the Development Consent Order (DCO) site boundary, with a focus on the main routes between the Black Cat and Caxton Gibbet roundabouts.

Walkers, Cyclists and Horse Riders

12.2.8. The study area for the assessment of impacts on WCHs include PRoWs and routes directly affected by the Scheme and any feeder PRoWs between likely destinations within and outward to 1 kilometre from the DCO site boundary.

12.2.9. The study area for community severance includes communities that may potentially be directly affected by severance introduced by the Scheme (this being the separation of residents from facilities and services that they use within their community) and reflects the same 1 kilometre study area adopted for the assessment of impacts on WCHs.

12.2.10. These study areas have been informed by the guidance contained within Volume 11 of the DMRB [REF 12-4].

Land Use

12.2.11. The study area for the assessment of land use effects has been informed by guidance contained in Volume 11 of the DMRB [REF 12-5], and comprises all private assets, community land, development land and planning applications, and agricultural land and holdings within the DCO site boundary and outward to 1 kilometre.

12.2.12. The aspects covered by the land use assessment are summarised as follows:

a. **Agricultural Land:** Agricultural land includes holdings that are affected by the Scheme by landtake, severance and changes in their operational and commercial viability.

b. **Development Land:** Development land is land allocated with local authority development plans for future development purposes, or for which a planning permission has been granted or is pending.

c. **Private Assets and Demolition of Private Property:** Private property is land outside the existing highway boundary that does not accommodate public open space or any other community facility or asset. It can be residential or commercial and industrial land.

d. **Community Facilities:** Community land is any area of public open space and other facilities such as schools, hospitals, libraries and recreation facilities.

Human Health

12.2.13. The study area for the human health assessment comprises the following wards: South Cambridgeshire, Papworth and Elsworth, Gransden and the Offords, Wyboston, Potton, St Neots Eaton Socon, St Neots Eynesbury, St Neots Priory Park.

12.2.14. These wards been selected based on their proximity to the Scheme such that there is a likelihood that they could potentially experience effects (direct and indirect) arising from construction activities and traffic using the Scheme.

12.3. Baseline Conditions

Information Sources

12.3.1. The following sources and types of information have been used in the assessment:

a. Google Streetview roadside photography, to assist the understanding of the composition and availability of views from the road.

b. Ordnance Survey mapping and aerial photography available in the public domain, to identify land use relationships, areas of community land and facilities (for example PRoW and cycle routes), and other receptors.

c. A review of planning applications within 1 kilometre of the Scheme registered with South Cambridgeshire District Council, Huntingdonshire District Council, Central Bedfordshire Council and Bedford Borough Council (see Chapter 15).

d. A review of development plan documents within the above local authorities to identify development land allocations.

Public Rights of Way and Other Routes

12.3.2. PRoWs are an important asset of the area acting as connections between villages and community facilities.

12.3.3. There are approximately 50 PRoWs within the study area, the extents of which are illustrated on Figure 12.1 within Volume 2.

12.3.4. These PRoW mainly occur north and west of Black Cat roundabout, with a further cluster of footpaths located south east of St. Neots between Hen Brook and Wintringham. Further PRoWs occur at the settlements of Weald, Croxton and Eltisley.

12.3.5. Most PRoWs within the study area are footpaths; however, bridleways are present surrounding the settlements of Eltisley and Caxton.

12.3.6. The most significant walking trail is the Ouse Valley Way which is a regional trail following the River Great Ouse between its source at Brackley Northamptonshire to its mouth at the Wash at King's Lynn. The pathway crosses the A421 west of Black Cat roundabout and continues into Chawston. From here it continues along the A1 toward Wyboston, where it crosses the existing A428 at the Wyboston interchange and then follows the Great North Road to Eaton Socon.

12.3.7. National Cycle Network (NCN) Route 12 runs north-south through the study area to the west of the Great North Road, crossing the A1 to the west of Black Cat roundabout. This cycle route when completed will run from Enfield Lock to Spalding, passing through St Neots.

Commercial Receptors

12.3.8. Commercial receptors within the study area include the following, the locations of which are illustrated on Figure 12.1 within Volume 2:

a. Service areas at Black Cat roundabout (including hotel and petrol garage) and at Caxton Gibbet roundabout including supermarket, petrol garage and cafés.

b. Whitehall Industrial Estate in Croxton (adjacent to the A428).

c. Little End Road and Howard Road industrial estates in St Neots (approximately 3 kilometres north of Black Cat roundabout).

d. Industrial estate along Alington Road, south of St Neots (adjacent to the A428).

e. Papworth Hotel on Ermine Street, where the A1198 meets the A428 (approximately 350m north of Caxton Gibbet roundabout).

f. Kelpie Marine boat yard by Tempsford Bridge (approximately 700m south of Black Cat roundabout).

g. Little Barford electricity generating power station, south-east of St Neots (approximately 390m south of the A428/Barford Road roundabout).

h. Businesses, including Cemex cement plant located within Wyboston Leisure Park (approximately 500m south of the A428 Wyboston interchange).

i. Roxton Garden Centre (approximately 300m south-west of Black Cat roundabout).

j. Business (including café, petrol garage, and independent retailers) adjoining the Great North Road in Wyboston (approximately 1 kilometre south of Black Cat roundabout).

k. St Neots Autograss Club motor sports circuit, located adjacent to the A428 immediately south of Black Cat roundabout (approximately 300m south-west of Black Cat roundabout).

l. Hotels and other businesses at Wyboston interchange (approximately 155m north-east of the A428 Wyboston interchange).

m. Grocery superstore south of St Neots (approximately 130m north-west of the A428, Barford Road junction).

n. Various farms, plantations, and associated businesses located in the surrounding countryside.

Community Facilities

12.3.9. There are several community facilities located within the study area which are accessed from the A428. Notable facilities include the following, the locations of which are illustrated on Figure 12.1 within Volume 2:

a. St Neots Community College located approximately 600m north of the A428 in St Neots.

b. Middle Field Community Primary School, located approximately 400m north of the A428 in St Neots.

c. Croxton Park Registered Park and Garden, located west of Eltisley (approximately 440m south of the A428).

d. Barford Road Pocket Park, located approximately 300m from the A428 in St Neots.

e. Wyboston Leisure Park, located south of St Neots (approximately 400m south-east of Black Cat roundabout).

f. Newton Primary School in Eltisley (approximately 450m south of the A428 at Eltisley).

12.3.10. Places of worship in St Neots, Croxton, Eltisley, and Little Barford include the following:

a. St John the Baptist Church, approximately 125m south of the existing A428 at Eltisley).

b. St James Church, located approximately 800m south of the A428 at Croxton.

12.3.11. Ordnance Survey AddressBase data will be used to establish the full extent of community facilities within the study area, as part of the ongoing assessment.

Development Land

<u>Development Land and Allocations</u>

12.3.12. The South Cambridgeshire Local Plan 2018 [REF 12-6] includes plans for the creation of a fourth sustainable linked village at Cambourne West (Emerging Policy SS/8). The zoned land south of Caxton Gibbet roundabout is allocated for a sustainable mixed use development with high levels of green infrastructure and aims to provide approximately 1,200 dwellings by 2031.

12.3.13. The Huntingdonshire Local Plan to 2036: Proposed Submission [REF 12-7] details a strategic expansion location east of St Neots. This expansion area comprises 224 hectares of land east of Loves Farm designated for mixed use sustainable

development, and has been carried forward from the St Neots Eastern Expansion Urban Design Framework 2010 [REF 12-8]. The Framework [REF 12-8] also laid provision for green areas, green corridors and pedestrian and cyclist provisions throughout the development area.

12.3.14. The Central Bedfordshire Pre-submission Local Plan 2015 – 2035 [REF 12-9] aims to provide a minimum of 20,000 additional new homes and 24,000 new jobs between 2015 and 2035. Several development areas have been zoned within the plan for consideration. Among those areas proposed is a new market town near Tempsford. This zoned growth area will include the development of approximately 7,000 homes and a business park. The delivery of development in this area will rely on the delivery of the Scheme and the delivery of the East West rail improvements.

12.3.15. Plans are under development for the East West rail improvements (also known as the "Varsity Line") between Oxford and Cambridge. The section of the line connecting Bedford to Cambridge requires a new rail connection, and several route options are currently being investigated by the East West Rail Company, some of which will take the new line on a corridor south of the existing A428. Should the East West rail improvements be introduced in full, they will provide a high quality rail alternative for freight, and it is likely that a proportion of freight currently on the strategic road network will shift towards transportation by rail.

12.3.16. Other development land within the study area includes:

a. Land to the east of Black Cat roundabout and the A1, which is designated as a Green Infrastructure Network Opportunity Zone (Lower Great Ouse Valley).

b. Two allocated housing sites located adjacent to the A428 in St Neots, comprising a 21 hectare site at Barford Road and a 58 hectare site on and east of the East Coast Main Line (north of Cambridge Road). The area at Barford Road is also allocated as an employment zone, where development of industry, warehousing and distribution, office and high technology uses will be prioritised.

c. The River Great Ouse valley north of the A428, which is designated as an area of strategic greenspace enhancement.

Planning Applications

12.3.17. Major planning applications and permissions have been identified within the study area through a review of planning information held by South Cambridgeshire District Council, Huntingdonshire District Council, Central Bedfordshire Council and Bedford Borough Council.

12.3.18. The details of these applications and permissions are presented in Chapter 15, the review of which is current ongoing to identify the status of all relevant developments for inclusion within this assessment and the cumulative effects assessment. A number of these applications and permissions relate to the areas of development land described above.

Agricultural Land

12.3.19. Most land holdings within the study area are large scale arable enterprises, and information is being obtained as part of the assessment to identify the current ownership and husbandry details of all holdings that may be affected by the Scheme.

12.3.20. Details of the grades and distribution of agriculturally viable soils within the study area are presented within the geology and soils assessment (see Chapter 9).

Vehicle Users

Views from the Road

12.3.21. Most of the study area is predominately an open and intensive arable landscape characterised by gently undulating topography and plateau areas, divided by broad shallow valleys.

12.3.22. Open or intermittent views of this countryside are possible from much of the A428 due to the absence of hedgerows alongside much of the highway boundaries. Similarly, views for vehicle travellers using the existing surrounding roads tend to be intermittent or open views of the large arable fields characteristic of the area.

12.3.23. Settlements close to the A428 include Croxton, Eltisley and Caxton Gibbet. Views of these settlements tend to be glimpsed for travellers along the A428 due to the presence of noise barriers, screening vegetation and cuttings.

Driver Stress and Vehicular User Severance

12.3.24. The main factors contributing to driver frustration along the A428 relate to the current capacity of the carriageway. There is congestion at the existing junctions and the route also passes through rural settlements. Vehicles are forced to reduce speed considerably during peak hours due to congestion which contributes to drivers' stress. Congestion, reduced speed and traffic jams can become acute when an accident or breakdown forces the closure of one or more lanes.

12.3.25. The fear of accidents can become particularly acute when driving in adverse weather conditions when spray from vehicles reduces visibility. Adverse weather conditions make overtaking more stressful and hazardous, increasing the fear of accidents.

12.3.26. Junctions and destinations are adequately signposted; however, some of the distances between successive merges and diverges are not in keeping with current design practice, which can lead to route uncertainty and wrong or late choices being made by some drivers. There are also many local accesses to lanes and isolated properties that have minimal, if any, junction tapers, which can lead to slow driving or sudden speed changes by those wishing to find these locations.

12.3.27. These conditions affect journeys made by vehicle to reach community facilities along and beyond the A428.

Human Health

12.3.28. Within the four local authority areas, those people who rate their health as 'bad' or 'very bad' (3.9%) is lower than both the regional (4.7%) and England and Wales (5.6%) averages. Similarly, rates of residents whose day-to-day activities are limited 'a lot' (6.2%) are somewhat lower than the regional (7.4%) and England and Wales (8.5%) averages.

12.3.29. The four local authorities have Index of Multiple Deprivation ratings ranging from the 148th (Bedford) to 316th (South Cambridgeshire) most deprived in England. Only 1.1% of the four local authority areas are within the top 10% most deprived areas nationally, compared to 4.1% across the East of England. Similarly, a majority (53.1%) of areas within the 4 local authorities are in the top 20% least deprived with regard to the health deprivation and disability domain, a component of the Index of Multiple Deprivation, compared to just 32.4% across the East of England [REF 12-10].

12.4. Potential Impacts

12.4.1. This preliminary assessment has identified that the Scheme will potentially result in both adverse and beneficial impacts on population and health during its construction and operation.

Construction

Vehicle Users

12.4.2. Driver stress may be temporarily increased during construction as a result of road works, traffic management and resultant traffic delays.

12.4.3. Users travelling on the A428 are likely to experience impacts from temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion, particularly during peak hours, leading to temporary impacts at a limited number of locations.

12.4.4. Existing views from the road are likely to be affected by construction activities. Construction plant and traffic management measures may partially obscure views and attract the attention of drivers away from the current views along the A428.

12.4.5. Construction may result in temporary severance to journeys for residents accessing community resources via local roads, due to the addition of construction traffic on the road network.

Walkers, Cyclists and Horse Riders

12.4.6. During construction there is expected to be disruption which may result in local road closures and temporary closures of local PRoWs and public footpaths.

12.4.7. As such, construction activities may adversely impact walking or cycling routes which are regularly used for recreation and commuting purposes (such as NCN Route 12 or the Ouse Valley Way Regional Trail).

Land Use

12.4.8. Impacts on land use during construction are likely to relate to the loss of land required to construct the Scheme, as well as land needed for borrow pits, material storage areas and construction compounds.

12.4.9. The majority of impacted land is likely to be agricultural land, permanently reducing the available resource of arable land and fertile soil in the region. In addition, construction has the potential to result in the temporary severance of access to areas of farmland from construction haul routes or other construction-related land use requirements. Although the severance will be temporary, there may be longer term effects if the viability of the assets becomes undermined through lack of use or access during the construction period. Other potential construction impacts may include: the deposition of dust on sensitive crops, land uses or buildings; disruption to drainage, irrigation and water supply systems; unintentional pollution of soil and watercourses; spread of injurious weeds to adjacent agricultural land from soil and material stockpiles; and construction noise.

12.4.10. Permanent construction impacts may potentially comprise: the net area of agricultural land required to accommodate the Scheme and the restoration of land required temporarily to unrestricted agriculture; permanent severance; and the permanent loss of, or impact on, farm infrastructure such as property, buildings and structures, and the consequential impacts on land uses and enterprises.

12.4.11. During construction, there is potential for impacts associated with the loss of land and the severance of land allocated for development.

12.4.12. The Scheme will require the extinguishment of some existing businesses and the demolition of some existing premises, the details of which are presented in Chapter 2.

12.4.13. Temporary impacts on the ability to access community facilities may also arise during construction, due to disruption to current journey patterns and movements.

Human Health

12.4.14. Potential impacts on human health determinants during construction include changes in noise and air pollution, severance, water quality and climate change due to construction activities and traffic.

12.4.15. Potential impacts on the different determinants of human health include the following:

a. Access to healthcare services and other social infrastructure.

b. Access to open space and nature.

c. Air quality, noise and neighbourhood amenity.

d. Accessibility and active travel.

e. Access to work and training.

f. Social cohesion and lifetime neighbourhoods (defined as places designed to be inclusive regardless of age or disability as set out by the UK Government).

g. Climate change.

Operation

Vehicle Users

12.4.16. It is anticipated that the Scheme will reduce existing levels of driver stress through reduced congestion, the separation of local and strategic traffic and the reduction in fear of accidents.

12.4.17. Operation of the Scheme is also anticipated to produce better and safer opportunities for overtaking along the new dual carriageway, in comparison to those on the existing A428. The new dual carriageway will be constructed to modern design standards and will provide a high quality road surface.

12.4.18. Once operational, available views from the new dual carriageway may be enhanced due to the alignment of the road through open countryside.

12.4.19. Beneficial changes in severance for residents of villages accessing community facilities and social infrastructure are also expected from the transfer of traffic from the A428 and onto the new dual carriageway.

Walkers, Cyclists and Horse Riders

12.4.20. The operational Scheme will deliver benefits due to greater access and movement for the local population making journeys on foot, by cycle or on horseback, which will provide safer, more reliable journeys.

12.4.21. Reductions in severance and improvements in route connectivity and local travel patterns are expected from new and modified routes incorporated into the design of the Scheme. Some increases and decreases in journey times for those accessing community resources are likely due to these modifications, depending on the length and route of journeys made to these facilities.

12.4.22. Facilities will be provided to enable a safe means of access to reduce existing levels of severance, and to enable the safe crossing of the new dual carriageway where required.

Land Use

12.4.23. Other than potentially reducing severance of holdings and improving farm connectivity, no potentially new or additional impacts on agricultural land and holdings are likely to result from the operation of the Scheme.

12.4.24. Potential operational impacts on private assets are likely to be associated with permanent landtake required to construct the Scheme.

Human Health

12.4.25. Potential impacts on human health determinants during operation of the Scheme are likely to include the following:

a. Lifestyle changes such as encouraging travel by other modes of transport, for example walking and cycling through the provision of new routes and potentially increased or reduced severance.

b. Impacts on local employment opportunities and activity through changes in access to employment resulting from reduced delays, congestion and potential reductions in severance.

c. Impacts on access to key services and social infrastructure such as health and education facilities due to a reduction in delays, congestion and reduced severance.

d. Beneficial impacts on access to open and recreation spaces through provision of new routes.

12.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

12.5.1. The Scheme has been designed, as far as possible, to avoid and minimise impacts and effects relating to population and health through the process of design development, and by embedding mitigation measures into the design.

12.5.2. The development of the Scheme design has sought to minimise the extent of agricultural land required permanently to accommodate the Scheme.

12.5.3. Appropriate provisions are being included in the design to enable WCHs to safely cross the new dual carriageway and ensure that the existing connectivity between PRoWs, local roads and communities is retained. The designs of these provisions are currently under development; however, the Scheme incorporates a combination of new bridges, underpasses, footpaths and bridleway diversions, crossings and new provision for cyclists to maintain and where possible enhance access along existing and new routes.

Standard Mitigation Measures

12.5.4. Standard measures will be implemented by the contractor to mitigate the impacts of construction upon the local population and human health.

12.5.5. These measures are likely to include the following:

a. Careful planning of the construction works to minimise the need to close/divert existing routes and facilities used by WCHs, and to minimise closure or diversion durations. Should closure be needed, safe and appropriate alternative means of access will be provided to ensure access is maintained at all times to avoid temporary severance. Any temporary diversions and closures will be agreed in

advance with the applicable local authorities, with advanced notice given to users and appropriate signage provided.

b. Sites used temporarily during the construction phase will be appropriately restored and returned to the applicable land owner.

c. The contractor will define the requirements relating to traffic management during the construction phase, which will take account of local public and business access requirements to reduce severance and disruption to local traffic movements.

d. Regular community liaison in advance of, and during the works, to help keep local communities informed of any potentially disruptive activities and to assist with journey planning.

12.6. Assessment of Effects

Construction

Vehicle Users

12.6.1. There is the potential for an increase in driver stress in the study area due to the presence of construction traffic, traffic management and construction activities. Construction activities are likely lead to some frustration amongst vehicle users. Measures will be put in place to make drivers aware of disruptions ahead of time to help them plan their routes and journeys accordingly, together with appropriate traffic management measures and signage. Therefore, with appropriate traffic management and signage, such effects are not anticipated to be significant.

12.6.2. During construction it is likely that views for vehicular travellers on the A428 will be affected by construction activities. Construction plant activities and traffic management may obscure views for vehicular users and attract attention away from the available views along the A428. Construction of the Scheme will therefore result in unavoidable adverse effects on views from the road. However, such effects will be temporary and are not anticipated to be significant.

12.6.3. Construction works and associated traffic management measures have the potential to result in severance impacts for vehicular user's journeys made by residents in the local area to access community facilities. Severance may also potentially occur due to the redistribution of traffic on the wider network, increasing the amount of congestion experienced on these roads. Information is not yet available regarding construction phase road diversions onto the wider network. Effects upon vehicular user severance will be assessed following confirmation of the construction phase traffic management provisions, although at this stage there remains the potential for significant temporary adverse severance effects.

Walkers, Cyclists and Horse Riders

12.6.4. Changes to journey times, local travel patterns, and certainty of route for WCHs may arise due to temporary closures and diversions of PRoWs through direct landtake, severance, and provision of access routes required during construction. Subject to further information being provided to inform this assessment, the construction works have the potential to result in some significant temporary adverse effects upon PRoW and associated users.

Land Use

12.6.5. The Scheme will require landtake to: facilitate construction and undertake diversions of existing utilities infrastructure; accommodate the engineering, drainage and

environmental components of the Scheme; and to modify or improve the existing strategic and local road network as part of the Scheme.

12.6.6. Construction will result in the unavoidable loss of agricultural land. Such losses have the potential to result in significant adverse effects upon affected agricultural land holdings in relation to their operational viability. These effects are being investigated and will be reported within the Environmental Statement following engagement with all parties potentially subjected to adverse effects. There may also be temporary severance of access to areas of farmland as a result of construction haul routes and other construction land use requirements. Although severance will be temporary, there is the potential for longer term effects on the viability of farmland due to prolonged lack of access during construction.

12.6.7. It is considered that the loss of residential and commercial receptors (as a result of demolition and extinguishment) have the potential to constitute significant adverse effects.

Human Health

12.6.8. During construction, effects on access to healthcare services and other social infrastructure are anticipated to be minimal. With the appropriate provision of diversion routes and appropriate access points, access to such facilities will be maintained. The effect on access to health care and local community assets as a determinant of human health during construction is therefore assessed to be neutral.

12.6.9. It is anticipated that the existing open and natural spaces near the Scheme will remain accessible during construction (where located beyond the DCO site boundary), with any changes to access being appropriately mitigated. With appropriate mitigation (for example temporary diversions to access routes and PRoWs), access to open and natural space during construction will be maintained such that effects on human health will be neutral.

12.6.10. As indicated in Chapter 5, mitigation measures will be required to reduce the risk of possible dust impacts on sensitive receptors. Air quality impacts associated with construction related traffic (specifically NO_x, nitrogen dioxide and PM_{10}) are currently uncertain and will be considered in the Environmental Statement once the findings of the air quality assessment are available.

12.6.11. Regarding noise and vibration, Chapter 11 indicates that construction has the potential to result in temporary noise impacts at receptors closest to the works, with some effects having the potential to be significant. In addition, construction traffic, including the operation of any required diversion routes, also has the potential to affect sensitive receptors located along existing roads used by these vehicles. The potential for traffic impacts during construction is dependent on the traffic volume and route. The potential construction phase noise and vibration effects of the Scheme will be determined and reported within the Environmental Statement.

12.6.12. Given the above, the human health effects associated with air quality and noise during the construction phase are subject to confirmation. However, measures to minimise air quality, noise and vibration impacts during construction will be recorded within the contractor's Construction Environmental Management Plan (CEMP) which will aim to mitigate potentially significant adverse effects and therefore minimise the effects of construction on human health.

12.6.13. During construction, there may be potential closures and diversions to the existing PRoW network at locations directly affected by the Scheme. However, diversions and other relevant access provisions will mitigate any human health impacts for users of

such routes. Any human health impacts resulting from construction traffic on journeys made by WCHs in the area will be minimised through appropriate traffic management measures and through measures specified within the CEMP. Disruption resulting from construction will be minimised through mitigation, diversions and alternative access routes. Therefore, the effect of construction on accessibility and active travel as a determinant of human health during construction is considered to be neutral.

12.6.14. Construction will provide net additional employment opportunities in the local area. Therefore, a beneficial effect on access to work and training as a determinant of human health has been identified.

12.6.15. During the construction phase, temporary severance issues may occur due to disruption to existing road usage. Through the provision of appropriate mitigation measures (for example the provision of defined diversions routes), the effect on social cohesion and lifetime neighbourhoods as a determinant of human health is considered to be neutral.

12.6.16. An assessment will be undertaken and reported in the Environmental Statement to consider the effect of construction on climate and greenhouse gas emissions, the findings of which will be used to inform the human health assessment.

Operation

Vehicle Users

12.6.1. The assessment has identified that operation of the Scheme will alleviate congestion, improve local and strategic connectivity and improve journey times. These will all contribute to a reduction in driver fear. Additionally, whilst the lighting, signage and technology strategy for the Scheme is yet to be finalised, it is considered that appropriate signage will help inform drivers about route changes and restrictions. It is therefore concluded that the overall effect of the Scheme on driver stress will be beneficial.

12.6.1. Scheme operation will improve capacity along the A428 and at some existing junctions as a result of the transfer of traffic onto the new dual carriageway. These improvements will relieve congestion currently experienced along the A428 and improve accessibility to community facilities in the area including those in St Neots, Eynesbury and Eaton Socon. Accordingly, is anticipated to have a potential significant beneficial effect in relation to vehicular users accessing community resources.

12.6.2. The Scheme may potentially enhance driver views along the A428 and will provide new viewing opportunities for journeys made along the new dual carriageway, which may have a potential beneficial effect.

Walkers, Cyclists and Horse Riders

12.6.1. The provision of new and realigned PRoWs is expected to have effects on journey times and local travel patterns.

12.6.2. Appropriate provisions for WCHs are being incorporated into the design of the Scheme, with the objectives of enabling safe crossing of the new dual carriageway and maintaining existing connectivity between PRoW, local roads and communities.

12.6.3. Subject to finalisation of the design, the provision of these facilities has the potential to generate some beneficial effects, some of which could be significant.

Land Use

12.6.1. There are unlikely to be any new or additional effects regarding the loss of land during Scheme operation, as there will be no requirement for further land from any residential or commercial properties, community facilities or agricultural land.

Human Health

12.6.2. The Scheme will provide additional capacity and improve accessibility to local centres where a number of healthcare facilities and social infrastructure are located. Improved access to these services facilitated is assessed to have a positive effect on the human health of residents in the study area.

12.6.3. The provision of appropriate PRoWs, footpaths and crossings will enable WCHs to access natural spaces within the study area. The Scheme is therefore anticipated to have a positive effect on the human health of residents in the study area.

12.6.4. The Scheme will result in improvements to traffic congestion, and will result in the redistribution of traffic, including moving traffic away from the A428 and onto the new dual carriageway. Some receptors located along the A428 are anticipated to experience improved air quality, and potential reductions in noise levels. Such effects are likely to be beneficial to human health. Conversely, traffic relocated onto the new dual carriageway will introduce a new source of air emissions and noise to the local area. As such, the Scheme has the potential to result in increases in traffic noise levels at some sensitive receptors; however, at this stage of the assessment it is considered very unlikely that air pollutant concentrations will increase sufficiently to exceed the air quality objective values for either NO_2 or PM_{10}. Accordingly, it is considered unlikely that the Scheme will contribute to a significant worsening of air quality at sensitive receptors either locally or regionally.

12.6.5. Operation of the Scheme is anticipated to improve accessibility to local employment and training opportunities with indirect benefits on mental health and well-being. The Scheme will help to support planned economic and housing growth in Cambridge and the surrounding area, and will also reduce congestion, delay and improve journey time reliability between Bedford and Cambridge, thereby improving accessibility to jobs in these areas. The influence of the Scheme on access to work and training as a determinant of health is therefore assessed to be positive for residents in the study area.

12.6.6. Scheme operation will reduce community severance through improved links between Cambridge and Bedford, as well as improve connections to St Neots and other smaller settlements. Traffic congestion will be reduced, allowing residents of surrounding villages to have improved access to neighbouring settlements and community resources. This will represent a substantial benefit in relation to encouraging social cohesion. Whilst levels of social interaction can be influenced by other factors (for example the availability and quality of community facilities, open and play space), the influence of the Scheme on social cohesion and lifetime neighbourhoods as a determinant of human health is assessed to be positive for residents in the study area.

12.6.7. Compared to the existing A428, the Scheme is anticipated to have an improved resilience to climate change given the provision of effective and maintained drainage systems and lighting systems and other measures; however, at this stage it is considered that with appropriate mitigation, the effects upon climate change as a determinant of human health are anticipated to be neutral.

12.6.8. The final outcomes of the likely significant effects of the Scheme on population and health will be reported within the Environmental Statement.

13. ROAD DRAINAGE AND THE WATER ENVIRONMENT

13.1. Introduction

13.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on road drainage and the water environment, which considers:

a. surface water;

b. groundwater;

c. flood risk; and

d. hydromorphology.

13.2. Approach to the Assessment

Scope and Methods

13.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the road drainage and the water environment assessment, and the approach and methods to be followed.

13.2.2. The Scoping Report [REF 13-1] 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 Scheme on road drainage and the water environment.

13.2.3. Following receipt of the Scoping Opinion [REF 13-2] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing road drainage and the water environment assessment:

a. Identification of the potential effects of the Scheme on any Water Framework Directive (WFD) waterbodies with potential hydrological connectivity, where significant effects are likely.

b. Inclusion of evidence regarding Elsworth Wood Site of Special Scientific Interest (SSSI) and why it is not considered responsive to changes in groundwater, and evidence of why it has no hydrological connectivity to the Scheme.

c. Inclusion of any flood compensation areas and surface water drainage features within the Development Consent Order (DCO) site boundary.

d. Acknowledgement of the Environment Agency's advice with regard to drainage design to ensure this is sufficiently developed to support the assessment of likely significant effects, with efforts made to discuss and agree these details with relevant consultees.

e. Inclusion of evidence as to how the Scheme will discharge surface water from the new dual carriageway, with any works illustrated on accompanying plans.

Legislation and Policy

13.2.4. The road drainage and the water environment assessment is being undertaken in accordance with the National Policy Statement for National Networks (NPSNN) [REF 13-3].

13.2.5. Details of how the road drainage and the water environment assessment will meet the requirements of the NPSNN [REF 13-3] in relation to assessing the potential impacts of flooding and on water quality are presented within the Scoping Report [REF 13-1].

13.2.6. The Scoping Report [REF 13-1] also details how other legislation and policy relating to road drainage and the water environment is being taken account of in the assessment.

Consultation

13.2.7. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the road drainage and the water environment assessment, the results of which are presented within the Scoping Opinion [REF 13-2].

13.2.8. Consultation will continue with the Environment Agency to identify any water related licences, consents and permits that may be required for construction and operation of Scheme.

13.2.9. Engagement will also continue with the Environment Agency, Lead Local Flood Authorities, Anglian Water, the Bedford group of internal drainage boards, and other organisations to confirm the following:

a. Modelling and assessment assumptions.

b. Allowable discharge rates.

c. Flood risk and floodplain compensation.

d. Climate change allowances.

e. Impacts on local land drains.

Limitations and Assumptions

13.2.10. 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 Scheme and the maximum likely extents of land required for its construction and operation.

13.2.11. It has not been possible at this stage to undertake a quantitative assessment of the potential effects if highway runoff and spillage risk on receiving watercourses, or the assessment of the risks of any changes to surface water catchment areas or groundwater flows. These assessments will be included in the impact assessment presented in the Environmental Statement.

13.2.12. The findings of this preliminary assessment may be subject to change as the design of the 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.

Study Area

13.2.13. The study areas for the road drainage and the water environment assessment comprise the following.

<u>Water Quality</u>

13.2.14. A study area of approximately 1 kilometre around the Development Consent Order (DCO) site boundary has been adopted to identify surface water and groundwater bodies that could reasonably be affected by direct impacts associated with the Scheme.

13.2.15. As watercourse flow and quality impacts may propagate downstream through hydrological connectivity, where relevant the assessment has also considered a wider study area of up to 2 kilometres downstream of the DCO site boundary to ensure that all possible water body attributes are accounted for in the assessment of water body importance.

Flood Risk

13.2.16. As flood risk impact can impact upstream and downstream, the assessment has considered a wider study area (where relevant), with professional judgement applied to identify the extent to which such features require consideration. Accordingly, the study area comprises flood zones [REF 13-4] along watercourses that may be affected by the Scheme (which are designated based on the annual probability of a flood event to occur).

13.3. Baseline Conditions

Information Sources

13.3.1. The following sources and types of information have been used in the assessment:

a. Environment Agency data and records relating to catchments, pollution incidents, licensed abstractions and flood zones.

b. Information published by the British Geological Survey and other sources relating to groundwater and its protection.

c. Information on the distribution and profile of soils.

d. Information on designated sites of ecological value that are water dependent.

13.3.2. The assessment has also been informed by site-based observations and water quality sampling which have been undertaken to establish the baseline conditions.

Surface Water

13.3.3. Surface water features within the 1 kilometre study area or within the wider 2 kilometre study area (where there is direct downstream hydrologic connectivity) that have been identified through a review of relevant data and field survey are presented in **Table 13-1**.

13.3.4. The locations of these features are illustrated on Figure 13.1 within Volume 2.

Table 13-1: Surface Waterbodies within the Study Area

Watercourse	Main River/Ordinary Watercourse	WFD Reportable Reach (where applicable)
River Great Ouse	Main River	Ouse (Roxton to Earith) – GB105033047921
River Ivel	Main River	Ivel (DS Langford to Roxton) – GB105033038170
River Kym	Main River	Kym -GB105033043270
Hen Brook	Main River	Abbotsley and Hen Brooks – GB105033043240
Fox Brook	Main River	Not designated – tributary of Hen Brook
West Brook	Main River	West Brook – GB105033042730
Begwary Brook	Ordinary Watercourse	Begwary Brook – GB105033043230
Stone Brook	Ordinary Watercourse	Stone Brook – GB105033038190
Wintringham Brook	Ordinary Watercourse	Not designated – tributary of Fox Brook
Rockham Ditch	Ordinary Watercourse	Not designated – tributary of River Great Ouse
Duloe Brook	Ordinary Watercourse	Duloe Brook – GB105033043260
Bourn Brook	Ordinary Watercourse	Bourn Brook – GB105033042690
Colmworth Brook	Ordinary Watercourse	Colmworth Brook – GB105033043220
South Brook	Ordinary Watercourse	Not designated – tributary of River Great Ouse

Watercourse	Main River/Ordinary Watercourse	WFD Reportable Reach (where applicable)
Gallow Brook	Ordinary Watercourse	Not designated – tributary of River Great Ouse
Upstream unnamed tributaries of above watercourses	Ordinary Watercourses	Situated across the various WFD catchments in the study area
Field drains and ditches	Ordinary Watercourses	Situated across the various WFD catchments in the study area
Several small ponds including ponds at Begwary Brook Nature Reserve	n/a	Situated across the various WFD catchments in the study area

13.3.5. The Environment Agency's Catchment Data Explorer website [REF 13-5] indicates that the study area is contained within the Anglian River Basin District, Ouse Upper and Bedford Management Catchment, and Great Ouse Lower Operational Catchment.

13.3.6. There are ten WFD waterbodies within the study area. Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses.

13.3.7. Within the catchments of the WFD waterbodies outlined in **Table 13-1**, there are also a number of named watercourses which are described in **Table 13-2**.

13.3.8. In addition to the watercourses described in **Table 13-1** and **Table 13-2**, there are numerous field drains and ditches in the study area which are predominantly for agricultural drainage. They do not have nature conservation designations and have minimal social and economic use. Numerous ditches of this type have been observed within the study area, and they are typically of the order of 0.5 – 1m in width, ephemeral (i.e. flowing for only part of the year or only after storms), overgrown with vegetation, have with heavily incised channels due to over-deepening for land drainage, and therefore generally do not support functional flows (i.e. flows with the ability to erode, transport and deposit sediment resulting in the formation of geomorphic bedforms).

13.3.9. Significant named watercourses in the study area that are not WFD designated are presented in **Table 13-3**.

Table 13-2: Water Framework Directive Surface Waterbodies

Waterbody	Ecological Potential	Chemical Status	Overall Target Objective	Hydro-morphological Designation	Designated Reach	Site Observation (29-11-17)
Ouse (Roxton to Earith) – GB105033047921	Moderate	Good	Moderate by 2015 (due to unfavourable balance of costs and benefits and disproportionate burdens)	Heavily modified	This reach of the River Great Ouse is designated from southeast of Roxton (TL 16067 53497). It flows north through St Neots and beyond to Godmanchester before flowing in an easterly direction towards Earith (TL 38856 74783). This WFD reach is 49.3km long and has a catchment area of 162.9km^2. It is crossed by the Scheme at TL 16781 55351.	The watercourse was visited at the proposed crossing location. It is around 20m width at this point, with the quarry site to the west and the fallow fields to the east. The east bank is noticeably higher than the west bank in terms of elevation. The channel was very turbid, carrying a high abundance of fine sediment. Flow was very low, such that the watercourse resembled a canal. There were some patches of floating macrophyte vegetation and Himalayan balsam was observed in the riparian zone.

Waterbody	Ecological Potential	Chemical Status	Overall Target Objective	Hydro-morphological Designation	Designated Reach	Site Observation (29-11-17)
Abbotsley and Hen Brooks – GB105033043240	Moderate	Good	Moderate by 2015 (due to disproportionate burdens, background condition and no technical solution being available).	Heavily modified	This waterbody is designated from its source east of Waresley (TL 26435 53975) and flows in a westerly direction to meet the River Great Ouse in St Neots at (TL 18147 60088). The watercourse is 12.9km long and has a catchment area of 58.05km^2. It is crossed by the Scheme at TL 19949 58656.	Hen Brook was visited to the east of the existing A428 crossing. Here the channel was 2m wide and 25cm deep at low flow. The bed was predominantly covered with fine sediment with some very fine gravel in patches. There are steep banks of around 2-3m up to the surrounding arable fields, giving poor connectivity to the floodplain. Flow is impeded in several places to create ponding. There are some submerged macrophytes and a surface scum indicative of organics. The crossing beneath the A428 is a box culvert of around 5m width. Flow backs up upstream of the culvert creating a ponded area 0.5-0.7m deep at the time of the visit. Downstream of the culvert there is an abundance of emergent reed vegetation which is filtering out fine sediment to some extent. The channel narrows back to around 2m wide and flow is increased in this narrower section.

Waterbody	Ecological Potential	Chemical Status	Overall Target Objective	Hydro-morphological Designation	Designated Reach	Site Observation (29-11-17)
West Brook – GB105033042730	Moderate	Good	Moderate by 2015 (due to unfavourable balance of costs and benefits. Action to get biological element to good will have significant adverse effect on use)	Heavily modified	Forms from the coalescence of numerous agricultural ditches approximately 4.5km north of the eastern extent of the Scheme at Papworth St Agnes (TL 26314 64772). It then flows northwest for 8.45km to meet the River Great Ouse at TL 32074 69839. It has a catchment area of 51.5km^2. This waterbody is hydrologically connected to the Scheme via upstream ditches and tributaries.	To be visited as part of the full impact assessment.
Stone Brook – GB105033038190	Moderate	Good	Moderate by 2015 (due to disproportionate burdens, background condition and no technical solution being available).	Heavily modified	This waterbody is designated from its source northeast of Sandy at TL 18391 49664 and flows in a northerly direction to meet the River Great Ouse to the east of Roxton (TL 16724 55185). It is 7.96km long and has a catchment area of 21.2km^2. The watercourse is not directly crossed by the Scheme but falls within the DCO site boundary.	To be visited as part of the full impact assessment.
Begwary Brook – GB105033043230	Good	Good	Good by 2015	Heavily Modified	This waterbody is designated from its source north of Duck's Cross (TL 11086 56911) and flows east for 6.5km to meet the River Great Ouse to the east of Wyboston (TL 16755 56527). It is 6.5km in length and 4.59km^2. The watercourse is directly crossed by a proposed access track for the Scheme at TL 16320 56511.	To be visited as part of the full impact assessment.

Waterbody	Ecological Potential	Chemical Status	Overall Target Objective	Hydro-morphological Designation	Designated Reach	Site Observation (29-11-17)
Bourn Brook – GB105033042690	Moderate	Good	Moderate by 2015	Heavily Modified	This waterbody is designated from its source southeast of Eltisley (TL 27575 59360) and flows southeast to meet the Cam at TL 43545 54654. It is 25.8km in length and has a catchment of 85.5km^2. This waterbody will not be crossed by the Scheme but is located within 500m of the DCO site boundary.	To be visited as part of the full impact assessment.
Ivel (DS Langford to Roxton) – GB105033038170	Moderate	Good	Moderate by 2015	Heavily Modified	This waterbody is designated from the west of Henlow (TL 18405 38656) and flows north to meet the River Great Ouse at TL 16079 53483. It is 19.65km in length and has a catchment of 43.57km^2. This waterbody will not be crossed by the Scheme but is located within 1km of the DCO site boundary.	This watercourse is upstream of any works and so is scoped out of further assessment.
Duloe Brook – GB105033043260	Moderate	Good	Moderate by 2015	Not designated artificial or heavily modified	This waterbody is designated from northeast of Duloe (TL 16377 61173) and flows southeast to meet the River Great Ouse at TL 17558 59259. It is 2.6km in length and has a catchment of 17.39km^2. This waterbody will not be crossed by the Scheme but is located within 1km of the DCO site boundary.	This watercourse is upstream of any works and so is scoped out of further assessment.

Waterbody	Ecological Potential	Chemical Status	Overall Target Objective	Hydro-morphological Designation	Designated Reach	Site Observation (29-11-17)
Kym - GB105033043270	Moderate	Good	Moderate by 2015	Heavily modified	This waterbody is designated from the west of Great Staughton and flows in a southeasterly direction to meet the River Great Ouse at TL 18160 61534. It is 13.95km in length and has a catchment of 30.078km^2. This waterbody will not be crossed by the Scheme but is located within 1km of the DCO site boundary.	This watercourse is upstream of any works and so is scoped out of further assessment.
Colmworth Brook – GB105033043220	Poor	Good	Poor by 2015	Not designated artificial or heavily modified	Colmworth Brook forms from the coalescence of several agricultural ditches to the west of Colmworth (TL 08836 58675). It flows in a generally easterly direction to meet the River Great Ouse at TL 17408 58834. It is 7.4km long and has a catchment of 22km^2. The watercourse will not be crossed by the Scheme but is located within 1km of the DCO site boundary.	This watercourse is upstream of any works and so is scoped out of further assessment.

Table 13-3 Significant Named Watercourses in the Study Area (Not WFD Designated)

Name	Tributary of	Watercourse Description	Site Observations (29/11/17)
Rockham Ditch	River Great Ouse	Rockham Ditch rises east of Roxton at (TL 13412 53847) and flows in a generally northeast direction to the north of Roxton before flowing east to meet the River Great Ouse at TL 16334 54885. It has an approximate length of 4.01km. There are to be two crossings of the Rockham Ditch by the Scheme at TL 15346 55311 and TL 15996 54927. There are also existing crossings at these locations which may be upgraded.	Rockham Ditch was observed downstream of its culverted crossing of the Bedford Road. At this location the watercourse was approximately 1m wide with steep banks rising 2-3m in height to the surrounding fields, resulting in poor floodplain connectivity. The watercourse is artificially straight. Water depth at the time of the site visit was 2-3cm. There was a small amount of gravel (2-3cm diameter) and some accumulations of fine sediment. The ditch was largely overgrown with vegetation including brambles and nettles. The channel was much larger upstream of the culvert, being around 3m wide and 20cm deep. This suggests that flow is being impeded by the culvert leading to pooling upstream. The watercourse was also visited between the large culvert beneath the A1 on the periphery of the Black Cat Quarry and its confluence with the Great Ouse (around 500m downstream of the large culvert). The A1 culvert was a circular, concrete culvert of around 1.5m diameter. There was very little distinguishable flow through the culvert and it was full of fine sediment, with a significant amount of emergent macrophyte vegetation growing in the channel immediately downstream.
South Brook	River Great Ouse	South Brook forms from the coalescence of various ditches close to Lady Wood, between the villages of Roxton and Wilden (TL 12640 54759). It flows towards the northeast and discharges into the River Great Ouse to the east of Chawston at TL 16915 55774. It has an approximate length of 5.09km. The watercourse is crossed by the Scheme at TL 16202 55829 and TL 16291 55792.	South Brook was visited adjacent to the existing A1 crossing. It flows beneath the A1 through a box culvert of approximately 50m length and 3m width. Immediately downstream of this the culvert the watercourse is 5-6m wide but narrows to 4m width further on. It has a section of solid concrete bed at this location, is artificially straightened, shows evidence of dredging and has steep banks of up to 2m to the surrounding land, causing poor floodplain connectivity. There is a significant amount of emergent macrophyte vegetation. There are road outfalls entering the stream here from the A1. There was a small amount of gravel visible on the bed, and little fine sediment. Around 100m downstream of the A1 culvert the channel narrows to 2.5-3m in width. It is overwide but with narrower reaches leading to some patches of faster flow, with flow otherwise generally being extremely slow.

Name	Tributary of	Watercourse Description	Site Observations (29/11/17)
Fox Brook	Hen Brook	Fox Brook rises as an agricultural ditch to the north of Weald (TL 23374 60184) and takes a westerly course towards St Neots, where it discharges into Hen Brook (TL 18557 60060) shortly upstream of the River Great Ouse. Fox Brook is approximately 5.4km long. There is a proposed crossing of the watercourse at TL 22870 60254.	Fox Brook was observed north of the A428 where it is proposed to be crossed. Here it is culverted beneath a public bridleway. There was no flow at this location with the channel consisting of a series of small ponded areas. The channel is around 1m width and was at 4-5cm depth where ponded. The bed has accumulations of fine sediment. The watercourse is very straight and is essentially an agricultural ditch at this location. It has deep banks rising around 2m from the bed to the surrounding arable fields. The culvert beneath the bridleway is around 10m length and is a pipe of around 0.5m diameter.
Gallow Brook	River Great Ouse	Gallow Brook forms from the coalescence of several agricultural ditches to the north of Croxton (TL 25499 60457). It flows in a generally westerly direction towards Little Paxton to finally discharge into the River Great Ouse at TL 19504 62323. Gallow Brook is approximately 7.5km long. There are two proposed crossings of Gallow Brook at TL 23716 60694 and TL 24361 60673.	Gallow Brook was observed at the crossing of Toseland Road, where it flows beneath the road through a 0.5m pipe culvert. There is a downstream pool round 5m wide, which then narrows to what is essentially a field drain of around 1m width as it runs through arable land. The depth was only 3-4cm deep at the time of the visit and the bed was covered with fine sediment. The stream is overgrown and only a small trickle of flow was coming through the culvert at the time of the site visit. A road outfall enters the brook through a 0.5m pipe downstream of the culvert and a large amount of sediment has accumulated beneath the outfall. The watercourse is ponded in places due to dams created by woody debris, restricting flow when the prevailing conditions are dry. There was poor connectivity to the surrounding fields with banks rising 1.5-2m from the watercourse.
Wintringham Brook	Fox Brook	Wintringham Brook rises southeast of Croxton at TL 23805 59611. It flows in a generally westerly direction to meet Fox Brook within St Neots at TL 19098 60350. It is approximately 5.5km in length. The watercourse will be crossed by the Scheme at TL 20355 59132.	To be visited as part of the full impact assessment. However, it is expected to have a very similar character to Fox Brook, being essentially a straightened agricultural ditch at the crossing location, which is then heavily culverted through St Neots before meeting Fox Brook.

13.3.10. Based on a review of online digital maps there are numerous ponds (i.e. a still waterbody smaller than 2 hectares and present for at least 4 months each year) and lakes (i.e. permanent still water body greater than 2 hectares) in the study area within the floodplain of the River Great Ouse. The locations of large ponds or clusters of ponds are outlined in **Table 13-4**.

Table 13-4: Surface Water Ponds Within the Study Area

Pond Reference	National Grid Reference	Description
Pond Site 1	TL 1921 5634	Small pond adjacent to Top Farm's property within vegetation.
Pond Site 2	TL2206 5991	Several small ponds within the grounds of residential property, Wintringham Cottages, and north of Wintringham Farm.
Pond Site 3	TL 2336 6017	Small pond that appears to be the source of Fox Brook.
Pond Site 4	TL 2562 6061	Small pond within wooded area.
Pond Site 5	TL 2675 6065	Small pond North of Eltisley/Eversden landfill.
Pond Site 6	TL 2833 6062	Large pond at North East Farm.
Pond Site 7	TL 2997 6069	Small pond present alongside the A428.
Pond Site 8	TL 16859 56132	Two lakes in Begwary Nature Reserve, online to Begwary Brook, shortly upstream of the River Great Ouse.
Pond Site 9	TL 15720 53885	Four large (presumed gravel pit) lakes to the west of Tempsford and the A1, on the floodplain of the River Great Ouse.
Pond Site 10	TL 16713 56742	The southern lakes (former gravel pits) within the Wyboston Lakes Training and Events Centre (including golf course) fall within the study area.
Pond Site 11	TL 15124 56558	Two lakes adjacent to Roxton Road at the periphery of the study area.
Pond Site 12	TL 19285 55104	Small pond in the grounds of Hill's Farm.
Pond Site 13	TL 19334 57761	Small pond in the grounds of Rectory Farm.
Pond Site 14	TL 20385 58441	Small pond surrounded by trees, adjacent to Hen Brook.
Pond Site 15	TL 20979 57617	Small pond in the grounds of Lanbury Farm.
Pond Site 16	TL 21560 59052	Two small ponds in the grounds of Lower Wintringham Farm.
Pond Site 17	TL 22935 59578	Numerous small ponds around Weald Farm.
Pond Site 18	TL 23570 59635/TL 23902 59399	Two small ponds east of the village of Weald.
Pond Site 19	TL 24676 59632	Four small ponds in the village of Croxton (two are named as Mill Dole Pond and White Gate pond).
Pond Site 20	TL 26896 59659	Four small ponds in the village of Eltisley.
Pond Site 21	TL 27686 59331	Large pond adjacent to Caxton End.
Pond Site 22	TL 27713 61238	Three small ponds at Papley Grove Farm.
Pond Site 23	TL 28744 60803	Small pond at Pembroke Farm.
Pond Site 24	TL 29021 60604	Small pond north of Pastures Farm.
Pond Site 25	TL 30456 60226	Small pond at Swansley Wood Farm.

13.3.11. Ecological surveys (see Chapter 8) have identified that a number of existing ponds within and surrounding the DCO site boundary are known to contain Great Crested Newt (GCN) and contain features which are important for biodiversity.

Groundwater

13.3.12. The British Geological Survey's Geology of Britain Viewer website [REF 13-6] indicates that the solid geology within the study area consists of Jurassic age strata, with the western section underlain by the Oxford Clay Formation (mudstone) and the eastern section underlain predominantly by the West Walton Formation and Ampthill Clay Formation (undifferentiated).

13.3.13. The Oadby Member (Diamicton) is the main superficial deposit present beneath most of the study area. Alluvium, Head and River Terrace Deposits are present near Black Cat roundabout, particularly in the lowland areas of the floodplain of the River Great Ouse and its tributaries, Hen Brook and Abbotsley Brook.

13.3.14. Data on the MAGIC Map website [REF 13-7] indicates that the bedrock is formed of unproductive strata (these being geological strata with low permeability and negligible significance for water supply or river base flow). The majority of the superficial deposits are designated as a secondary (undifferentiated) aquifer, with the river terrace and alluvial deposits designated as Secondary A aquifer (these being permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers). Secondary (undifferentiated) aquifers are assigned in cases where it has not been possible to attribute either category A or B to a rock type.

13.3.15. Cranfield University's Soilscapes website [REF 13-8] indicates that the majority of the study area (with the exception of the floodplain of the River Great Ouse) is underlain by lime-rich loamy and clayey soils with impeded drainage. The floodplain of the River Great Ouse is underlain by freely draining slightly acid loamy soils.

13.3.16. Environment Agency data [REF 13-5] confirms that the study area is not underlain by a WFD designated groundwater body.

13.3.17. There are no groundwater source protection zones in the study area and the Scheme does lie within a drinking water safeguard zone for groundwater. However, it is within a drinking water safeguard zone and protected area for surface water [REF 13-5].

Abstractions

13.3.18. The Environment Agency has provided data (January 2019) on the locations of licenced water abstractions, the details of which are presented **Table 13-5** and are illustrated on Figure 13.1 within Volume 2.

Table 13-5: Groundwater and Surface Water Abstractions (Environment Agency)

Ref	Licence Holder	NGR	Licence Number	Type of Use	Annual Quantity (m^3)	Surface/ Groundwater
A1	Mr F Keegan	TL 1586 5615	6/33/20/* G/0031	Spray Irrigation – Direct	6,165	Ground Water
A1	Mr F Keegan	TL 1586 5615	6/33/20/* G/0031	General Farming & Domestic	518	Ground Water
A2	S A Merton-Jones & R Merton-Barrett	TL 165 568	6/33/20/* G/0039	Spray Irrigation – Direct	248	Ground Water
A2	S A Merton-Jones & R Merton-Barrett	TL 165 568	6/33/20/* G/0039	General Farming & Domestic	116	Ground Water
A2	S A Merton-Jones & R Merton-Barrett	TL 164 566	6/33/20/* G/0039	General Farming & Domestic	90.92	Ground Water
A2	S A Merton-Jones & R Merton-Barrett	TL 164 566	6/33/20/* G/0039	General Farming & Domestic	90.92	Ground Water
A3	E Wootton	TL 1525 5660	6/33/20/* G/0134	Spray Irrigation – Direct	10,274	Ground Water
A3	E Wootton	TL 1525 5660	6/33/20/* G/0134	General Farming & Domestic	45.5	Ground Water
A4	Huntingdon District Council	TL 20245 62860	AN/033/0 022/001	General Use Relating To Non-Remedial River/Wetland Support	19,630	Ground Water
A5	Bates Bros (Farms) Ltd	TL 174 586	6/33/20/*S /0013	Spray Irrigation – Direct	39,778	Surface Water (River Ouse)
A5	Bates Bros (Farms) Ltd	TL 174 586	6/33/20/*S /0013	Spray Irrigation – Direct	13,638	Surface Water (River Ouse)
A5	Bates Bros (Farms) Ltd	TL 16162 54408	6/33/20/*S /0013	Spray Irrigation – Direct	13,638	Surface Water (River Ouse
A5	Bates Bros (Farms) Ltd	TL 16372 54862	6/33/20/*S /0013	Spray Irrigation – Direct	13,638	Surface Water (River Ouse)
A6	E Wootton & Sons	TL 154 567	6/33/20/*S /0052	General Use Relating To Industrial, Commercial And Public Services	909	Surface Water (Begwary Brook)
A7	S A Merton-Jones & R Merton-Barrett	TL 1670 5675	6/33/20/*S /0069	Spray Irrigation – Direct	455	Surface Water (Stream at Wyboston)
A8	RWE Generation UK PLC	TL 18142 57667	6/33/20/*S /0116	Evaporative Cooling	6,100,000	Surface Water (Great Ouse)
A8	RWE Generation UK PLC	TL 18142 57667	6/33/20/*S /0116	Process Water (Production of Energy)	150,000	Surface Water (Great Ouse)

Ref	Licence Holder	NGR	Licence Number	Type of Use	Annual Quantity (m^3)	Surface/ Groundwater
A9	Chawston Irrigation Management	TL 17008 56011	6/33/20/*S /0131/R01	Spray Irrigation – Direct	60,000	Surface Water (Great Ouse)
A10	Eaton Socon Hydro Limited	TL 17341 58755	AN/033/0 020/001	Hydroelectric Power Generation	76,032,000	Surface Water (Eaton Socon Mill Leat)

13.3.19. The majority of abstractions relate to agricultural use such as direct spray irrigation. Other abstraction uses include hydroelectric power generation and use in unspecified industrial, commercial and public services. Annual consented abstraction quantities range from 90 to 76,032,000m^3.

13.3.20. Details on private water supplies will be obtained from local authorities at the full impact assessment stage.

Water Activity Permits

13.3.21. The Environment Agency has provided data indicating that there are 17 active water activity permits (formerly known as discharge consents), the details of which are presented in **Table 13-6** and are illustrated on Figure 13.1 within Volume 2. The receiving watercourses are also listed in **Table 13-6**.

Table 13-6 Active Discharge Consent Data (Environment Agency)

Ref	Number	NGR	Holder	Discharge Type	Receiving Waters
D1	AWCNF11485	TL2448060040	Abbotsley Road Pumping Station	Pumping Station on Sewerage Network	Ditch (tributary of Hen Brook)
D2	PRCNF05022	TL2335060180	North Farm	Domestic property (single) (inc. farm house)	Fox Brook
D3	PRCNF14832	TL2447560185	Whitehall Farm	WwTW (not water co) (not STP at a private premises)	Ditch (tributary of Gallow Brook)
D4	PRCNF17425	TL2446860208	Cambridgeshire Chemicals	WwTW (not water co) (not STP at a private premises)	Ditch (tributary of Gallow Brook)
D5	EPRKP3822XC	TL2734059344	Manor Farm	Domestic property (single) (inc. farm house)	Ditch (tributary of Eastern Brook)
D6	AW1NF286	TL3000060000	Pumping Station Conington	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of Eastern Brook)
D7	GWCLF30367	TL1930057700	Brook End Farm	Farms (not house)/Crop + Animal Rearing/Plant Nursery	Ditch (tributary of Hen Brook)

Ref	Number	NGR	Holder	Discharge Type	Receiving Waters
D8	AWCNF11477	TL2759059390	Caxton Road Pumping Station	Pumping Station on Sewerage Network (water company)	Ditch (tributary of Eastern Brook)
D9	AWCNF1223	TL1662154577	Tempsford Water Recycling Centre	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of Stone Brook)
D10	AWCNF11935	TL1551754586	Roxton (School Lane) Pumping Station	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of River Great Ouse)
D11	EPRHP3724GA	TL1607655348	Black Cat Roundabout	Mineral/Gravel Extraction/Quarrying	Ditch (tributary of River Great Ouse)
D12	PRCLF14267	TL1599055520	Shell Fortune	Shop incl Garden Centre/Retail Trade (not Motor Vehicle)	Ditch (tributary of River Great Ouse)
D13	PRCNF01483	TL1601055880	Bridge Farm	WwTW (not water co) (not STP at a private premises)	South Brook
D14	AW1NF950	TL1650056300	Chawston STW	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of River Great Ouse)
D15	AW1NF462A	TL1800057100	Little Barford STW	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of River Great Ouse)
D16	PRCNF05375	TL1809057510	Little Barford Power Station	WwTW (not water co) (not STP at a private premises)	River Great Ouse
D17	AW1NF2721	TL1540354356	Roxton STW	WwTW/Sewage Treatment Works (water company)	Ditch (tributary of River Great Ouse)

13.3.22. The vast majority of consented discharges are from pumping stations and sewage treatment works, both from sewerage undertakers and from domestic properties. There are also consented discharges relating to plant nurseries, quarrying and a retail site.

Pollution Incidents

13.3.23. The Environment Agency has provided data on pollution incidents. For the period 2013-2018 there were 12 pollution incidents of Category 3 (minor) relating to the water environment, the details of which are presented in **Table 13-7** and are illustrated on Figure 13.1 within Volume 2. The receiving watercourses are also listed in **Table 13-7**.

13.3.24. All recorded incidents are minor and are not expected to have had long term consequences on receiving watercourses.

Table 13-7 Pollution Incident Data (Environment Agency)

Ref	Notification ID	NGR	Pollutant	Cause of incident	Probable Receiving Waters
P1	1102821	TL 287 624	Oils and Fuel	Vandalism	Ditch upstream of West Brook
P2	1329084	TL 278 604	Oils and Fuel (diesel)	Road Traffic Accident	Ditch upstream of West Brook
P3	1419815	TL 162 537	Sewage Materials (crude sewage)	Sewer Failure or Overflow	Tributary immediately upstream of River Great Ouse
P4	1117088	TL 162 537	Sewage Materials (crude sewage)	Unauthorised Discharge or Disposal	Ditch upstream of River Great Ouse
P5	1368452	TL 154 541	Sewage Materials (final effluent)	Abnormal Process Operation	Ditch upstream of River Great Ouse
P6	1466405	TL 167 545	Sewage Materials (final effluent)	Other	Stone Brook
P7	1465101	TL 164 561	Sewage Materials (final effluent)	Control Measure Failure	Ditch upstream of Begwary Brook
P8	1542815	TL 164 562	Oils and Fuel	Other Fire	Begwary Brook
P9	1146018	TL 183 566	General Biodegradable Materials and Wastes (algae)	Algal Activity	Ditch upstream of River Great Ouse
P10	1515310	TL 184 576	Inorganic Chemicals/Products	Control Measure Failure	River Great Ouse
P11	1351786	TL 154 541	Sewage Materials (crude sewage)	Septic Tank or Sewage Treatment Plant Failure	Ditch upstream of River Great Ouse
P12	1455747	TL 154 541	Sewage Materials (final effluent)	Abnormal Process Operation	Ditch upstream of River Great Ouse

Surface Water Quality

13.3.25. A programme of water quality monitoring commenced in September 2017 at points along the following watercourses within the study area which may receive treated road drainage:

a. River Great Ouse.

b. Hen Brook.

c. Fox Brook.

d. Rockham Ditch.

e. South Brook.

f. Gallows Brook.

13.3.26. The water sampling programme has tested for a range of physico-chemical parameters, metals and hydrocarbons that may typically be found in road runoff, the objectives being to establish existing water quality to inform the assessment.

13.3.27. The full findings of the sampling programme will be presented within the Environmental Statement.

13.3.28. Photography taken during the sampling programme are illustrated on Figure 13.2 within Volume 2.

Aquatic Ecology

Fish

13.3.29. Fish survey data was available on the UK Government website [REF 13-9] for the River Great Ouse at Eynesbury (TL1809259686), which is the nearest monitoring point to the Scheme. This location was most recently surveyed in August 2015 and identified eight coarse fish species, specifically 307 roach (*Rutilus rutilus*), 132 bleak (*Alburnus alburnus*), 86 dace (*Leuciscus leuciscus*), 37 silver bream (*Abramis bjoerkna*), seven perch (*Perca fluviatilis*), five common bream (*Abramis brama*), 2 gudgeon (*Gobio gobio*) and 1 ruffe (*Gymnocephalus cernuus*).

13.3.30. Hen Brook was most recently surveyed for fish at Duck Lane in St Neots (TL1857659970) in April 2011, and a single catch sample was overwhelmingly dominated by roach (>10,000). Other coarse fish types identified included Chub (*Leuciscus cephalus*), bleak, dace, gudgeon, perch, pike (*Esox lucius*), rudd (*Scardinius erythrophthalmus*), silver bream, common bream and tench (*Tinca tinca*) were also present at lower numbers.

13.3.31. No fish data was available for the remaining watercourses in the study area. The majority of smaller watercourses in the study area are unlikely to support significant fish populations, with many being ephemeral.

Macroinvertebrates

13.3.32. Macroinvertebrate data has been provided by the Environment Agency for the River Great Ouse at Eaton Socon Mill (TL1757158529), west of Eynesbury, the most recent sample being taken in May 2019. Data from the sample indicated moderate pollution levels.

13.3.33. Data was also provided for Begwary Brook, which was most recently surveyed at Wyboston (TL1637356440) in October 2018. Data from the sample also indicated similar moderate pollution levels to the River Great Ouse.

13.3.34. Data provided for Hen Brook indicates that the most recent survey was undertaken at Cromwell Road, Eynesbury (TL1895159402) in October 2018. Here, the data shows more significant levels of pollution than the River Great Ouse and Begwary Brook.

13.3.35. Data provided for Stone Brook last sampled in October 2016 (sampled at TL1662554596) also indicates substantial pollution pressures.

Macrophytes

13.3.36. Macrophyte survey data was provided by the Environment Agency for Begwary Brook, Hen Brook and Stone Brook.

13.3.37. The latest sample for Begwary Brook was collected near Top Farm at TL1504456652 in June 2013 and indicated nutrient-enriched waters.

13.3.38. Data provided for Stone Brook (TL1662554596) and Hen Brook (TL1895159402) was collected in September 2013 and July 2016 respectively, and both indicated nutrient enrichment which is likely to be driven in part by the surrounding agricultural land uses, including probable widespread use of fertilisers.

Diatoms

13.3.39. Diatom survey data was provided by the Environment Agency for Stone Brook, the latest available data for which was collected from Stone Bridge (TL1662554596) in September 2013 and indicated relatively eutrophic conditions (excess nutrients leading to oxygen depletion).

13.3.40. Similar conditions are expected in Hen Brook, Begwary Brook, Gallow Brook, Fox Brook and South Brook given the agricultural nature of their catchments.

Riparian Mammals

13.3.41. Ecological surveys have shown otter to be present on the River Great Ouse, Hen Brook, South Brook and along numerous of the minor unnamed watercourses within the study area (see Chapter 8).

Flood Risk

13.3.42. The UK Government's Flood Risk Map for Planning [REF 13-4] indicates that the majority of the DCO site boundary is predominantly located in Flood Zone 1, which comprises land assessed as having a less than 1 in 1,000 year, or 0.1% Annual Exceedance Probability of fluvial or tidal flooding in any given year. These areas are considered to have a low risk of flooding.

13.3.43. There are higher areas of flood risk within the study area, with areas of Flood Zone 2 and 3 associated with locations where the Scheme will cross the River Great Ouse, Hen Brook, Fox Brook (and its main tributary) and South Brook. Flood Zone 2 is an area of medium risk and is defined as land having between a 1 in 100 (1% AEP) and 1 in 1,000 (0.1% AEP) annual probability of river flooding. Flood Zone 3 is an area of higher risk (i.e. land having a 1 in 100 or greater annual probability of river flooding. These areas are mainly over agricultural land but do also cross into urban areas at the eastern extent of St Neots.

13.3.44. The area of land at potential risk of flooding (Flood Zones 2 and 3) associated with the River Great Ouse is its wide floodplain (aligned north-south through St Neots). The areas at risk of flooding associated with Hen Brook, Fox Brook (and its tributary), Duloe Brook, the River Kym and South Brook are much less extensive.

13.3.45. The UK Government's Flood Risk Mapping [REF 13-4] indicates that the majority of the study area is at 'very low' risk of surface water flooding (less than 0.1% AEP). However,

around all watercourses there are areas at 'high risk' (greater than 3.3% AEP), 'medium risk' (between 1% and 3.3% AEP) and 'low risk' (between 0.1% and 1% AEP). The extent of 'medium' and 'low' risk surrounding these watercourses varies, depending on their size. There are also patches of high, medium and low surface water flood risk within the study area located immediately around ponds and lakes, and existing roads. The latter includes several sections of the A428 that are at 'high risk' of flooding.

13.3.46. There are no identified locations with reports of groundwater flooding within the study area.

13.3.47. The UK Government's Flood Risk Mapping [REF 13-4] indicates that the floodplains of the River Great Ouse and South Brook within the study area fall within the maximum extent of flooding that may result from reservoir failure. The risk of flooding from this source is considered to be low.

13.3.48. Given the rural nature of the study area, the current flood risk from sewers and drains is considered to be low.

13.3.49. The extents of flood zones are illustrated on Figure 13.3 within Volume 2.

Designated Sites of Ecological Importance

13.3.50. Data on the MAGIC Map website [REF 13-7] indicates that there are two ecologically sensitive sites present within the study area. These are:

a. Elsworth Wood SSSI – located 850m from the DCO site boundary, to the north east of Caxton Gibbet roundabout; and

b. St Neots Common SSSI – located 900m from the DCO site boundary, to the north of Wyboston interchange.

13.3.51. Elsworth Wood SSSI comprises mixed deciduous woodland and is not considered to be hydrologically connected to the Scheme nor water dependent.

13.3.52. St Neots Common SSSI is a riverside common holding alluvial grassland and associated ponds, ditches and willow carr which together provide an area of diverse wildlife habitat. This includes a wet grassland type characterised by presence of species including marsh foxtail (*Alopecurus geniculatus*) and floating sweet grass (*Glyceria fluitans*), together with a variety of sedges. The habitat is further enhanced by presence of ponds and ditches which support a good aquatic flora and fauna. There are thriving colonies of toads and frogs, the latter being rare in the county.

13.3.53. Begwary Brook Local Nature Reserve is located within the study area and contains ponds upstream of its confluence with the River Great Ouse, to the east of the A1. The area was once a large marsh fed by the River Ouse, but in the 1960s gravel extraction created a small lake and a series of pools in the small area of marsh which survives today. Willow trees fringe the water's edge. Great burnet, an indicator of old pasture, survives here together with common fleabane and marsh woundwort.

Existing Road Drainage

13.3.54. The Highways England Drainage Data Management System website [REF 13-10] indicates that there are existing road outfalls from the A1 and A428 to watercourses in the study area including Rockham Ditch, South Brook, Begwary Brook, the River Great Ouse, Fox Brook, Hen Brook and to ditches upstream of West Brook. The status of the outfalls to Rockham Ditch, South Brook and Begwary Brook are 'Low Priority', with the status of the outfalls to other waterbodies 'undetermined'.

13.3.55. The only possible soakaways are two 'detention ponds' located to the west and southwest of Black Cat roundabout, which although not classified as soakaways, do appear to have no outfalls.

Importance of Receptors

13.3.56. The key local water resources receptors within the study area are summarised in **Table 13-8**.

Table 13-8: Summary of Important Receptors

Watercourse	Main River/Ordinary Watercourse	WFD Body Catchment	Importance Descriptions
Ouse (Roxton to Earith)	Main River	Ouse (Roxton to Earith) – GB105033047921	High Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015), but also has important navigation requirements. Low Importance for morphology on the basis that it is a heavily modified waterbody that has been substantially affected by past land use, previous engineering works and impacted by navigation.
Ivel (DS Langford to Roxton)	Main River	Ivel (DS Langford to Roxton) – GB105033038170	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime).
Kym	Main River	Kym - GB105033043270	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime).
Hen Brook	Main River	Abbotsley and Hen Brooks – GB105033043240	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential

Watercourse	Main River/Ordinary Watercourse	WFD Body Catchment	Importance Descriptions
			(with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime).
Fox Brook	Main River	Not designated – tributary of Hen Brook	Medium Importance as a tributary of the medium importance WFD designated River Great Ouse. It shows several indicators of pollution (for example elevated nitrates, orthophosphates). Low Importance for morphology as ephemeral, agricultural ditchcourses.
West Brook	Main River	West Brook – GB105033042730	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime).
Begwary Brook	Ordinary Watercourse	Begwary Brook – GB105033043230	High Importance for water quality on the basis of being a WFD designated waterbody that is at Good Ecological Potential (with an objective of Good by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody.
Stone Brook	Ordinary Watercourse	Stone Brook – GB105033038190	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime).

Watercourse	Main River/Ordinary Watercourse	WFD Body Catchment	Importance Descriptions
Wintringham Brook	Ordinary Watercourse	Not designated – tributary of Fox Brook	Medium Importance as an upstream tributary Fox Brook. Low Importance for morphology as an ephemeral, agricultural ditchcourse.
Rockham Ditch	Ordinary Watercourse	Not designated – tributary of River Great Ouse	Medium Importance as a tributary of the medium importance WFD designated River Great Ouse. It shows several indicators of pollution (for example elevated nitrates, orthophosphates, dissolved metals, BOD, COD); Low Importance for morphology as a heavily modified ditchcourse, with incised banks, numerous structures impeding flow and deficiency of bedforms.
Duloe Brook	Ordinary Watercourse	Duloe Brook – GB105033043260	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Status (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is thought to have an artificial, agricultural character upstream and is culverted through St Neots.
Bourn Brook	Ordinary Watercourse	Bourn Brook – GB105033042690	Medium Importance for water quality on the basis of being a WFD designated waterbody that is at Moderate Ecological Potential (with an objective of Moderate by 2015). Low Importance for morphology on the basis that it is a heavily modified waterbody that show numerous signs of intervention (for example straightened channels, heavily incised, ponding around structures and poor flow regime);
Colmworth Brook	Ordinary Watercourse	Colmworth Brook – GB105033043220	Low Importance as a WFD designated waterbody at Poor Ecological Status (and objective of Poor by 2015). Low Importance for morphology due to its probable agricultural ditchcourse character.
South Brook	Ordinary Watercourse	Not designated – tributary of River Great Ouse	Medium Importance as a tributary of the medium importance WFD designated River Great Ouse. It shows several indicators of

Watercourse	Main River/Ordinary Watercourse	WFD Body Catchment	Importance Descriptions
			pollution (for example elevated nitrates, orthophosphates, dissolved metals). Low Importance for morphology as a heavily modified watercourse, with an artificial concrete bed in places, numerous structures impeding flow and deficiency of bedforms.
Gallow Brook	Ordinary Watercourse	Not designated – tributary of River Great Ouse	Medium Importance as a tributary of the medium importance WFD designated River Great Ouse. It shows several indicators of pollution (for example elevated nitrates, orthophosphates). Low Importance for morphology as an ephemeral, agricultural ditchcourse.

13.3.57. In addition to the watercourse receptors identified within the study area, several waterbody receptors were also identified:

a. **GCN Ponds:** High Importance on the basis of containing species protected by law.

b. **Non-GCN ponds:** Low Importance as they are not designated and have minimal social and economic use.

c. **Lakes in Begwary Nature Reserve:** Medium Importance as they are online to the medium importance Begwary Brook and have social and economic importance being part of a local nature reserve.

d. **Groundwater**: Medium Importance in areas where there is superficial secondary A aquifer that may support water supply at a local scale.

13.3.58. The importance of water resource receptors will continue to be reviewed and will be confirmed in the Environmental Statement following further site surveys.

Floodplain Sensitivity

13.3.59. For the construction assessment the key receptor in terms of flood risk are the construction workers present on site, who are considered to be of High Importance. For the operation assessment, the importance is based on understanding of the receptors present within areas at risk of flooding and the existing risk of flooding from all sources.

13.3.60. The floodplain adjacent to the River Great Ouse within the study area includes areas of Flood Zone 2 and 3, and these overlap with, and are adjacent to, between 1 and 100 residential and commercial properties. Therefore, the sensitivity of the floodplain adjacent to the River Great Ouse for impact assessment purposes is considered High.

13.3.61. Similarly, the floodplains of Stone Brook, South Brook, Begwary Brook, Hen Brook, West Brook, Fox Brook and Gallow Brook also feature areas of Flood Zone 2 and 3 which overlap with, or are adjacent to, numerous properties. As such, the sensitivity of these floodplain is considered High. Rockham Ditch and the various agricultural ditches are not associated with Flood Zone 2 or 3 and do not affect property, and so they have floodplains of Low sensitivity.

13.3.62. The sensitivity of non-fluvial forms of flood risk are as follows:

a. Surface Water – mainly Low Sensitivity, with localised areas of Medium and High Sensitivity associated with watercourses and ponds.

b. Flooding from Artificial Sources (Reservoirs) – Low Sensitivity.

c. Flooding from Artificial Sources (Other Artificial Water Bodies) – Low Sensitivity.

d. Flooding from Groundwater – Low Sensitivity.

e. Flooding from Sewers and Water Supply Infrastructure – Low Sensitivity.

13.3.63. Floodplain sensitivity will be reviewed and confirmed in the Environmental Statement.

13.4. Potential Impacts

Construction

13.4.1. Construction activities such as earth works, excavations, site preparation, levelling and grading operations result in the disturbance of soils. Exposed soil is more vulnerable to erosion during rainfall events due to loosening and removal of vegetation to bind it, compaction and increased runoff rates. Surface runoff from such areas can contain excessive quantities of fine sediment, which may eventually be transported to watercourses where it can result in adverse impacts on water quality, flora and fauna. Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation.

13.4.2. Contamination of surface waters, groundwater and soil could result from leakage and spills of fuels, oils, chemicals and concrete during construction affecting watercourses indirectly via site runoff or directly where works are close to and within a water body. Contamination may reduce water quality and impact aquatic fauna and flora. It may also affect the quality and availability of resource at local points of water abstraction.

13.4.3. Any construction works on the floodplain have the potential to 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 rise in flood risk. Works to construct a new bridge over the River Great Ouse may have impacts on the safe an uninterrupted navigation along the waterway.

Operation

13.4.4. During Scheme operation the following water environment impacts may occur:

a. Impacts on surface water or groundwater quality from highway runoff (including the use of de-icing materials) or as a result of accidental spillages.

b. Changes in the topography or the creation of cuttings that may have a subsequent impact on surface water drainage patterns and groundwater flows resulting in changes in the base flow of rivers and water levels in ponds.

c. Potential increase in volume and rate of surface water runoff from new impervious areas, leading to an impact on flood risk, upstream (afflux) and downstream of the Scheme.

d. Hydromorphological impacts including changes to physical form (for example scour effects, culverting a watercourse), hydraulic processes and sediment dynamics (for example constriction of flows, floodplain disconnection, diversions) underpinning habitats in watercourses and their floodplains.

13.4.5. It is possible that improvements to water quality in watercourses in the study area may result from the transfer of traffic from the A428 onto the new dual carriageway, which

will incorporate improved water quality treatments for runoff in comparison to outfalls from the A428.

Maintenance

13.4.6. During the future maintenance of the Scheme, potential impacts could occur as a result of routine inspection and maintenance activities, for example the clearance of drains, periodic carriageway resurfacing and emergency repair works, which could lead to accidental spillages and pollution events on surface water and groundwater bodies.

13.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

13.5.1. Measures are being incorporated into the Scheme as part of the design-development process, the purpose being to avoid or reduce impacts on water quality and flood risk. Such measures include the following:

a. The channel designs for watercourse crossings and diversions are being informed by the hydromorphological, flood risk and ecological assessments to ensure that existing flow conditions within the channels are maintained. The morphological and ecological functions of these channels are also being taken into account as part of the design-development process, with opportunities for enhancement being identified where feasible.

b. New structures that cross watercourses are being designed to clear span where possible, with no new structures positioned in channels and set back as far as possible from the top of banks.

c. Minimising the number of new surface water outfalls to avoid the need for unnecessary structures.

d. Development of a drainage design strategy (in consultation with the relevant authorities and consultees), incorporating sustainable drainage systems where possible to enable attenuation of surface water flows and provide treatment of runoff.

e. The siting of construction compounds outside of areas at risk of flooding.

f. The inclusion of land within the DCO site boundary to provide floodplain compensation for land within Flood Zone 3 lost to the Scheme.

13.5.2. These measures will serve to mitigate the operational impacts of the Scheme.

Standard Mitigation Measures

13.5.3. In order to avoid, prevent, minimise and reduce such adverse impacts, construction will be undertaken in line with best practice by the contractor. A framework of measures will be set out within an Outline Environmental Management Plan for the Scheme, which will form part of the DCO application.

13.5.4. The contractor will be required to develop these measures into a Construction Environmental Management Plan (CEMP), which will reflect current good construction practices and detail the procedures and methods that must be followed to minimise the potential impacts of construction activities on surface water and groundwater.

13.5.5. The CEMP will include procedures to prevent pollutants entering the drainage system or discharging directly to surface water features or to ground, and will describe the procedures in the event of an environmental emergency, for example a fuel or chemical spillage.

13.5.6. Following completion of Scheme, routine maintenance will be carried out in accordance with good practice guidance for elements including wetlands, sediment tanks, swales, culverts, and road drainage networks (where these form part of the Scheme), in order to reduce the risk of failure or improper function of the drainage system.

13.6. Assessment of Effects

13.6.1. The preliminary assessment indicates that the following adverse and beneficial effects may arise in relation to road drainage and the water environment.

Surface Water Quality (Construction)

13.6.2. The preliminary drainage designs incorporate new road drainage outfalls to Rockham Ditch, South Brook, Hen Brook, Gallow Brook and ditches upstream of the River Great Ouse, Stone Brook and West Brook). There will be 11 watercourse crossings associated with the Scheme, as well as 11 crossings of ditches, which may require some channel realignment works. All of these outfalls, crossings and any potential channel diversions will require construction within, or in immediate proximity to watercourses, with potential for conveyance of spills and fine sediment to result in indirect impacts on downstream receptors including West Brook and River Great Ouse. Based on the adopted of mitigation measures, the assessment has identified that construction will potentially have neutral to slight adverse effects.

13.6.3. All ponds immediately downslope of construction works may experience temporary adverse effects on water quality through site runoff or spillages. Based on the adoption of mitigation measures, the assessment has identified that such effects are likely to be negligible to slight adverse only.

Surface Water Flow (Construction and Operation)

13.6.4. Construction has the potential to temporarily change the flow regime of Begwary Brook, South Brook, Rockham Ditch, Wintringham Brook, Hen Brook, Fox Brook and Gallow Brook (and numerous agricultural drainage channels that may convey flow to downstream waterbodies such as West Brook) and, to a lesser extent, the River Great Ouse (due to its larger size). Flows may be locally interrupted or caused to spill out of bank by blockages or increases in runoff, which could impede flow and result in localised flooding. These waterbodies are at potential risk as will have new watercourse crossings constructed as part of the Scheme, and all are likely to receive surface water runoff from the area of construction works. Further assessment of these risks is currently being undertaken and will be reported in the Environmental Statement.

13.6.5. In the longer term, construction will result in an additional impermeable area of carriageway draining through to new outfalls. There will also be alterations to the impermeable area draining to several existing outfalls around Black Cat junction and the A428 at the eastern extent of the Scheme between Eltisley and Caxton. The impermeable areas for the Scheme are yet to be established through the assessment; however, due to the increased impermeable area there is the potential for increased surface flows to surrounding watercourses during both construction and operation of the Scheme.

13.6.6. Construction will increase the impermeable area discharging to narrow watercourses with potential for blockages. Based on the implementation of mitigation measures, the assessment has identified that a potential sight adverse effect to surface water flow could potentially be experienced at all surface watercourses during construction, and to those receiving road drainage during operation.

River Morphology (Construction and Operation)

13.6.7. The main morphological effects are expected to be linked to the new watercourse crossings of the River Great Ouse, Begwary Brook, Rockham Ditch, South Brook, Hen Brook, Fox Brook, Gallow Brook, a tributary of West Brook and numerous agricultural ditches. Adverse effects resulting from new structures are likely to include the loss of bed and riparian habitat continuity, shading of the watercourse, and impact to the flow and sediment transport regime through the hydraulic influence of the structures, potentially causing impoundment of water upstream of crossings. Impoundment of flows could also cause deposition of any sediment being carried during elevated flows, preventing transport of such material downstream. This sediment deposition across the stream beds could exacerbate existing fine sediment pressures that cause smothering of stream bed habitats.

13.6.8. As the River Great Ouse crossing comprises a clear span bridge, the assessment has identified that a neutral to slight adverse effect on its morphology.

13.6.9. Currently it is uncertain what form the structures across the smaller watercourses will take, therefore the assessment has assumed a worst case scenario (based on the use of narrow culverts). For the high importance waterbodies (i.e. Begwary Brook) the use of this type of structure will result in a moderate to large adverse effect. For the medium importance waterbodies this will result in a moderate adverse effect, whereas for the low importance agricultural ditches this will result in a slight adverse effect.

13.6.10. A secondary potential morphological impact will be the potential realignment and regrading of various ditches plus minor realignments of larger watercourses to accommodate their proposed crossings. The extent of any realignments remains to be confirmed, but these may involve the loss of and shortening of the channel and corresponding loss of habitat. The realignment and regrading of watercourses and ditches may result in a moderate adverse effect on those of medium importance. The realignment and regrading of low importance agricultural ditches will result in a slight adverse effect. However, it is possible that these effects may become beneficial, subject to further survey, assessment and design.

Groundwater: Flow and Quality (Construction and Operation)

13.6.11. The excavation of cuttings and deep excavations has the potential to intercept groundwater, or perched groundwater levels. Any interaction with the groundwater during construction has the potential to temporarily change the hydraulic gradient in the area of the excavation.

13.6.12. The new dual carriageway includes several areas within cutting, and with the hydraulic gradient likely to be quite shallow in the gently undulating topography, this could intercept groundwater flows and potentially result in a slight adverse effect.

13.6.13. There are no planned discharges to groundwater. Based on the adoption of mitigation measures, a potential neutral to slight adverse effect on groundwater quality is predicted during construction.

Potential Pollution of Surface Watercourses: Routine Road Runoff (Operation)

13.6.14. The Scheme will result in a significant increase in impermeable area of carriageway where pollutants (including hydrocarbons, heavy metals and sediments) can accumulate and be washed into receiving watercourses as routine road runoff.

13.6.15. Surface water from the operational road will drain to new outfalls to Rockham Ditch, South Brook, Hen Brook, Gallow Brook and ditches upstream of the River Great Ouse, Stone Brook and West Brook.

13.6.16. Based on appropriate mitigation measures being incorporated into the design of the Scheme, the assessment has identified that there will potentially be a neutral to slight adverse effect from routine road runoff to receiving waterbodies.

Potential Pollution of Surface Watercourses: De-icing (Operation)

13.6.17. De-icing salt is a potential pollution source from routine highway maintenance as no practical form of treatment can remove salt from carriageway runoff after road salting, and this can potentially affect receiving aquatic ecosystems.

13.6.18. The effects from de-icing will be localised and generally of short duration. This will generally occur during winter periods when fauna and flora may be less sensitive. Given that outfalls are mainly planned to small watercourses (some of which are ephemeral), the assessment has identified that a potential slight adverse effect may arise at these locations. The significance of such effects will be reduced for larger watercourses where salt dilution will be greater.

Potential Pollution of Surface Water: Accidental Spillages (Operation)

13.6.19. The increase in impermeable area from the Scheme has the potential to increase the risk of accidental spillages. The risk of an accidental spillage causing a pollution impact on receiving waterbodies has yet to be undertaken as part of the assessment, as this relies on the availability of traffic data and information on road lengths draining to each outfall.

13.6.20. Notwithstanding this, the risk of pollution from accidental spillages is generally very low, and with the adoption of mitigation measures the potential effects of this are likely to neutral to slight adverse.

Surface Water Ponds: Water Quality (Operation)

13.6.21. For ponds that will not be lost or partly backfilled, there will be limited potential for adverse effects resulting from receiving unclean water from routine highway runoff or accidental spillages (based on all routine highway runoff from operation of the Scheme being directed to watercourses).

13.6.22. The biodiversity assessment has identified that none of the ponds that may suffer direct morphological impacts contain GCN; therefore, the assessment has identified potential for neutral to slight adverse effects on these ponds.

Navigation along River Great Ouse (Construction)

13.6.23. Construction of the bridge over the River Great Ouse has the potential to affect navigation in the river, depending on construction methodologies used. This aspect will be considered in the assessment once all design details are finalised; however, at this stage the assessment has identified that a slight adverse effect on navigation may result.

Flood Risk (Construction and Operation)

13.6.24. Construction and operational activities may pose an increase in flood risk from fluvial, surface water and groundwater sources if not appropriately managed and controlled.

13.6.25. Mitigation will be defined within a Flood Risk Assessment, which is being carried out in parallel to this assessment, which will address the risk of flooding to and from the Scheme from these sources (including future flood risk considering climate change).

13.6.26. Based on the adoption of mitigation measures, the assessment has identified that effects are likely to be neutral.

14. CLIMATE

14.1. Introduction

14.1.1. This chapter presents the preliminary findings of the assessment of the potential effects of the Scheme on climate.

14.1.2. The subject of climate covers three separate elements:

a. **Greenhouse gas (GHG) impact assessment**: the effects on climate of GHG emissions arising from the Scheme, including how the Scheme may affect the ability of Government to meet its carbon reduction plan targets in accordance with National Policy Statement for National Networks (NPSNN) [REF 14-1].

b. **Climate resilience assessmen**t: the resilience of the Scheme to impacts resulting from a changing climate, including how the Scheme's design takes account of the projected impacts of climate change in accordance with NPSNN [REF 14-1] and The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [REF 14-2].

c. **In-combination climate assessment**: the combined effects of a changing climate and the Scheme on the surrounding environment.

14.2. Approach to the Assessment

Scope and Methods

14.2.1. A scoping exercise was undertaken in early 2019 to establish the form and nature of the climate assessment, and the approach and methods to be followed.

14.2.2. The Scoping Report [REF 14-3] 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 Scheme in relation to climate.

14.2.3. Following receipt of the Scoping Opinion [REF 14-4] as to the information to be provided in the Environmental Statement (see Chapter 4), the following requirements have been identified by the Inspectorate which will be taken account of as part of the ongoing climate assessment:

a. Inclusion of a description and assessment (where relevant) of the likely significant effects the Scheme will have on climate, and the vulnerability of the Scheme to climate change.

b. Inclusion of a description and assessment of the adaptive capacity that has been incorporated into the design of the Scheme.

c. Inclusion of an explanation as to any assumptions made about embodied carbon in the anticipated products used, with the expectation that sustainable procurement practices will be implemented, with reference to the assessment of material assets and waste.

d. Demonstration of how the effects associated with the expected land use changes resulting from the Scheme have been assessed.

Legislation and Policy

14.2.4. The climate assessment is being undertaken in accordance with the NPSNN [REF 14-1].

14.2.5. Details of how the climate assessment will meet the requirements of the NPSNN [REF 14-1] in relation to taking account of climate change in the development of the Scheme, providing evidence of the carbon impact of the Scheme, assessing against the Government's carbon budgets and providing evidence of mitigation, are presented within the Scoping Report [REF 14-3].

14.2.6. The Scoping Report [REF 14-3] also details how other legislation and policy relating to climate is being taken account of in the assessment.

Consultation

14.2.7. A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Scheme and the scope of the climate assessment, the results of which are presented within the Scoping Opinion [REF 14-4].

14.2.8. Consultation will be undertaken with the Environment Agency and the relevant local authorities to agree data sets for use in the assessment.

Limitations and Assumptions

14.2.9. 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 Scheme and the maximum likely extents of land required for its construction and operation.

14.2.10. The findings of this assessment may be subject to change as the design of the Scheme is refined through the design-development and consultation processes, and as further research and investigative surveys are completed to fully understand its likely effects.

Study Area

14.2.11. The following study areas have been adopted within the climate assessment.

<u>GHG Impact Assessment</u>

14.2.12. The study area adopted for the GHG emissions assessment covers all direct GHG emissions arising from activities undertaken within the Development Consent Order (DCO) site boundary associated with the construction and operation of the Scheme. It also considers indirect emissions embedded within construction materials arising as result of the energy used for their extraction and production, as well as emissions arising from the transportation of materials, waste and construction workers to and from site.

14.2.13. The GHG study area for the construction phase covers the area of construction works falling within the DCO site boundary. The GHG study area for the operational phase includes both direct emissions arising from energy use within this boundary, and emissions from road users.

<u>Climate Resilience Assessment</u>

14.2.14. The study area adopted for the climate change resilience assessment comprises the DCO site boundary, which captures all highways assets and infrastructure associated with the Scheme (including all temporary works).

In-combination Climate Assessment

14.2.15. The study area for the in-combination climate impact assessment reflects the study area adopted within other environmental topic assessments, where in-combination climate impacts are predicted to occur.

14.3. Baseline Conditions

Information Sources

14.3.1. The following sources and types of information have been used in the assessment:

a. Information relating to the current design of the Scheme.

b. Information and records relating to historic climate data.

c. Data relating to future climate projections for the UK.

GHG Impact Assessment

14.3.2. The baseline for the GHG assessment is currently being established. This will be based on a 'business as usual' scenario (also referred to as the 'do minimum' scenario) whereby the Scheme is not implemented.

14.3.3. There are likely to be GHG emissions from the use and maintenance of the existing road network, including those associated with traffic on the existing A428.

14.3.4. In addition, greenfield land will be acting as a GHG emissions sink. Accordingly, the baseline will include an estimation of the size of this GHG emissions sink so that effects associated with predicted land use changes resulting from the Scheme can be considered in the GHG impact assessment.

In-combination Climate Assessment and Climate Change Resilience Assessment

Current Baseline

14.3.5. Historic climate data obtained from the Met Office website [REF 14-5] recorded at the closest meteorological station to the Scheme (Bedford Weather Station) for the period 1981 – 2010 indicates the following:

a. Average annual maximum daily temperature was 13.9°C;

b. Warmest month on average was July (mean maximum daily temperature of 22.1°C);

c. Coldest month on average was February (mean daily minimum temperature of 0.8°C);

d. Mean annual rainfall levels were 597.6mm;

e. Wettest month on average was October (62.5mm of rainfall on average for the month);

f. Driest month on average was February (36.7mm of rainfall on average for the month);

g. Windiest month on average was January;

h. Least windy month was July.

14.3.6. The Met Office baseline climate averages for the East Anglia region [REF 14-5] identify gradual warming (although not uniformly so) between 1968 and 2017, with slightly

increased rainfall. Information on mean maximum annual temperatures (°C) and mean annual rainfall (mm) is summarised in **Table 14-1**.

Table 14-1: Climate Variations from 1969 to 2018 in the East Anglia Region

Climate Period	Climate Variables	
	Mean Maximum Annual Temperatures (°C)	Mean Annual Rainfall (mm)
1969 – 1978	13.541	567.11
1979 – 1988	13.329	629.52
1989 – 1998	14.299	579.7
1999 – 2008	14.723	663.87
2009 – 2018	14.704	610.65

Future Baseline

14.3.7. The future baseline conditions are expected to differ from those associated with the present day.

14.3.8. UK Climate Projections published in 2018 (UKCP18) have been developed by the UK Climate Impacts Programme (UKCIP) [REF 14-6] to provide projections for future climate scenarios and trends.

14.3.9. The UKCP18 data [REF 14-6] is the most robust source of information on the UK's future climate and provides climate change projections for pre-defined 30-year time slices (for example, 2010 – 2039, 2040 – 2069, and 2070 – 2099) at annual and seasonal levels for changes to mean climatic conditions over land areas.

14.3.10. Projections for the following average climate variables have been obtained and analysed:

a. Mean summer temperature.

b. Mean winter temperature.

c. Mean summer precipitation.

d. Mean winter precipitation.

14.3.11. A range of possible pathways called Representative Concentration Pathways (RCPs) selected from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report [REF 14-7] have been used by UKCP18 [REF 14-6] to inform differing future emission trends. The four scenarios are RCP2.6, RCP4.5, RCP6.0 and RCP8.5, as presented in **Table 14-2**. RCP8.5 is the closest to the UKCP18 [REF 14-6] high emissions scenario.

Table 14-2: UKCP18 RCP Pathways

RCP	Description
RCP2.6	Represents a pathway where GHG greenhouse are strongly reduced, resulting in a best estimate global average temperature rise of 1.6°C by 2100 compared to the pre-industrial period.
RCP4.5	Medium stabilisation pathway, with some level of mitigation, resulting in a best estimate global average temperature rise of 2.4°C by 2100 compared to the pre-industrial period.
RCP6.0	Medium stabilisation pathway, with some level of mitigation, resulting in a best estimate global average temperature rise of 2.8°C by 2100 compared to the pre-industrial period.
RCP8.5	A pathway where GHG emissions continue to grow unmitigated, leading to a best estimate global average temperature rise of 4.3°C by 2100 compared to the pre-industrial period.

14.3.12. IPCC [REF 14-7] provides evidence to suggest that current global population and urbanisation trends, slow uptake of renewable energy sources, delay in nuclear power growth, and slow development of international climate change policy means that it is most likely that global emissions will follow the predicted RCP8.5 pathway.

14.3.13. UKCP18 [REF 14-6] also allows for future climate projections across a range of probability levels to be assessed, ranging from 10% probability to 90% probability:

a. 10% probability level: this demonstrates what the future change is unlikely to be less than. There is a 90% chance the projected change will be more than this.

b. 50% probability level: this is known as the central estimate, with an even chance of it occurring and not occurring.

c. 90% probability level: this demonstrates what the future change is unlikely to be more than. There is a 10% chance the projected change will be more than this.

14.3.14. Taking into account the expected design life of the Scheme, the UKCP18 [REF 14-6] for the RCP8.5 pathway was applied to the location of the closest weather station to the Scheme (Bedford Weather Station).

14.3.15. **Table 14-3** summarises climate projections for the 2050s and 2080s time periods, with the results presented as anomalies relative to the 1981 – 2010 average.

Table 14-3: Summary of Climate Projections for the 2050s and 2080s Time Periods

Climate Variable		2050s	2080s
Mean winter air temperature anomaly at 1.5m (°C)	50%* probability (central estimate)	+1.7°C	+3.1°C
	Range	+0.5 to + 2.9°C	+1.1 to +5.1°C
Mean summer air temperature anomaly at 1.5m (°C)	50% probability (central estimate)	+2.5°C	+4.9°C
	Range	+1.0 to +4.1°C	+2.3 to +7.7°C
Winter precipitation rate anomaly (%)	50% probability (central estimate)	+10%	+21%
	Range	-4 to +26%	+1 to +46%
Summer precipitation rate anomaly (%)	50% probability (central estimate)	-21%	-34%
	Range	-45 to +3%	-64 to -3%
* 50% probability is consistent with the requirements of the NPSNN [REF 14-1]			

14.4. Potential Impacts

14.4.1. This preliminary assessment has identified that the Scheme will potentially result in adverse impacts in relation to climate during its construction, operation and future maintenance.

GHG Impact Assessment

14.4.2. The environmental impacts from GHG emissions occur at a global level with targets for their reduction being set at a UK national level. The receptor for GHG emissions for this assessment is defined as the UK National GHG Inventory, as well as the GHG reduction targets set by the UK government.

14.4.3. There is good scientific evidence to show that our climate is changing because of emissions of GHG resulting from human activity, with global consequences. By the very nature of any transport infrastructure development, no matter the nature or level of mitigation measures implemented, GHGs will be emitted as materials are used and construction activity occurs.

14.4.4. The Scheme comprises a major road project which will involve the use of construction materials and activities (including changes in land use). On this basis, all lifecycle stages have been scoped into the lifecycle GHG assessment, with the exception of the decommissioning stage which has not been included in the assessment as the decommissioning or renewal of the Scheme's infrastructure is not reasonably foreseeable. It is anticipated that whilst the Scheme has a design life, in practice it will be maintained beyond this timeframe and therefore including the GHG emissions associated with its demolition/decommissioning is not realistic or relevant.

14.4.5. To assess the GHG emissions arising from the construction and operation of the Scheme, a lifecycle assessment approach is being adopted using available design, construction and transportation data.

14.4.6. The likely key GHG emission sources considered in the GHG emissions assessment are described in the following sections for both the construction and operation phases.

Construction

14.4.7. Potential GHG emissions sources during Scheme construction are detailed in **Table 14-4**. These have been categorised in line with the Highways England carbon emissions calculation tool [REF 14-8] and guidance on lifecycle stages set out in PAS 2080:2016 [REF 14-9].

Table 14-4: Potential Greenhouse Gas Emissions Sources (Construction)

PAS 2080 Lifecycle Stage	Carbon Tool Reporting Category	Activity	Description of Emissions Source
Product phase	Embodied carbon in raw materials	Use of products and/or materials required to construct the Scheme.	Embodied GHG emissions in construction materials.
Construction process phase	Fuel, energy and water	Energy and water consumption used for the construction of the Scheme.	GHG emissions from grid electricity. GHG emissions from fuel consumed. GHG emissions from the provision of water and treatment of wastewater.
	Business and employee travel	Transportation of construction workers to the site.	GHG emissions arising from the fuel consumed for worker commuting.
	Waste and waste transport	Waste generated and transported during the construction phase.	Emissions arising from the transportation and treatment of waste.

Operation

14.4.8. Potential GHG emissions impacts during the operation, use and future maintenance of the Scheme are set out in **Table 14-5**.

Table 14-5: Potential Greenhouse Gas Emissions Impacts (Operation)

PAS 2080 Lifecycle Stage	Activity	Primary Emission Impacts
Operational	Operation of the associated road including lighting, overhead gantries etc.	GHG emissions from energy consumed (grid electricity and fuel).
Maintenance	Maintenance activities	Embodied emissions associated with maintenance activities (fuel) and embedded carbon in materials.
Use	Vehicles using the road	GHG emissions from vehicle fuel use.

Climate Change Resilience

Construction

14.4.9. During construction, receptors are likely to be vulnerable to a range of short term (2020s) climate risks. Potential climate resilience impacts during the Scheme construction phase include the following:

a. Inaccessible construction site(s) due to severe weather events associated with flooding, snow and ice, and storms restricting working hours and delaying operations.

b. Health and safety risks to the workforce during severe weather events.

c. Increased frequency and severity of unsuitable conditions, for example due to very hot weather or very wet weather during construction activities involving laying pavement materials and the delivery of construction plant, thereby increasing the need to repeat certain works.

d. Increased frequency and severity of damage to construction materials, plant and equipment, including damage to temporary buildings/facilities such as offices, compounds, material storage areas and worksites, temporary access, temporary bridges and haul routes.

Operation

14.4.10. Once operational, the Scheme has the potential to be impacted by a changing climate, and in particular, more frequent severe weather events in the medium to long term (2050s and 2080s respectively).

14.4.11. Potential climate resilience impacts during the Scheme operational phase include the following:

a. Material and asset deterioration due to high temperatures.

b. Overheating of electrical equipment, for example information and communication systems.

c. Health and safety risks to road users.

d. Changes in travel patterns of network users.

e. Longer vegetation growing seasons resulting in increased periods of tree fall and increased maintenance and management requirements.

f. Damage to roads from periods of heavy rainfall.

g. Flood risk (surface, groundwater, fluvial and snow/ice melt) on the network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding.

h. Increased slope instability from prolonged/heavy precipitation leading to subsidence.

i. Storm damage to structures.

j. Inaccessibility of the network during severe weather events.

14.5. Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

14.5.1. Through the design-development and assessment processes, mitigation measures are being incorporated into the design of the Scheme to reduce carbon emissions and provide climate change resilience. Example measures include the following:

a. The incorporation of sustainable highway drainage systems to manage road runoff and provide resilience against potential future flood events associated with climate change.

b. The use of energy efficient road lighting to reduce energy consumption.

c. The inclusion of new or diverted public rights of way to preserve and, where possible, improve connectivity and journeys for pedestrians, equestrians and cyclists and thereby promote alternative modes of transport that do not generate GHG emissions.

Standard Mitigation Measures

14.5.2. A number of construction-based mitigation measures will be implemented by the construction contractor to reduce GHG emissions. Example measures include the following:

a. Developing and implementing a management plan to reduce energy consumption and associated GHG emissions during construction.

b. The recording and reporting of energy consumption and materials used during construction.

c. Implementing measures to manage material resources, such as using materials with lower embedded GHG emissions and recycled or secondary materials.

d. The sustainable reuse of soils and aggregates won from excavation and demolition activities, where feasible, to minimise GHG emissions associated with importation of materials.

14.5.3. Highways England is also committed to reducing carbon emissions from activity on its network by implementing the following mitigation hierarchy:

a. Avoidance/prevention: to maximise potential for reusing and refurbishing existing assets.

b. Reduction: through the application of low carbon solutions including technologies, materials and products to minimise resource consumption.

c. Remediation: applied to further reduce carbon through on or offsite offsetting or sequestrations.

14.6. Assessment of Effects

GHG Assessment

14.6.1. The NPSNN [REF 14-1] states that it is unlikely that the impact of a single road development, such as the Scheme, will affect the UK's ability to meet its overarching binding GHG reduction targets. However, as the UK's trajectory to this overall target is defined by a series of five year carbon budgets, it is important to assess the GHG impact of the Scheme against these budgets.

14.6.2. The Government's national carbon reduction strategy (provided in the Carbon Plan 2011 [REF 14-10]) provides a plan for the UK to meet to meet its carbon reduction targets. While the Government is legally bound to meet the commitments set out in this plan, any increase in GHG emissions as a result of the Scheme will not necessarily result in the Scheme being refused consent unless the increase causes a materially significant effect.

14.6.3. While the NPSNN [REF 14-1] does not specify significance criteria for GHG emissions, it does highlight the document 'Investing in Britain's Future' [REF 14-11] which states that the programme of investment planned for the UK Strategic Road Network will equate to below 0.1% of average annual carbon emissions allowed in the fourth carbon budget. This needs to be considered in the context of other policy around an increase in the use of electric vehicles and the decarbonisation of the national electricity grid.

14.6.4. Based on the lifecycle stages shown in **Table 14-4** and **Table 14-5**, the embodied carbon associated with materials use is likely to be the biggest contributor to the carbon footprint of the Scheme. Materials such as steel, concrete and bitumen can have high embodied carbon contents depending on the specifications used. The assessment to be included in the Environmental Statement will identify the materials used and calculate the associated carbon emissions from their production as well as transport to site.

14.6.5. The Environmental Statement will provide a comparison of the total GHG emissions from the construction and operation/maintenance of the Scheme with national level carbon budgets and the associated five year reduction targets.

14.6.6. To put the impact of the Scheme into context, total GHG emissions will also be compared against other new road schemes within the UK's strategic road network to benchmark GHG performance. The length of the Scheme represents less than 0.1% of the 4,400 mile UK strategic road network [REF 14-12]. Based on the inclusion of mitigation measures in the Scheme design, any increase in GHG emissions is expected to be minimal when considered in the national context. Furthermore, the five year carbon budgets and associated carbon reduction targets already allow for a proportion of carbon emissions resulting from the existing road network.

Climate Resilience Assessment

14.6.7. The Scheme has been identified as being vulnerable to a range of climate risks and its resilience to these impacts will be assessed on an ongoing basis as the Scheme design develops and further data becomes available. The Environmental Statement will present the outputs of the climate resilience assessment, identifying the key impacts and effects on the Scheme and the mitigation measures that will be implemented.

14.6.8. The Scheme will be inherently designed to minimise the impacts of climate change on future operations as far as is reasonably feasible. Potential effects as a result of more extreme temperature fluctuations, an increase in the frequency of storms and the risk of more flash flooding will be mitigated through the design of the Scheme, the selection of materials used for its construction and operational procedures. The Scheme's drainage, for example, is being designed to be resilient to the increase in predicted levels of precipitation, whilst materials specification will consider the ability of the product to withstand a wide range of temperature scenarios. Based on the information available, the expected Scheme design, the mitigation measures set out herein, and the preliminary assessment undertaken to date, no likely significant effects around the resilience of the Scheme to climate change are anticipated.

In-combination Climate Impact Assessment

14.6.9. The Environmental Statement will outline the outcomes of the assessment of the likelihood and consequence of in-combination impacts, and the significance of in-combination effects during the construction and operational phases of the Scheme.

14.6.10. The final outcomes of the likely significant effects of the Scheme in relation to climate will be reported within the Environmental Statement.

15. ASSESSMENT OF CUMULATIVE EFFECTS

15.1. Introduction

15.1.1. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [REF 15-1] (the EIA Regulations) set out a requirement to consider the cumulative environmental effects of a development project.

15.1.2. Cumulative effects comprise the following types of effect:

a. **Combined Effects**: these occur when the environmental impacts and effects of the Scheme combine with each other to result in new or different effects, or effects of greater significance, on environmental resources and/or receptors.

b. **Cumulative Effects**: these occur when the environmental impacts and effects of the Scheme interact with those associated with other planned developments to result in new or different effects, or effects of greater significance, on environmental resources and/or receptors.

15.1.3. Due to the potential for cumulative effects to occur as a result of the construction, operation and maintenance of the Scheme, a cumulative assessment is being undertaken as part of the Environmental Impact Assessment (EIA) in accordance with the EIA Regulations [REF 15-1] and the assessment requirements of the National Policy Statement for National Networks (NPSNN) [REF 15-2].

15.1.4. As cumulative effects assessments rely on the outcomes of the individual topic assessments being available and the data relating to other planned developments being confirmed, they are typically undertaken towards the end of the EIA process.

15.1.5. Accordingly, the following sections present the approach to, and the current status of, the cumulative assessment and the preliminary data obtained for major development proposals in the vicinity of the Scheme.

15.1.6. The Environmental Statement will report the findings of the cumulative assessment, where the EIA identifies a likelihood of significant cumulative effects.

15.2. Method of Assessment

Guidance

15.2.1. A combination of professional judgement and established guidance are being used to confirm the scope of the cumulative effects assessment, and to aid the identification and (where necessary) mitigation of likely significant effects.

15.2.2. Guidance contained within the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects [REF 15-3] has been used to inform the development of the criteria being applied within the cumulative effects assessment.

15.2.3. Further guidance contained within Cumulative Effects Assessment – Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects [REF 15-4], which provides advice on the identification and assessment of other planned developments, is being referenced within the cumulative effects assessment.

15.2.4. Both sets of guidance [REF 15-3, REF 15-4] build on the general EIA approach and methods presented in Chapter 4.

Criteria

15.2.5. The significance of both combined and cumulative effects are being determined using the criteria set out in **Table 15-1**, which draws upon the DMRB guidance [REF 15-3].

Table 15-1: Combined and Cumulative Effects Significance Criteria

Significance Category	Typical Descriptors of Effect
Very large (typically adverse only)	Where the combined impacts of the Scheme or cumulative impacts of the Scheme in association with other development upon an individual or collection of environmental receptors will be very highly significant (positive or negative). Effects will be permanent for receptors of very high value.
Large (adverse or beneficial)	Where the combined impacts of the Scheme or cumulative impacts of the Scheme in association with other development upon an individual or collection of environmental receptors will be highly significant (positive or negative). Effects will be: • widespread/large scale for a receptor of high value • permanent for a receptor or receptors of high value; • localised for a receptor or receptors of very high value; or • temporary for a receptor or receptors of very high value.
Moderate (adverse or beneficial)	Where the combined impacts of the Scheme or cumulative impacts of the Scheme in association with other development upon an individual or collection of environmental receptors will be significant (positive or negative). Effects will be: • permanent for a receptor or receptors of medium value; • localised for a receptor or receptors of high value; or • temporary for a receptor or receptors of high value.
Slight (adverse or beneficial)	Where the combined impacts of the Scheme or cumulative impacts of the Scheme in association with other development upon an individual or collection of environmental receptors will be noteworthy but not significant (positive or negative). Effects will be: • permanent for receptors of low value; • localised for a receptor or receptors of medium value; or • temporary for a receptor or receptors of medium value.
Neutral	Where the combined impacts of the Scheme or cumulative impacts of the Scheme in association with other development upon an individual or collection of environmental receptors will be negligible and not significant (positive or negative).

15.2.6. Combined and cumulative effects that are of moderate, large or very large significance will be considered significant effects in relation to the EIA Regulations [REF 15-1].

15.3. Assessment of Combined Effects

15.3.1. The assessment of combined effects considers whether an individual environmental receptor or resource will be affected by more than one type of impact as a result of the Scheme. For example, a residential occupant could be exposed to temporary increases in both noise and dust during construction of the Scheme.

15.3.2. The assessment method for combined effects involves the identification of impact interactions associated with the Scheme upon separate environmental receptors and resources, the objective being to understand the overall environmental effect of the Scheme.

15.3.3. The potential interactions between individual effects will be identified within the latter stages of the EIA by reviewing the final conclusions of the assessments within the topics presented in Chapters 5 to 14.

15.3.4. The significance of combined effects upon environmental receptors and resources will then be determined using professional judgement, assisted by the views and opinions of the competent experts responsible for undertaking the topic assessments.

15.4. Assessment of Cumulative Effects

Overview

15.4.1. The assessment of cumulative effects is considering the effects on environmental resources and receptors that will likely occur from the changes arising from the Scheme in conjunction with those associated with other planned developments.

15.4.2. The assessment of cumulative effects has commenced as part of the EIA and is following the four-stage approach presented in guidance published by the Inspectorate [REF 15-4], as summarised below, and is being guided by the following principles:

a. Understanding the limits of the effects associated with the Scheme and those of other planned developments.

b. The sensitivity, value or importance of environmental resources or receptors, and their susceptibility to effects.

c. Whether different types of effect will occur and interact in a way that alters their significance.

d. Whether effects will be temporary or permanent in duration, what their timescales will be, and whether such effects will be intermittent or constant.

e. The degree of certainty and confidence relating to the effects.

Stage 1

Zones of Influence

15.4.3. The cumulative effects assessment of the Scheme is currently at Stage 1

15.4.4. Given the scope and scale of the proposed works associated with the Scheme, the Stage 1 activities are focusing on establishing the Scheme's likely Zones of Influence (ZoI) associated with each of the environmental topic areas being assessed within the EIA.

15.4.5. **Table 15-2** presents the largest ZoI identified within each environmental topic. Each ZoI is indicative and will be subject to further review as the individual assessments progress.

Table 15-2: Summary of Indicative Zones of Influence

Environmental Topic	Zone of Influence
Air Quality	**Construction**: 200m ZoI from construction activities for effects relating to construction dust and emissions. **Operation**: The 'affected roads' define the ZoI. As the operational phase traffic data for the Scheme include the traffic associated with other planned developments, the air quality assessment to be included within the Environmental Statement will partially be a cumulative assessment. Accordingly, these developments will not be considered in the cumulative assessment. Refer to Chapter 5 for further information on the ZoIs and assessment study areas.
Cultural Heritage	**Construction and Operation**: A 1km ZoI for both construction and operational effects on archaeological remains, historic buildings and historic landscapes. Refer to Chapter 6 for further information on the ZoIs and assessment study areas.
Landscape	**Construction and Operation**: A 2km ZoI for both construction and operational effects on designated landscapes, landscape character and the visual environment. As the preliminary findings of the assessment indicate that significant effects are unlikely between the 2km and 5km study areas, the assessment will focus on receptors within the 2km ZoI. Refer to Chapter 7 for further information on the ZoIs and assessment study areas.
Biodiversity	**Construction and Operation**: A 2km ZoI for both construction and operational effects on national statutorily designated sites and non-statutorily designated sites, and for bats. As no internationally designated sites are located within the 5km ZoI adopted in the assessment, this ZoI will not be considered in the cumulative assessment. As the preliminary findings of the Habitats Regulations Assessment screening exercise indicate that no significant effects on European Sites are likely to occur as a result of the Scheme, the ZoI does not extend to cover the 30km study area adopted within this exercise. Refer to Chapter 4 and Chapter 8 for further information on the ZoIs and assessment study areas.
Geology and Soils	**Construction and Operation**: A 500m ZoI for both construction and operational effects on geology and soils. Refer to Chapter 9 for further information on the ZoIs and assessment study areas.
Material Assets and Waste	**Construction**: A ZoI defined by the DCO site boundary for material resources, sterilisation of active and allocated mineral extraction sites, mineral safeguarding areas and peat resources, and a ZoI defined by the region within which waste management facilities are located. **Operation**: Scoped out of the EIA; therefore no ZoI applies.

Environmental Topic	Zone of Influence
	Refer to Chapter 10 for further information on the ZoIs and assessment study areas.
Noise and Vibration	**Construction**: The construction ZoI is defined by the proximity of identified receptors to the construction works, the location and type of which are yet to be confirmed. **Operation**: A 1km ZoI for operational effects on receptors has been defined around the extents of the Scheme and the sections of the A428 and A1 that will be bypassed. As the operational phase traffic data for the Scheme include the traffic associated with other planned developments, the noise and vibration assessment to be included within the Environmental Statement will partially be a cumulative assessment. Accordingly, these developments will not be considered in the cumulative assessment. Refer to Chapter 11 for further information on the ZoIs and assessment study areas.
Population and Health	**Construction and Operation**: A ZoI capturing the wards of Wyboston; Great Barford; Potton; St Neots Eaton Ford; St Neots Eynesbury; St Neots Priory Park; Bourn; and Papworth and Elsworth (these being the areas within which health effects could arise from the construction and/or operation of the Scheme. Refer to Chapter 12 for further information on the ZoIs and assessment study areas.
Road Drainage and the Water Environment	**Construction and Operation**: A 1km ZoI (extending to 2km for watercourse flow impacts and flood risk) on hydrological features and receptors for construction and operational effects. Refer to Chapter 13 for further information on the ZoIs and assessment study areas.
Climate	**Construction and Operation**: A ZoI covering greenhouse gas emissions arising from the construction and operation of the Scheme. Refer to Chapter 14 for further information on the ZoIs and assessment study areas.

15.4.6. Guidance contained in the DMRB [REF 15-3] states that the study area for the assessment of cumulative effects should be defined on a case-by-case basis, reflecting the project in question and the area over which significant effects can reasonably be considered to have the potential to occur from both the project and in combination with other developments.

15.4.7. Accordingly, the following areas of search are being adopted as part of Stage 1:

a. Largest topic ZoI + 1 kilometre buffer – this is being applied when searching for other planned developments within, and development allocations made by, the relevant local authorities.

b. Largest topic ZoI + 3 kilometre buffer – this is being applied when searching for Nationally Significant Infrastructure Projects (NSIPs) and other highway projects proposed to be implemented on the strategic road network.

15.4.8. Within these two areas of search, a long list of other planned developments with the potential to generate significant cumulative effects is being populated using information on developments within the traffic model, and information available from other sources.

Developments Within the Traffic Model

15.4.9. As described in Chapter 2, the traffic model developed by Highways England to forecast future traffic conditions (both with and without the Scheme) on different parts of the road network is being refined alongside the EIA and the ongoing development of the Scheme's design.

15.4.10. In predicting these future conditions, the traffic model has taken account of the influence that other planned developments beyond the Scheme will likely have on traffic flows.

15.4.11. Developments currently accounted for within the traffic model include the following:

a. Major housing developments and allocations.

b. Employment land allocations.

c. Road infrastructure developments.

15.4.12. Each individual development or allocation currently included within the model has been allocated a level of certainty (confidence) in relation to it being implemented, based on the following Department for Transport's Transport Analysis Guidance [REF 15-5] descriptors:

a. Near certain: The outcome will happen or there is a high probability that it will happen i.e. where there is intent announced by a proponent to regulatory agency, or a development proposal is approved, or where a project is under construction.

b. More than likely: The outcome is likely to happen but there is some uncertainty i.e. where the submission of a planning or other consent application is imminent, or where an application is currently within the consent process.

c. Reasonably foreseeable: The outcome may happen but there is significant uncertainty i.e. where a development is identified within a development plan, or not directly associated with the Scheme (but may occur if the Scheme is implemented), or is conditional on the Scheme proceeding, or is a committed policy goal whose outcomes are subject to significant uncertainty.

d. Hypothetical: There is considerable uncertainty whether the outcome will ever happen i.e. the development is a policy aspiration or is one of a number of possible inputs to an initial consultation process, or is conceptual.

15.4.13. A review of the traffic model is being undertaken as part of Stage 1 to identify which developments and allocations fall within the adopted areas of search, and of those which are identified as being "near certain" or "more than likely" to be implemented (these being the developments that will be transferred into the long list).

Local Authority and Major Infrastructure Developments

15.4.14. For planned developments not already included within the traffic model, for example those which have come forward or may have a change in status or certainty after completion of the modelling, the following search criteria are being applied during Stage 1:

a. Local authority planning applications that represent 'major developments', the definitions and thresholds for which are set out in The Town and Country Planning (Development Management Procedure) (England) Order 2015 [REF 15-6].

b. Development Consent Order applications for NSIPs in England, contained in the Register of Applications on the National Infrastructure Planning website [REF 15-7].

c. Any major development projects being progressed through other statutory procedures.

Initial List of Developments

15.4.15. The search of local authority planning applications commenced in May 2019, the objective being to verify the status of the planned developments and allocations previously identified during the EIA scoping stage, and to identify any new developments which may have come forward since scoping was undertaken.

15.4.16. This initial search has focused on major developments either within or in proximity to the DCO site boundary which meet the search criteria, the findings of which are presented in **Table 15-3**. This search is preliminary based on information available from local authority online planning portals and will be extended as further work is carried out during Stage 1 to capture other developments within the adopted areas of search, and to ensure the most up to date information is used to inform the EIA.

Table 15-3: Planned Developments and Development Allocations within or in proximity to the DCO Site Boundary

Application Ref	Local Authority	Details of Development	Status
S/3440/18/OL	South Cambridgeshire District Council	Overview: Application for outline planning permission for a new mixed use village comprising residential development of approximately 3,500 dwellings; mixed uses comprising employment, retail, hotel, leisure, residential institutions; education, community facilities, open space including parks, ecological areas and woodlands, landscaping; engineering for foul and sustainable urban drainage systems; footpaths, cycle ways, public transport infrastructure; highways including a principal eastern access from the roundabout on St Neots Road and western access with Broadway including first section of strategic public transport route; associated infrastructure, groundworks and demolition; with all matters reserved except for the principal highway junctions from the St Neots Road roundabout and onto Broadway with some matters reserved except for access. Location: Bourn Airfield St Neots Road Bourn Cambridge	Application registered 10 September 2018 Out for consultation

Application Ref	Local Authority	Details of Development	Status
		CB23 2TQ	
S/0883/15/FL	South Cambridgeshire District Council	Overview: Application for full planning permission for the demolition of a straw barn and erection of educational centre, to serve a wildlife park including a car park area and associated works. Location: Wildlife Park Educational Centre GW Topham and Son Cambridge Road Eltisley Cambridgeshire PE19 6TR	Approved on 21 January 2016
S/2715/18/FL	South Cambridgeshire District Council	Overview: Application for full planning permission to extend an existing car park. Location: Land east of Unit 2 Caxton Gibbet Park Ermine Street Caxton CB22 3PE	Approved on 18 October 2018
S/2903/14/OL	South Cambridgeshire District Council	Overview: Application for outline planning permission for up to 2,350 residential units inc. retail, offices/light industry, community and leisure facilities, schools, vehicle access points and associated infrastructure. Location: Land to the west of Cambourne (excluding Swansley Wood Farm)	Approved on 29 December 2017
S/1430/19/RM	South Cambridgeshire District Council	Overview: Reserved matters planning application for the appearance, layout and scale of highways and drainage (strategic engineering). This application is associated with ref: S/2903/14/OL. Location: Land to the west of Cambourne (excluding Swansley Wood Farm)	Submitted for determination on 17 April 2019
S/4106/17/FL	South Cambridgeshire District Council	Overview: Full planning application for a triple span bulk grain store. Location: North East Farm	Approved on 19 February 2018

Application Ref	Local Authority	Details of Development	Status
		Cambridge Roads Eltisley Cambridgeshire PE19 6TR	
17/02308/OUT	Huntingdonshire District Council	Overview: Hybrid application for outline and full planning permission for development of a mixed-use urban extension of residential development, district and local centre, schools, open space and recreational facilities inc. new roads and associated infrastructure. Location: Wintringham Park Cambridge Road St Neots	Approved on 6 November 2018
13/00388/OUT	Huntingdonshire District Council	Overview: Phased outline application for the development of up to 1,020 dwellings, mixed uses including a nursery/crèche, public house, hotel, care accommodation, and employment uses, a primary school, formation of new access junctions onto Cambridge Road, connections with Loves Farm, onsite roads and pedestrian/cycle routes and other related infrastructure. Location: Loves Farm Eastern Expansion Area Cambridge Road St Neots	Approved on 16 April 2018
17/02645/FUL	Huntingdonshire District Council	Overview: Full planning application for the construction of two vehicular access points and associated works. Location: Wintringham Park Cambridge Road St Neots	Approved 9 April 2018
18/02719/REM	Huntingdonshire District Council	Overview: Reserved matters planning application for 222 dwellings, including details of the appearance, landscaping, layout and scale of the dwellings. This application is associated with ref: 17/02308/OUT. Location: Wintringham Park Cambridge Road St Neots	Approved on 26 April 2019

Application Ref	Local Authority	Details of Development	Status
15/02551/EIAWM	Bedford Borough Council	Overview: Mineral extraction application for an extension of sand and gravel extraction (650,000 tonnes) at Black Cat Quarry with restoration to agriculture and nature conservation. Location: Land at Black Cat Roundabout Great North Road Chawston Bedford MK44 3BE	Approved on 8 April 2016

15.4.17. Based on a review of these developments, it is considered that potential exists for some of these to generate cumulative impacts with the Scheme based on their location, scale and/or their likely construction and operational timescales.

15.4.18. Searches have yet to be completed during Stage 1 of NSIPs and major projects which may be progressing through other statutory processes.

15.4.19. Once compiled from the different sources, any duplicate information on individual developments will be consolidated within the long list and will reflect the most current available information.

15.4.20. Each development within the long list will then be reviewed to determine its status at the time of undertaking the assessment and will be assigned a status (or tier), informed by the guidance and levels presented within Advice note seventeen [REF 15-4]. This will be informed, for example, by feedback from the relevant local authorities to establish the level of certainty and detail available for each development.

Stage 2

15.4.21. This stage will involve a review of the long list of planned developments, to identify those to be taken forward (shortlisted) into the cumulative assessment.

15.4.22. In determining which of the developments should be shortlisted, a minimum level of information will be necessary. Only those developments with at least a Scoping Report, Environmental Assessment Report or Environmental Statement available shall be considered for shortlisting.

15.4.23. Developments and projects that are already in existence i.e. those which are completed and operational, shall be considered to form part of the environmental baseline conditions within which the Scheme will be implemented (and will be treated as such within the EIA). Similarly, where other developments are expected to be completed prior to Scheme construction, and where the effects of those projects are fully determined, these will also be considered within the environmental baseline adopted in the EIA.

15.4.24. The shortlisting process will involve the application of inclusion/exclusion criteria and will be informed by engagement with the relevant local authorities and the professional judgement of the environmental specialists undertaking the EIA.

Stage 3

15.4.25. This stage will involve reviewing the available information relating to the shortlisted developments to establish the details of their likely environmental effects.

15.4.26. This will consider factors including: the ZoI of environmental topics assessed; the planned timescales for construction, operation and (where relevant) decommissioning; and details of their potential or likely significant effects.

Stage 4

15.4.27. Those developments which meet the criteria set out in the above stages shall be incorporated into the cumulative assessment. This will involve identifying where effects are likely to occur and assessing the significance of those effects on environmental receptors and resources, taking into account any mitigation measures.

16. SUMMARY

16.1. Summary of the Preliminary Assessments

16.1.1. Chapters 5 – 14 present the findings of the preliminary assessments of the environmental topics being assessed within the Environmental Impact Assessment.

16.1.2. A summary of the potential significant effects from these assessments is summarised in **Table 16-1**.

Table 16-1: Summary of the Preliminary Assessment

Topic	Construction	Operation
Air Quality	No likely significant effects anticipated.	No likely significant effects anticipated.
Cultural Heritage	Likely significant adverse effects associated with the demolition of Brook Cottages and the removal of a milestone at Eltisley.	No likely significant effects anticipated.
Landscape	Likely temporary significant adverse effects on defined areas of landscape character. Likely temporary significant adverse visual effects for users and residents of isolated properties in the open countryside, the residents within nearby settlements at Eltisley, Croxton, Little Barford, Wyboston, Roxton, Tempsford, Chawston, St Neots, Papworth Everard and Cambourne and the fringes of Toseland and Yelling, and users of some public rights of way in the local area.	Likely significant adverse effects on defined areas of landscape character, particularly in the locality of the Black Cat junction. Likely significant adverse visual effects for residents and users of the public rights of way network in proximity to the new Black Cat, Cambridge Road and Caxton Gibbet junctions.
Biodiversity	No likely significant effects anticipated.	No likely significant effects anticipated.
Geology and Soils	Significant adverse effects from the loss and disturbance of the highest grade of agricultural soils.	No likely significant effects anticipated.
Material Assets and Waste	No likely significant effects anticipated.	No likely significant effects anticipated.
Noise and Vibration	Likely temporary significant adverse effects on noise sensitive receptors in proximity to the Scheme from certain construction operations, and from the movement of traffic.	Potentially significant adverse effects associated with the introduction of noise to isolated properties to the south-east of St Neots.
Population and Health	Likely significant adverse effects relating to the demolition of residential dwellings and commercial property in the locality of the Black Cat roundabout. Likely significant effects relating to the loss of agricultural land which may affect agricultural viability.	No likely significant effects anticipated.
Road Drainage and the Water Environment	No likely significant effects anticipated.	No likely significant effects anticipated.
Climate	No likely significant effects anticipated.	No likely significant effects anticipated.

17. REFERENCES

17.1. References

17.1.1. **Table 17-1** lists the documents and information sources referenced within this volume of the Preliminary Environmental Information Report.

Table 17-1: List of References Used in the Preliminary Environmental Information Report

Number	Reference
Chapter 1: Introduction	
REF 1-1	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. HMSO (2017). http://www.legislation.gov.uk/uksi/2017/572/contents/made
REF 1-2	Planning Act 2008. HMSO (2008). https://www.legislation.gov.uk/ukpga/2008/29/contents
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REF 1-5	National Policy Statement for National Networks. HMSO (2014). https://www.gov.uk/government/publications/national-policy-statement-for-national-networks
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REF 1-7	A428 Black Cat to Caxton Gibbet: Environmental Scoping Report. Highways England (2019). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000006-BCCG%20-%20Scoping%20Report.pdf
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Chapter 2: The Scheme	
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REF 2-5	Control of Pollution Act 1974. HMSO (1974). https://www.legislation.gov.uk/ukpga/1974/40/pdfs/ukpga_19740040_en.pdf
Chapter 3: Assessment of Alternatives	
N/A	No references are contained within this chapter.
Chapter 4: Environmental Assessment Methodology	
REF 4-1	National Policy Statement for National Networks. Department for Transport (2014). https://www.gov.uk/government/publications/national-policy-statement-for-national-networks
REF 4-2	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. HMSO (2017). http://www.legislation.gov.uk/uksi/2017/572/contents/made
REF 4-3	Design Manual for Roads and Bridges, Volume 11: Environmental Assessment. Highways Agency (1993 to date). http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/index.htm
REF 4-4	Interim Advice Note 125/15: Environmental Assessment Update. Highways England (2015). http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian125r2.pdf
REF 4-5	A428 Black Cat to Caxton Gibbet: Environmental Scoping Report. Highways England (2019). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000006-BCCG%20-%20Scoping%20Report.pdf
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REF 5-7	2015-based background maps for NOx, NO2, PM10 and PM2.5 for the year 2017. DEFRA 2018. https://uk-air.DEFRA.gov.uk/data/laqm-background-maps?year=2015
REF 5-8	IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management (2014). www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf
Chapter 6: Cultural Heritage	
REF 6-1	A428 Black Cat to Caxton Gibbet: Environmental Scoping Report. Highways England (2019). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000006-BCCG%20-%20Scoping%20Report.pdf
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REF 6-4	Design Manual for Roads and Bridges, Volume 11: Environmental Assessment, Section 3, Part 2 – Cultural Heritage. Highways Agency (2007). http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/index.htm
REF 6-5	Code of Conduct. Chartered Institute for Archaeologists (2014). http://www.archaeologists.net/sites/default/files/node-files/CodesofConduct.pdf
Chapter 7: Landscape	
REF 7-1	A428 Black Cat to Caxton Gibbet: Environmental Scoping Report. Highways England (2019). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000006-BCCG%20-%20Scoping%20Report.pdf
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18. GLOSSARY

18.1. Glossary of Terms and Abbreviations

18.1.1. **Table 18.1** provides definitions for terms and abbreviations used within this Preliminary Environmental Information Report.

Table 18.1: Terms and Abbreviations Used in the Preliminary Environmental Information Report

Term	Abbreviation or Acronym	Definition
A		
Above Ordnance Datum	AOD	Above the mean sea level at Newlyn in Cornwall calculated between 1915 and 1921, taken as a reference point for the height data on Ordnance Survey maps.
Additional mitigation		Mitigation measures which are over and above any embedded and standard mitigation measures, and which are required to further reduce the significance of an environmental effect.
AddressBase data		An Ordnance Survey data product which enables property information to be linked to addresses on a map.
Affected Road Network	ARN	Parts of the road network which are identified as likely to be affected by changes in air quality as a result of a development project.
Aggregate		Granular material (for example sand and gravel or crushed rock) that can be used for building and/or civil engineering purposes (for example for concrete production).
Agricultural Land Classification	ALC	The system devised and introduced by the Ministry of Agriculture, Fisheries and Food to classify agricultural land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. Land is graded between 1 (excellent quality) to 5 (very poor quality), with grade 3 subdivided into agricultural subgrades 3a and 3b.
Air Quality Action Plan		A plan that must be compiled by a local authority if they declare an air quality management area.
Air quality exceedance		Where pollutant concentrations exceed an air quality standard.
Air quality limit value		A maximum pollutant concentration to be achieved in the atmosphere, either without exception or with a permitted number of exceedances. Limit values are defined in European Union Directives and implemented in United Kingdom legislation.
Air Quality Management Area	AQMA	If a local authority identifies any locations within its boundaries where the air quality objectives are not likely to be achieved, it must declare the area as an air quality management area. The local authority is subsequently required to put together a local air quality action plan.
Air quality objective		Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK Government's Air Quality Strategy for the key air pollutants.
Alluvial deposits		Natural materials deposited within and adjacent to rivers.

Term	Abbreviation or Acronym	Definition
Ambient noise		A sound that is totally encompassing in a given situation at a given time usually composed of sound from many sources near and far.
Amenity		The benefits of enjoyment and well-being which are gained from a resource in line with its intended function. Amenity may be affected by a combination of factors such as: sound, noise and vibration; dust/air quality; traffic/congestion; and visual impacts.
Ancient woodland		Land that has been continually wooded since at least the year 1600AD.
Anno Domini	AD	The term used to describe a division of time that falls within the Christian era.
Annual Exceedance Probability		Flood frequency is expressed in terms of an annual exceedance probability, which is the inverse of the annual maximum return period. For example, the 100-year flood (a flood likely to occur once every 100 years) can be expressed as the 1% AEP flood, which has a 1% chance of being exceeded in any year.
Aquifer		An underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt).
Arboricultural impact assessment		An assessment which identifies the effects of a development project on trees.
Area of Outstanding Natural Beauty		Land protected by the Countryside and Rights of Way Act 2000. It protects the land to conserve and enhance its natural beauty.
A-Road		A type of road prefixed with the letter 'A'. These are the busiest and most direct main roads, apart from motorways, and can be of different standard.
Assemblage		A group of species found in the same location.
At-grade		On the same level. For example, when a road is on the current ground level.
B		
Barrow (bowl)		A type of burial mound.
Baseline conditions		The environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that will take place before completion of the project.
Bedrock		Rock that underlies loose deposits such as soil or alluvium.
Best and most versatile (land)		Land defined as grades 1, 2 and 3a of the Agricultural Land Classification. This land is considered the most flexible, productive and efficient and is most capable of delivering crops for food and non-food uses.
Biodiversity		The variety of life in the world or in a particular habitat or ecosystem.
Biodiversity Action Plan	BAP	A plan that identifies threatened species and habitats and seeks to protect and restore biological systems.

Term	Abbreviation or Acronym	Definition
Biodiversity offsetting		A system used predominantly by planning authorities and developers to fully compensate for biodiversity impacts associated with economic development, through the planning process. In some circumstances, biodiversity offsets are designed to result in an overall biodiversity gain.
Borehole		A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.
Bridleway		A path or track along which horse riders have a right of way.
British Geological Survey	BGS	A body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of systematic surveying, monitoring and research
British Standard	BS	Standard produced by the British Standards Institution.
British Standards Institution		A group which produces British Standards across industry sectors and which is formally designated as the National Standards Body for the UK.
B-road		Numbered distributor roads that have lower traffic densities than trunk roads or A-roads.
Buffer		Specified area or distance surrounding a site or feature of interest.
Built heritage		A structure or building of historic value. These structures are visible above ground level.
Bund		An embankment which acts as a visual or noise screen, or acts as a barrier to control the spillage of fluids.
Buried archaeology (or buried heritage)		An archaeological asset beneath ground level, which may include earthworks.
Bypass		The diversion of a major road to carry traffic around a built up area, constructed to improve the journey of through traffic and/or improve the environmental conditions along the original route.
Byway		A track, often rural, which is too small to be called a road but which may be open to use by all vehicular traffic or have restrictions on use by non-mechanically propelled vehicles.
C		
Carbon footprint		The total greenhouse gas emissions associated with a particular policy or development.
Carbon monoxide	CO	A pollutant gas generated by combustion sources. At very high concentrations it can be a dangerous asphyxiant.
Carriageway		The width of a highway that can be used by motorised vehicles and walkers, cyclists and horse riders, formed by a number of lanes.
Catchment		A drainage/basin area within which precipitation drains into a river system and eventually into the sea.
Celsius	°C	A scale of temperature.
Clay		An inorganic component of soil derived from the weathering of rock and comprising particles less than 0.002mm in equivalent diameter.

Term	Abbreviation or Acronym	Definition
Climate		The climate can be described simply as the 'average weather', typically looked at over a period of 30 years. It can include temperature, rainfall, snow cover, or any other weather characteristic.
Climate change		This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer.
Climate resilience		The ability to anticipate, prepare for, and respond to climatic events, trends or disturbances.
Closed Circuit Television	CCTV	A TV system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes.
Combined effect		A type of cumulative effect which occurs when different types of activity combine to have an effect on a specific receptor or resource.
Community facilities		Facilities designed for the use and benefit to the local population.
Compensation (environmental)		Mitigation measures applied where nothing can be done to reduce an environmental impact or effect. An example is habitat and species relocation.
Congestion		A situation where the volume of traffic is too great for the road, causing vehicles to slow down or stop, often caused by bottlenecks, traffic incidents and junction design.
Connectivity		A measure of the availability of the habitats needed for a particular species to move through a given area.
Conservation area		An area designated under section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as being of special architectural or historic interest and with a character or appearance which is desirable to preserve or enhance.
Conservation status		The state of a species or habitat including for example, extent, abundance, distribution and their trends.
Construction and demolition waste		Waste debris arising from the destruction of buildings or hard infrastructure. The debris varies from insulation, electrical wiring, rebar, wood, concrete, and bricks. It also may contain lead, asbestos or different hazardous materials.
Construction compound		Construction compounds will generally act as the points of entry to the worksites from the public highway. They may also be used for major stockpiling of materials such as top soil, and to facilitate transfer of materials to and from the site.
Construction Environmental Management Plan	CEMP	A plan prepared by a contractor which sets out how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area and the protocols to be followed in implementing these measures, in accordance with environmental commitments.
Construction plant		Portable construction machinery and equipment.

Term	Abbreviation or Acronym	Definition
Construction working area		The construction working areas are where the construction of the Scheme will take place. They can be temporary in the case of construction compounds or permanent, in the case of the Scheme.
Consultation Report		A report which summarises all consultation responses received and explains how the applicant of a nationally significant infrastructure project has given regard to those responses.
Contractor		A general term used to describe an individual or company appointed by a developer to construct or manage a project at a certain price or rate.
Controlled waters		Rivers, streams, estuaries, lakes, canals, ditches, ponds and groundwater as far out as the UK territorial limit. The statutory definition is provided in section 104 (1) of the Water Resources Act 1991 and section 30A (d) of the Control of Pollution Act 1974.
County Wildlife Site	CWS	A conservation designation in the United Kingdom, which despite conferring no statutory protection onto a site, does affirm a site's importance and value for wildlife in its county context.
C-road		Roads and lanes with low traffic densities which are sometimes designated as unclassified roads.
Cropmark		Cropmarks are a means through which sub-surface archaeological, natural and recent features may be visible from the air or a vantage point on higher ground or a temporary platform.
Culvert		A tunnel (pipe or box shaped) that carries a stream or open drain under a road or railway.
Cumulative effect (or impact)		A cumulative impact (or effect) may arise as the result of: the combined impact of a number of different environmental topic-specific impacts from a single environmental impact assessment project on a single receptor/resource; and the combined impact of a number of different projects within the vicinity (in combination with the environmental impact assessment project) on a single receptor/resource.
Cut-fill balance		A construction process whereby the amount of material obtained from earthwork cuttings broadly matches the amount of fill material required to form embankments, thereby minimising the amount of material needed to be imported into, or exported from, a construction site.
Cutting (earthwork)		Excavation of earth material to lower the ground level on which a road would be positioned, in order to help to reduce noise and/or visual impact.
D		
Decibel	dB	The scale used to measure noise is the decibel scale which extends from 0 to 140 decibels, corresponding to the intensity of the sound pressure level.
Decommission		Withdraw something from service.

Term	Abbreviation or Acronym	Definition
Delay		For pedestrians, this is the increase in the 'person-minutes' of the journey times of pedestrians, cyclists and horse riders. For traffic, this is the increase in journey times for drivers and passengers.
Department for Environment, Foods & Rural Affairs	DEFRA	The Government department responsible for policy and regulations on environmental, food and rural issues. The department's priorities are to grow the rural economy, improve the environment and safeguard animal and plant health.
Department for Transport	DfT	The national government body responsible for transport in Britain, and therefore in overall control of the road network. It is mainly responsible for policy decisions, and its responsibilities are carried out by a range of agencies and local authorities.
Deposition (dust)		The vertical passage of a substance (for example dust) to a surface or the ground.
Deposition (sediment)		The laying down of part, or all, of the sediment load of a stream on the bed, banks or floodplain which forms various sediment features such as bars, berms and floodplain deposits.
Design Manual for Roads and Bridges	DMRB	A set of documents that provide a comprehensive manual system which accommodates all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads (including motorways).
Design-development		The process in which technical specialists (engineers and environmentalists) refine the design for the various elements of a development project.
De-trunked		The transfer of trunk roads from Highways England's responsibility to the local highway authority.
Development allocation		Areas of land allocated by a local planning authority for a particular type of development.
Development Consent Order	DCO	The consent for a Nationally Significant Infrastructure Project required under the Planning Act 2008.
Development Consent Order Site Boundary		The maximum extents of land likely to be required to construct, operate and maintain a Nationally Significant Infrastructure Project.
Development plan		Documentation which seeks to guide development and planning in a local authority area for a set period of time.
Diffusion tube		Passive devices used in air quality monitoring to measure weekly or monthly average pollutant concentrations.
Directive		Legal obligations imposed on European member states by the European Union.
Discharge consent		A consent or permit to discharge effluent that could harm the environment.
Diverge		The point where two streams of traffic split and go in different directions.
Do Minimum		The conditions that would persist in the absence of the implementation of a construction or improvement project, but given that maintenance on the road network is ongoing.

Term	Abbreviation or Acronym	Definition
Do Nothing		The conditions that would persist in the absence of the implementation of a construction or improvement project.
Do Something		The conditions that would occur as a consequence the implementation of a construction or improvement project.
Drift geology		Materials of glacial origin including sediments and large rocks derived from erosion, transportation and deposition by glaciers.
Driver stress		The adverse mental and physiological effects experienced by a driver traversing a road network. Factors influencing the level of stress include road layout and geometry, surface riding characteristics, junction frequency, and speed and flow.
Dual carriageway		A road with a dividing strip between the traffic in opposite directions, and usually two or more lanes in each direction
Dumbbell		A type of grade-separated junction which takes the form of a roundabout either side of a major road, linked by a bridge.
Dust		All airborne particulate matter.
E		
Early Assessment and Sifting Tool	EAST	A Department for Transport tool developed to quickly summarise and present evidence on options in a clear and consistent format, to provide decision-makers with comparative evidence on how they perform.
Earthworks		The removal or placement of soils and rocks such as in cuttings, embankments and environmental mitigation, including the in-situ improvement of soils/rocks to achieve the desired properties.
East Coast Main Line		A 393-mile long major railway between London and Edinburgh via Peterborough, Doncaster, York, Darlington, Durham and Newcastle.
Ecological potential		Surface waters identified as Heavily Modified Water Bodies or Artificial Water Bodies must achieve 'good ecological potential' (good potential is a recognition that changes to morphology could make Good Ecological Status very difficult to achieve).
Ecological status		The state of a water body, derived from a number of factors, including: the abundance of aquatic flora and fauna, nutrient availability, salinity, temperature and chemical pollution levels.
Ecosystem		Biological community of interacting organisms (for example plants and animals) and their environment.
Effect		Term used to express the consequence of an impact (expressed as the 'significance of effect'), which is determined by correlating the magnitude of the impact (or change) to the importance, value or sensitivity of the receptor or resource, in accordance with defined significance criteria.
Electric vehicles		A vehicle which uses one or more electric motors for propulsion.
Elements		Individual parts which make up the landscape, such as trees, hedges and buildings.

Term	Abbreviation or Acronym	Definition
Embankment		Artificially raised ground, commonly made of earth material, such as stone, on which the carriageway is laid.
Embedded mitigation		Mitigation measures incorporated (embedded) into the design of a development project, for example earthworks to visually screen traffic movements in available views.
Enclosure		Enclosure (sometimes inclosure) was the legal process in England of consolidating (enclosing) small landholdings into larger farms.
Enhancement		A measure that is over and above what is required to mitigate the adverse effects of a project.
Environment Agency		Government agency established to protect and improve the environment and contribute to sustainable development in England. Responsibilities include: water quality and resources, flooding and coastal risk management and contaminated land.
Environmental assessment		A method and process by which information about environmental effects is collected, assessed and used to inform decision-making.
Environmental Health Officer		A local authority officer with responsibilities for protecting public health through the administration and enforcement of environmental health legislation.
Environmental Impact Assessment	EIA	The statutory process through which the likely significant effects of a development project on the environment are identified and assessed.
Environmental Impact Assessment Directive	EIA Directive	Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014, amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.
Environmental Impact Assessment Regulations	EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Environmental Masterplan		A plan which illustrates the environmental measures integrated into the design of the Scheme.
Environmental Statement		A document produced in accordance with the EIA Directive, as transposed into UK law by the EIA Regulations, which the outcomes of an Environmental Impact Assessment.
European Economic Area	EEA	The European Economic Area (EEA) was established via the EEA Agreement, an international agreement which allows for the extension of the EU's single market to non-EU member parties.
European protected species		Species of plants and animals (not birds) which are protected by European law.

Term	Abbreviation or Acronym	Definition
European site		The generic term used to describe the following designated sites: • Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); • Sites that are in the process of designation as SACs and SPAs -these are known as proposed SACs (pSACs), candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Importance (SCIs), depending on the type of designation and point of progression through the designation process; and • Ramsar Sites.
European Union	EU	An economic and political union of 28 countries which operates an internal (or single) market which allows the free movement of goods, capital, services and people between member states.
Evaluation		The determination of the significance of effects. Evaluation involves making judgements as to the value of the receptor/resource that is being affected and the consequences of the effect on the receptor/resource based on the magnitude of the impact.
Excavated material		Largely natural soil and rock material that is removed from the ground during construction.
F		
Fill		Material used to artificially raise the existing ground levels.
Find spot		A term used to describe the location at which an archaeological find was discovered.
Flood Risk Assessment		The process of assessing potential flood risk to a site and identifying whether there are any flooding or surface water management issues that may warrant further consideration or may affect the feasibility of a development.
Flood Zone 1		Flood Zone 1: land outside the floodplain. There is little or no risk of flooding in this zone;
Flood Zone 2		Flood Zone 2: the area of the floodplain where there is a low to medium flood risk; and
Flood Zone 3		Flood Zone 3: the area of the floodplain where there is a high risk of flooding.
Floodplain		Land adjacent to a watercourse over which water flows or would flow in times of flood, but for defences in place.
Fluvial		A term that relates to rivers and streams and the processes that occur within them.
Formation (geological)		A group of related rock strata with some common properties.
Fragmentation (ecological)		The breaking up of a habitat, ecosystem or land use types into smaller parcels.
Free-flow link		A section of road on a junction that links two roads and enables traffic to move without stopping.
Fugitive (emissions)		Visible emissions of dust that does not come from a definable point source, for example a smoke stack. Typical examples would include stored piles of soil, dry bare earth on construction sites or haul roads etc.

Term	Abbreviation or Acronym	Definition
Future baseline		The situation and conditions that would prevail should a Scheme not proceed. Predicted impacts are compared against this theoretical scenario.
G		
Regionally Important Geological Sites	RIGS	Locally designated sites of importance for geodiversity.
Geomorphology		The study of landforms and the processes which create them.
Geophysical survey		A process involving ground-based physical sensing techniques to determine the presence or absence of anomalies likely to be caused by archaeological features, structures or deposits.
Grade-separated		A type of junction where the major route (or routes) through the junction do not stop and do not cross any other road on the level. Movements to other roads are made using sliproads and bridges.
Great Crested Newt	GCN	A newt in the family Salamandridae, found across Europe and parts of Asia, which are protected under the Conservation of Habitats and Species Regulations 2017.
Greenhouse gases	GHG	Atmospheric gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Green Infrastructure Network Area		An interconnected network of open, greenspaces that provide a range of ecosystem functions.
Ground investigation		An intrusive investigation undertaken to collect information relating to the ground conditions, normally for geotechnical or land contamination purposes.
Ground-borne vibration		Vibration generated by an event such as the pass-by vehicles in a tunnel, propagated through the ground or structure (i.e. not the air) into a receiving building.
Groundwater		All water which is below the surface of the ground and within the permanently saturated zone.
Groundwater source protection zone		Areas defined by the Environment Agency which show the risk from contamination/pollution to groundwater that is extracted for drinking water.
H		
Habitat		The natural home or environment of an animal, plant, or other organism.
Haul road		A temporary road provided within a contractor's site area to allow for the movement of construction material, construction machinery and/or construction labour around the site.
Heavy Goods Vehicle	HGV	A commercial carrier vehicle with a gross vehicle weight of more than 3.5 tonnes.
Hectare	ha	A metric unit of measurement, equal to 2.471 acres or 10,000 square metres.

Term	Abbreviation or Acronym	Definition
Heritage asset		A building, monument, site, place, area or landscape of historic value.
Highways England		A government-owned company charged with operating, maintaining and improving England's motorways and major A-roads.
Highways England Drainage Data Management System		Management system used to store technical information about the location and condition of drainage infrastructure on the network.
Highways England	HE	The government agency responsible for the operation, maintenance and improvement of England's trunk roads and motorways.
Historic England		Executive non-departmental public body created under section 32 of the National Heritage Act 1983 to: • secure the preservation of ancient monuments and historic buildings situated in England; • promote the preservation and enhancement of the character and appearance of conservation areas situated in England; and • promote the public's enjoyment of, and advance their knowledge of, ancient monuments and historic buildings situated in England and their preservation.
Historic Environmental Record	HER	A record of all known archaeological finds and features and historic buildings and historic /landscape features, relating to all periods from the earliest human activity to the present day; maintained by each County and Unitary Authority in the United Kingdom.
Hot rolled asphalt		A common type of road surfacing comprising a dense mixture of mineral aggregate, sand and bitumen.
Hydrology		The scientific study of the movement, distribution, and quality of water on Earth and other planets, including the water cycle, water resources and environmental watershed sustainability.
Hydrogeology		The nature, distribution and movement of groundwater in soils and rocks, including in aquifers.
Hydro-morphology		The physical characteristics of the shape, boundaries and content of a water body.
I		
Impact		Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).

Term	Abbreviation or Acronym	Definition
Inert waste		Defined in Article 2(e) of EU Landfill Directive (1999/31/EC) as waste that does not undergo any significant physical, chemical or biological transformations: • inert waste 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 • the 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 and/or groundwater.
Institute of Air Quality Management	IAQM	The professional body for air quality practitioners.
Interchange		A term used to describe a grade separated junction that provides free-flow from one mainline to another.
Interim Advice Note	IAN	Guidance notes issued by Highways England which incorporate amendments or additions to the Design Manual for Roads and Bridges.
Inter-governmental Panel on Climate Change	IPCC	An intergovernmental body of the United Nations, dedicated to providing the world with an objective, scientific view of climate change, its natural, political and economic impacts and risks, and possible response options.
Inspectorate		See Planning Inspectorate.
Intervention		Types or groups of highways works, for example online options, designed to meet a series of project objectives.
Invasive species		Non-native UK plants that are invasive, for example Japanese Knotweed.
J		
Junction		A place where two roads meet, regardless of design or layout.
K		
Key characteristics (landscape)		The combination of elements that are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Kilometre	km	A unit of measurement.
L		
Land use		What land is used for, based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.
Landform		The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape Character Area	LCA	Areas of landscape that have a broadly consistent pattern of topography, land use and vegetation cover.
Landtake		The extent of land required temporarily or permanently to construct, operate and maintain a development project.
Lane		A section of carriageway marked out for the use of traffic, and typically intended for use in one direction.

Term	Abbreviation or Acronym	Definition
Lead Local Flood Authority		Authority responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets.
Limits of Deviation	LoD	The maximum lateral and vertical extents within which a highway project can be built.
Link (road)		A section of road between two junctions.
Listed building		A building or structure of special architectural or historic interest. Listed buildings are graded I, II* or II, with Grade I being the highest. Listing includes the interior as well as the exterior of the building or structure.
Local authority		The body officially responsible for all the public services and facilities in a particular area.
Local Air Quality Management	LAQM	A key part in the UK Government's and the Devolved Administrations' strategies to achieve the air quality objectives.
Local Biodiversity Action Plan		A local plan that identifies threatened species and habitats and seeks to protect and restore biological systems.
Local Nature Reserve		A statutory designation made under Section 21 of the National Parks and Access to the Countryside Act 1949 by principal local authorities.
Local authority		The authority or council that is empowered by law to exercise planning functions.
M		
Macro-invertebrate		Organisms without backbones which are visible to the eye without the aid of a microscope
Macrophyte		A plant (especially a marine plant) large enough to be visible to the naked eye.
Made ground		Land where natural and undisturbed soils have largely been replaced by man-made or artificial materials. It may be composed of a variety of materials including imported natural soils and rocks with or without residues of industrial processes (such as ash) or demolition material (such as crushed brick or concrete).
Magnitude		The size of something.
MasterMap		A source of highly-detailed geographic data of Great Britain, provided by Ordnance Survey.
Main River		A river maintained directly by the Environment Agency. They are generally larger arterial watercourses.
Mainline		The carriageway carrying the main flow of traffic, generally traffic passing straight through a junction or interchange.
Merge		The point where two different traffic flows come together and continue as one.
Met Office		The United Kingdom's national weather service.
Methane		The main constituent of natural gas, and the second most important greenhouse gas.
Metre	m	A unit of measurement.
Microgram	µg	One millionth of a gram.
Millimetre	mm	A unit of measurement.

Term	Abbreviation or Acronym	Definition
Mineral safeguard areas		Areas defined by mineral planning authorities with known mineral resources that are of identified economic or conservation value.
Mitigation		Measures intended to avoid, reduce and, where possible, remedy significant adverse environmental effects.
Modelling		The process of estimating changes within an area of interest under a specific set of conditions.
Monitoring		A continuing assessment of the performance of the project, including mitigation measures. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
Motorway		A special type of road reserved for motorised traffic only, the numbers of which are prefixed with the letter 'M'.
Movement (traffic)		A movement is one of the turns or changes in direction that a junction allows.
Multi-Agency Geographic Information Service	MAGIC	A website which provides geographic information about the natural environment.
N		
National Character Area	NCA	Areas of England defined by their unique combination of landscape, biodiversity, geodiversity, history and cultural an economic activity.
National Cycle Network	NCN	A national cycling route network of the United Kingdom, which was established to encourage cycling throughout Britain, as well as for the purposes of bicycle touring.
National Heritage List for England	NHLE	A database of designated heritage assets.
National Planning Policy Framework	NPPF	A planning framework which sets out the Government's planning policies for England and how these are expected to be applied.
National Policy Statement for National Networks	NPSNN	A statement setting out the need for, and Government's policies to deliver, the development of nationally significant infrastructure projects on the national road and rail networks in England.
Nationally Significant Infrastructure Project	NSIP	A type of project listed in the Planning Act 2008, which must be consented by a Development Consent Order.
Natural England		Executive non-departmental public body constituted under the Natural Environment and Rural Communities Act 2006 (section 2(1)) to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.
Nitrogen dioxide	NO_2	A gas produced when fuels are burned and is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.

Term	Abbreviation or Acronym	Definition
Nitrogen oxides	NO_X	A group of chemical compounds consisting only of nitrogen and oxygen which may be interconverted in the atmosphere. The principal oxides of nitrogen are nitric oxide and nitrogen dioxide.
Nitrous oxide		A naturally occurring gas that is colourless and non-flammable.
Noise barrier		A solid construction that reduces unwanted sound. It may take many forms including: engineering cutting; retaining wall; noise fence barrier; landscape earthworks; a 'low level' barrier on a viaduct; a parapet barrier on a viaduct; or any combination of these measures. Also called an attenuation barrier.
Noise Important Area	NIA	Areas identified with respect to noise from major roads and from roads within agglomerations where 'the 1% of the population that are affected by the highest noise levels from major roads' are located according to the results of the strategic noise mapping.
Noise Insulation Regulations		Noise Insulation Regulations 1975 made under Part II of the Land Compensation Act 1973.
Non-hazardous waste		Any waste not defined as 'hazardous' under Directive 91/689/EEC. Examples include soils from ground/site clearance and demolition wastes.
Non-statutory consultation		Engagement with members of the public, local groups or stakeholders which is not determined or governed by statutory requirements.
O		
Offline		Highway development on land under non-highway use, for example a new dual carriageway constructed on agricultural land.
Online		Highway development proposed along, or on the line of, an existing road, for example road widening.
Operational		The functioning of a project on completion of construction.
Ordinary Watercourse		Ordinary Watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river.
Ordnance Survey		The national mapping agency for the UK.
Outline Environmental Management Plan	OEMP	A framework document which sets out the matters that the contractor will need to include in their Construction Environmental Management Plan.
Overbridge		A bridge crossing over a transport corridor (for example a highway).
P		
Particulate matter	PM_{10} or $PM_{2.5}$	Discrete particles in ambient air, with diameters ranging between nanometres (billionths of a metre) to micrometres (millionths of a metre).
Pathways		The routes by which pollutants are transmitted through air, water, soils, plants and organisms to their receptors.

Term	Abbreviation or Acronym	Definition
Phase 1 Habitat survey		A habitat classification and field survey technique to record semi-natural vegetation and other wildlife habitats.
Photomontage		Inserting an image of a proposed development onto a photograph for the purposes of creating an illustrative representation of potential changes to existing views.
Planning Act 2008		An Act of Parliament in the UK intended to speed up the process of approving major new infrastructure projects.
Planning Inspectorate		An executive agency with responsibilities for planning appeals, national infrastructure planning applications, local plan examinations and other planning-related casework in England and Wales. Referred to as 'the Inspectorate'.
Pollution Climate Mapping	PCM	A collection of models designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of particular pollutants in the atmosphere.
Preferred route		The chosen design option that most successfully achieves the project objectives and becomes subject to further design and assessment.
Preferred Route Announcement		An announcement made by Highways England following the selection of a preferred option or solution for a given road project.
Preliminary Environmental Information Report	PEI Report	A report prepared as part of an applicant's pre-application consultation duties which contains the environmental information required by the EIA Regulations, the purpose of which is to enable the local community to understand the environmental effects of a nationally significant infrastructure project.
Priority habitat		Habitats identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan.
Principal Aquifer		Aquifers previously designated as major aquifer.
Protected Road Verge	PRV	A section of road verge protected because of their special habitat, species or ecological interest.
Protected species		Species of wild plants, birds and animals which are afforded protection through legislative provisions.
Public right of way	PRoW	A highway where the public has the right to walk. It can be a footpath (used for walking), a bridleway (used for walking, riding a horse and cycling), or a byway that is open to all traffic (including motor vehicles).
R		
Ramsar (site)		Wetland sites that are of international importance, as designated under Article 2(1) of the Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar (Iran), 2 February 1971. UN Treaty Series No. 14583.
Receptor		A defined individual environmental feature usually associated with population, fauna and flora that has potential to be affected by a project.
Registered Historic Park and Garden	RPG	Parks and gardens of special historic interest in England.

Term	Abbreviation or Acronym	Definition
Reference design		A term used to describe the design information upon which an Environmental Impact Assessment is based.
Remediation (contaminated land)		The process of removing a pollution linkage (i.e. by removing one or more of the elements in a source-pathway-receptor linkage) in contaminated land in order to render an acceptable risk. Usually this involves a degree of removal of contaminants and/ or blockage of pathways.
Representative Concentration Pathway	RCP	A greenhouse gas concentration (not emissions) trajectory adopted by the IPCC for its fifth Assessment Report in 2014
Resource		A defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, material assets, including the architectural and archaeological heritage that has potential to be affected by a project.
Ribbon development		The building of houses along a main road, especially one leading out of a town or village.
Riparian		Relating to or situated on the banks of a river.
Risk assessment		An assessment of the probability of a hazard occurring that could result in an impact.
Road Investment Strategy	RIS	A document which sets out a long-term vision for England's motorways and major roads, outlining how smooth, smart and sustainable roads will be achieved through investment over a five year period (2015 – 2020).
Rochdale Envelope		An approach to consenting and environmental impact assessment, named after a UK planning law case, which allows the promoters of development projects to broadly define their schemes within agreed parameters to retain flexibility of design.
Roundabout		A circular, one-way junction at which other roads meet and terminate.
Runoff		The flow of water over the ground surface.
S		
Sand		Soil particles from 0.06mm-2.0mm in equivalent diameter. Fine sand particles are from 0.06mm-0.2mm; medium sand from 0.2mm-0.6mm; and coarse sand from 0.6mm-2.0mm.
Scheduled Monument		Nationally significant heritage assets protected by the 1979 Ancient Monuments and Archaeological Areas Act.
Scoping		The process of identifying the issues to be addressed by 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 to be not significant.
Scoping Opinion		The written opinion of the relevant authority, following a request from the applicant for planning permission, as to the information to be provided in an Environmental Statement.
Scoping Report		A report which records the outcomes of the scoping process and is typically submitted as part of a formal request for a Scoping Opinion.
Scheme		The A428 Black Cat to Caxton Gibbet Improvements.

Term	Abbreviation or Acronym	Definition
Screening		The formal process undertaken to determine whether it is necessary to carry out a statutory Environmental Impact Assessment and publish an Environmental Statement in accordance with the EIA Regulations.
Secondary aquifer		There are two types of secondary aquifer designations: Secondary A: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers; and Secondary B: predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secretary of State		The cabinet minister who (among other things) acts as decision-maker on all national infrastructure applications for development consent.
Sediment		Organic and inorganic material that has precipitated from water to accumulate on the floor of a water body, watercourse or trap.
Setting (cultural heritage)		The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive, negative or neutral contribution to the significance of an asset and may affect the ability to appreciate it.
Severance (land)		The splitting of a land holding into more than one part, for example through the introduction of a new section of road.
Severance (walkers, cyclists and horse riders)		The perceived separation of residents from facilities and services they use within their community caused by new or improved roads, or by changes in traffic flows.
Sewage Treatment Works		Sewage treatment is the process of removing contaminants from municipal wastewater, containing mainly household sewage plus some industrial wastewater.
Significance (of effect)		A measure of the importance or gravity of the environmental effect, defined by generic significance criteria or criteria specific to an environmental topic.
Silt		Soil particles from 0.002mm to less than 0.06mm in equivalent diameter.
Single carriageway		A single carriageway or undivided highway is a road with one, two or more lanes arranged within a single carriageway with no central reservation to separate opposing flows of traffic.
Site of Special Scientific Interest	SSSI	Area of land notified by Natural England under section 28 of the Wildlife and Countryside Act 1981 as being of special interest due to its flora, fauna or geological or physiological features.
Site Waste Management Plan		A plan that is used to outline how a construction project will avoid, minimise or mitigate effects on waste production and handling on the environment and surrounding area.

Term	Abbreviation or Acronym	Definition
Slip road		A connector road within a junction between a mainline carriageway and the local highway network, or vice versa, which meets the local highway network at-grade.
Soil		The upper layer of the earth's crust, in which plants grow. It consists of weathered rock, organic matter, air spaces and water. Descriptions usually identify the relevant characteristics of its (usually) horizontal layers in terms of their significance for soil characteristics and crop growth, usually to a depth of 1.2m.
Soil erosion		The detachment and movement of soil by the action of water and/or wind.
Soil resource		The textures, structures and volume of different qualities of topsoil and subsoil that have a potential for beneficial reuse.
Sound pressure level		The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Source Protection Zone		Zones defined by the Environment Agency to protect groundwater sources such as wells, boreholes and springs from potential contamination.
Span		The horizontal distance between the two supports of a structure (for example the piers of a bridge or viaduct).
Special Area of Conservation	SAC	Sites designated under EU legislation for the protection of habitats and species considered to be of European interest.
Species of Principal Importance		Habitats and species of principal importance in England. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England.
Stakeholder		An organisation or individual with a particular interest in a development project.
Standard mitigation		Measures comprising standard techniques and activities which are implemented during the construction of a development project to protect the environment and/or mitigate adverse effects, for example the covering of exposed materials to reduce dust emissions.
Statement of Community Consultation		A document detailing how an applicant of a nationally significant infrastructure project intends to undertake consultation on its proposals.
Statutory consultation		Engagement with stakeholders determined or governed by statutory requirements.
Statutory consultee		Organisations and bodies, defined by statute, which must be consulted on relevant planning matters.
Statutory undertaker		Companies and agencies with legal rights to carry out certain types of development and/or highways works.
Strategic road network		The network of motorways and trunk roads in England.

Term	Abbreviation or Acronym	Definition
Study area		The spatial area within which environmental effects are assessed.
Subsoil		Weathered soil layer extending between the natural topsoil and the unweathered basal layer (geological parent material) below, or similar material on which topsoil can be spread. Subsoil has lower organic matter and plant nutrient content than topsoil. In most cases topsoil requires a subsoil to perform one or a number of natural soil functions.
Sulphur dioxide		A gas primarily arising from anthropogenic activities and more specifically combustion of fuels containing sulphur and sulphur compounds. Sulphur dioxide is emitted in negligible quantities during the combustion of natural gas but generally at higher concentrations for liquid fuels which have a higher sulphur content.
Superficial deposit		A geological deposit that was laid down during the Quaternary period. Such deposits were largely formed by river, marine or glacial processes but can also include wind-blown deposits known as loess.
Surface water		Waters including rivers, lakes, loughs, reservoirs, canals, streams, ditches, coastal waters and estuaries.
Sustainable development		Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Sustainable drainage systems		Measures designed to control surface runoff close to its source, including management practices and control measures such as storage tanks, basins, swales, ponds and lakes. Sustainable drainage systems allow a gradual release of water and thereby reduce the potential for downstream flooding.
Sustrans		A UK charity which aims to make it easier for people to walk and cycle, and which promotes the National Cycle Network.
Swale		A low or hollow place, especially a marshy depression between ridges.
T		
Thin surfacing system		A generic term covering proprietary surface course materials that are laid at a thickness less than 50mm, which provides a high performance, rut resistant, low noise and skid resistant layer that supports the high volume of traffic found on the strategic road network.
Till		Unsorted glacial sediment deposited directly by a glacier.
Tonnes of carbon dioxide equivalent	tCO_2e	A measure that allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of CO_2.
Topsoil		Upper layer of a soil profile, usually darker in colour (because of its higher organic matter content) and more fertile than subsoil, and which is a product of natural biological and environmental processes.
Transboundary effects		The term used to describe the significant environmental effects of a development project which extend beyond the boundary of the European Economic Area State within which it would be implemented.

Term	Abbreviation or Acronym	Definition
Transport Analysis Guidance	TAG	Guidance produced by the Department for Transport for undertaking transportation studies, appraisals and modelling. Also referred to as WebTAG.
Tree Preservation Order	TPO	An order made by a local planning authority, under the Town and Country Planning Act 1990, in respect of trees or woodlands. The principal effect of a tree preservation order is to prohibit the cutting down, uprooting, topping, lopping, willful damage or willful destruction of trees without the local planning authority's consent.
Trial trenching		A method of onsite archaeological investigation where trenches are dug at intervals across a site to identify any archaeological remains.
Trunk road		A road operated and maintained in England by Highways England.
U		
UK Climate Projections 2018	UKCP18	A climate analysis tool used to guide decision-making and boost resilience to climate change.
Unclassified (road)		A road which has no number.
Underbridge (or underpass)		A bridge crossing under a transport corridor (for example a highway).
Unexploded ordnance		Explosives that did not explode when deployed and thus still pose a risk of detonation.
Unproductive strata		Layers of rock or superficial deposits with low permeability or porosity that have a negligible significance for water supply.
Upgrade		Refers to the physical improvement of a road, through widening of the carriageway or rebuilding a junction.
Utilities		The term utilities can refer to the set of services provided by these organisations consumed by the public: Coal, electricity, natural gas, water, sewage, telephone, and transportation. Broadband internet services (both fixed-line and mobile) are increasingly being included within the definition.
V		
Variable Message Signs	VMS	An electronic traffic sign that provides travellers with information, for example alerts concerning special events or weather conditions.
Vehicle movement		A journey made by a vehicle. This can either be a one way or two way trip.
Vehicle recovery area		An area designated explicitly for vehicle recovery.
Viewpoint		A place from which something can be viewed.
Visual amenity		The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.
Visual receptor		People who may have a view of a proposed development during construction or operation.

Term	Abbreviation or Acronym	Definition
W		
Walkers, cyclists and horse riders	WCH	A collective term used to describe pedestrians, cyclists and equestrians.
Waste water treatment works	WwTW	A facility that treats waste water by removing contaminants.
Water activity permit		See discharge consent.
Water Framework Directive	WFD	Water Framework Directive 2000/60/EC – an EU Directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies.
Wildlife Trust		The Wildlife Trusts represent the Royal Society of Wildlife Trusts and include 46 local Wildlife Trusts in the United Kingdom, the Isle of Man and Alderney. Wildlife Trusts are individual charitable Trusts.
Z		
Zone of Influence	ZoI	The geographic area (or timescale) over which existing environmental conditions are likely to be influenced by change.
Zone of Theoretical Visibility	ZTV	A computer-generated tool which identifies the likely (or theoretical) extent of visibility of a development.

APPENDIX 6.1: KNOWN HERITAGE ASSETS

The following table lists all known identified heritage assets considered as part of the assessment of cultural heritage, as reported within Chapter 6 of the Preliminary Environmental Information (PEI) Report.

The first number in the reference column is that used on Figure 6.1 within Volume 2 of the PEI Report.

Reference	Grid Reference	Period	Description
1013521; MBD1494	TL 14875 55013	Bronze Age	Bowl barrow known as the "Round Hill", 440m WNW of College Farm. It is circular in plan, measuring about 21m in diameter, and survives to a height of approximately 1.7m, with steep sloping sides descending from a level area on the summit which measures 10m across. The barrow, which is apparently unexcavated, is thought to be an outlying example associated with a pattern of Bronze Age barrows located along the gravel terraces flanking the River Great Ouse. **Scheduled monument.**
1005393; 5994	TL 16189 54551	Post-Medieval	Tempsford Bridge, built 1814-20 built of dressed sandstone, with cutwaters and arches made of Bramley fall stone. Measures approximately 50m long and 10m wide. **Scheduled monument** and **Grade II listed.**
1010114; MBD475	TL 15121 56125	Medieval	Chawston Manor moated site and associated fishpond. The monument includes the remains of a medieval moated enclosure, and an associated fishpond and supply channel forming the south and west sides of a subsidiary enclosure. The principal moated enclosure in the eastern part of the monument is rectangular measuring some 56m north to south by 75m east to west, inclusive of the 8m wide dry surrounding moat. **Scheduled monument.**
1012076; MBD474	TL 16084 56730	Medieval	Moated enclosure and associated building platforms The Lane, Wyboston. The moated enclosure is `D' shaped in plan and measures some 85m along the straight southern edge of the moat. The surrounding moat is 8m wide and about 1.2m deep and is dry except for part of the east arm. Prominent external banks, surviving up to 1m high, flank the west and east sides. **Scheduled monument.**
1108; 1114917	TL 1506 5430	Post-Medieval	Roxton House, a small country house dated to the late 18th century with 19th century additions and constructed of red brick with a stone coped slate roof in neo classical style. **Grade II listed.**
10413; 1146329	TL 1512 5426	Post-Medieval	A 17th century timber framed barn to the south east of Roxton House. Mainly weather boarded with some rough cast and brick infill. **Grade II listed.**
2397; 1321209	TL 1539 5423	Post-Medieval	Poplar Farm a 17th century farmhouse with 19th century alterations. Built in an L-shaped plan of colour washed rough cast over a timber frame with one storey and attics. **Grade II listed.**
2399; 1114926	TL 1527 5433	Post-Medieval	51 High Street, a 17th century house, colour washed rough cast over timber frame. **Grade II listed.**
2410; 1311825	TL 1523 5437	Post-Medieval	60 High Street, a 17th century cottage, timber framed with colour washed plaster infill and a thatched roof. **Grade II listed.**
2401; 1146386	TL 1521 5440	Post-Medieval	50 & 56 High Street, 17th century cottages with early 19th century alterations, colour washed rough cast over timber frame. **Grade II listed.**
2402; 1114925	TL 1522 5443	Post-Medieval	46 & 48 High Street, a pair of 18th century thatched cottages, colour washed rough cast over timber frame. **Grade II listed.**

Reference	Grid Reference	Period	Description
1106; 1146376	TL 1518 5444	Post-Medieval	Congregational Chapel built in 1808 in thatched cottage style. Built in T-plan, one storey, of colour washed rough cast. **Grade II* listed.**
2409; 1321211	TL 1529 5449	Post-Medieval	Church Farmhouse, High Street. C.1600 and refaced in the 19th century. Timber framed, L-plan and two storeys with attics. **Grade II listed.**
1105; 1114927	TL 1534 5452	Medieval	St Mary's Church, a 14th- 15th century building with some 19th century reworking. Built of brown cobblestones with ashlar dressings and slated roofs. **Grade II* listed.**
2404; 1146343	TL 1522 5452	Post-Medieval	38 High Street, a c.1700 cottage. Colour washed rough cast over timber frame with a thatched roof. Consisting of one storey with attics. **Grade II listed.**
2403; 1321210	TL 1521 5453	Post-Medieval	28,30,32,34 High Street, a group of thatched cottages built c.1700. Colour-washed rough cast over timber frame. **Grade II listed.**
7859; 1114924	TL 1518 5452	Post-Medieval	36 High Street, an 18th century, colour washed rough cast over timber frame, with a thatched roof. **Grade II listed.**
2405; 1311841	TL 1522 5458	Post-Medieval	22 High Street, (The Cedars), a 17th century timber framed house with 19th century alterations. **Grade II listed.**
2406; 1114923	TL 1525 5466	Post-Medieval	14 High Street, an 18th century thatched cottage with later extensions. Possibly originally divided into two. **Grade II listed.**
1107; 1311876	TL 152 548	Post-Medieval	College farmhouse, a 16th-17th century timber framed farmhouse in Roxton. **Grade II listed.**
1744; 1114919	TL 151 561	Post-Medieval	Chawston Manor, a 17th century manor house on moated site. A two storey, L-plan building. **Grade II listed.**
1745; 1138337	TL 1544 5612	Post-Medieval	Claygates (formerly College Farm), a 17th century timber framed and thatched cottage with 20th century additions. **Grade II listed.**
1746; 1321207	TL 1567 5619	Post-Medieval	Laburnum Cottage, Chawston. A timber framed and thatched cottage built c.1700 with 20th century alterations. **Grade II listed.**
1747; 1311859	TL 1576 5614	Post-Medieval	Holly Cottage, Chawston an early 19th century thatched cottage. **Grade II listed.**
16142; 1245334	TL 1572 5615	Post-Medieval	Chawston Lodge, The Lane, Wyboston. A timber framed core house, c.1600 with 19th and 20th century alterations and additions. **Grade II listed.**
1748; 1114920	TL 159 560	Post-Medieval	Bridge Farmhouse, a 17th century, colour wash tough cast over timber frame. Old clay tile roof. T-plan, 2 storeys to main block, 2 storeys and attics to cross-wing. **Grade II listed**.
12458; 1311862	TL 161 558	Post-Medieval	Brook Cottages, Great North Road. A pair of 18th century, timber-framed thatched cottages. **Grade II listed.**

Reference	Grid Reference	Period	Description
12459; 1321208	TL 162 562	Post-Medieval	Scuttle Cottage, Circa 1700. Timber framed, with some colour washed brick infill and some colour washed plaster incised to imitate ashlar. Thatched roof. 3-bay plan, one storey and attics. S elevation: ground floor has 2 2-light casements, one 2-lignt horizontal sash, attic has one dormer with 2-light horizontal sash, all with glazing bars. C20 door and porch in line with red brick double ridge stack. C20 one storey additions to W and N. **Grade II listed.**
12477; 1146418	TL 16438 56397	Post-Medieval	Farmhouse. Circa 1800, probably encasing earlier building, reworked C19, with later C19 block added to road elevation. Red brick, probably encasing timber frame, old clay tile roof. **Grade II listed.**
1715; 1146425	TL 16414 56586	Post-Medieval	31 Great North Road, Wyboston. A late 17th century house. Colour washed rough cast. C20 tile roof, 3-room plan, two storeys. **Grade II listed.**
1713; 1114928	TL 16480 56878	Post-Medieval	64 Great North Road, Wyboston. House, formerly the Queen's Head public house. 17th century, refronted C18. Colour washed brick over timber frame, old clay tile roof. 3-room plan, 2 storeys. **Grade II listed.**
12464; 1114918	TL 14767 55997	Post-Medieval	Aubretia Cottage, Chawston. Circa 1700. Timber framed, with weather boarding to ground floor and colour washed rough cast above. Thatched roof. 2-room plan, one storey and attics. **Grade II listed.**
2408; 1321206	TL 14808 54399	Post-Medieval	Roxton House Lodge, an early C19 cottage. Main block of colour washed rough cast. S block of colour washed brick. Thatched roof. Single storeyed, octagonal plan with rectangular block to S, in cottage orne style. **Grade II listed.**
12471; 1114930	TL 15720 56904	Post-Medieval	Heddings Farmhouse, The Lane, Wyboston. Circa 1700 Farmhouse, refaced early C19. Pebble-dashed exterior, old clay tile roof. 3-room plan, 2 storeys. **Grade II listed.**
12478; 1321213	TL 16458 56405	Post-Medieval	Dovecote at Forty Farm, Great North Road, Wyboston. 17th century, timber framed with red brick infill, now colour washed. Corrugated iron roof, lower part hipped, upper gablets weather boarded. Small, square plan. **Grade II listed.**
878; 1114929	TL 16475 56920	Post-Medieval	66 & 68 great North Road, Wyboston. House. C17. Colour washed rough cast over timber frame, ground floor of N wing of colour washed brick. Old clay tile roof. L-plan, one storey and attics. **Grade II listed.**
2398; 1114922	TL 1515 5424	Post-Medieval	2, 4 & 6 Ford Lane, a former farmhouse, now divided into separate dwellings. Built c.1600 with 18th century additions, timber framed two storeys. **Grade II listed.**
2400; 1321212	TL 15217 54360	Post-Medieval	58 High Street, 18th century Cottage. Colour washed plaster over timber frame, with colour washed brick plinth. Half-hipped thatched roof. 2-room plan, one storey and attics. **Grade II listed.**
1114877	TL 12218 53930	Post-Medieval	Birchfield Farmhouse. A 17th century farmhouse, consisting of two storeys in an L-shaped plan, of colour washed rough cast over timber frame. **Grade II listed.**

Reference	Grid Reference	Period	Description
1137788	TL 13746 53317	Post-Medieval	Barford House, a small country house dated 1843 and remodelled and extended in c.1856. It is built of yellow brick with stone dressings in Italianate style, in an irregular plan with two storeys, and dominated by a four storey square tower. **Grade II listed.**
1114885	TL 13761 53336	Post-Medieval	Game Larder at Barford House dated to the mid-late 19th century. It is a one storey structure of octagonal plan with a projecting gabled porch to the west elevation. It is built of wood cladding with a thatched roof. **Grade II listed.**
1321232	TL 13752 53326	Post-Medieval	A screen wall adjoining Barford House to outbuildings to the north. Built of yellow brick with five projecting brick piers imitating banded rustication and surmounted by stone urns. There is also a cambered arched gateway with vermiculated stone keystone. **Grade II listed.**
1137796	TL 13753 53353	Post-Medieval	A mid-late 19th century barn at Barford House with wood cladding and a thatched roof. It consists of a low rectangular block with projecting gabled entrance to the south elevation. **Grade II listed.**
1321231	TL 13761 53096	Post-Medieval	Gate piers and gate to Barford House, dated to the mid-late 19th century. It consists of ashlar piers, square, approximately six feet tall with Ionic base and cornice. The gate is built of wood and wrought iron with a pierced arcading design. **Grade II listed.**
1137728	TL 13816 53120	Post-Medieval	Lowlands, an early 19th century house with later 19th century alterations, consisting of two storeys and five bays, of yellow brick and colour washed front elevation. **Grade II listed.**
1137550	TL 12339 52684	Post-Medieval	Greenlands, an 18th century house, consisting of two storeys in an L-plan. Colour washed and rough cast. **Grade II listed.**
1010864	TL 12105 54061	Medieval	Birchfield Farm moated site and associated fishponds and leats. It includes the remains of a medieval moated enclosure, measuring 100m by 85m inclusive of the 14m wide surrounding moat. A platform at the south side of the island is thought to represent the site of the original 12th century manorial building. **Scheduled monument.**
1010948	TL 13050 54449	Medieval	Palaceyard Wood medieval moated enclosure and associated enclosures, woodland bank and cultivation earthworks. The moated site is roughly circular in shape, measuring about 70m in diameter including the surrounding water-filled moat which is between 6m and 12m wide. **Scheduled monument.**
1004504; 1113881	TL 15539 51886	Post-Medieval	Blunham Bridge, two adjoining bridges spanning the River Ivel. The west bridge is 17th-18th century with 19th century additions, consisting of coursed ironstone and lime stone with five arches. The east bridge is a signle span late 19th century bridge, with iron girders mounted on coursed stone. **Scheduled monument, Grade II listed.**

Reference	Grid Reference	Period	Description
1013419	TL 16045 52935	Medieval	Gannocks Castle moated site. The moat is rectangular in form measuring ome 65m by 55m including the 10m wide surrounding moat. The moat is approximately 2.5m deep and water-filled along its northern arm. A mound at the north-eastern edge may be the site of a defensive structure. The site is thought to be built on the same spot as an earlier Danish fortress referred to in Anglo-Saxon chronicle as constructed in AD921. **Scheduled monument,**
1137920	TL 16325 51237	Post-Medieval	Dick Turpin Public House, a 17th century, two storey timber-framed building, and refaced in colour washed brick in the 19th century. **Grade II listed.**
1312362	TL 15271 51894	Post-Medieval	A 17th century house, of timber frame construction with colour washed rough cast exterior and a thatched roof. It consists of one storey and attics and two room plan. **Grade II listed.**
1113874	TL 15253 51957	Post-Medieval	An early 19th century house, originally a pair. It is of timber frame construction with brick infill, now with colour washed roughcast render leaving timber framing partly exposed. The building consists of two storeys with a four room plan. **Grade II listed.**
1321755	TL 15155 52111	Post-Medieval	A 17th century house, with colour washed roughcast over timber frame construction and a thatched roof. The building consists of one storey with attics and a three room plan. **Grade II listed.**
1321634	TL 16243 52943	Post-Medieval	Church Farmhouse, 16th century with 17th -19th century reworking. A substantial timber framed structure, the front brick faced, and almost the whole under colour washed render, in H-plan. The cross-wings of two storeys and the central block of one storey and attics but apparently originally an open hall. **Grade II listed.**
1114093	TL 16245 52912	Post-Medieval	Brewhouse and outbuilding at Church Farm. Timber framed with some weatherboarding and colour washed brick infill and built in L-plan. **Grade II listed.**
1321635	TL 16258 52960	Post-Medieval	A late 17th – early 18th century house, formerly Gannock Farm. It is a single storey, timber framed structure with colour washed plaster infill and a thatched roof. **Grade II listed.**
1114094	TL 16236 52992	Post-Medieval	Two houses of late 17th century- early 18th century origins, and extended in the 19th century. The buildings are two storeys, L-plan with colour washed rough cast render over a timber-frame core and a slate roof. **Grade II listed.**
1114110	TL 16234 52985	Modern	A K6 telephone kiosk, designed 1935 and built of cast iron consisting of a square kiosk with domed roof. **Grade II listed.**
1138206	TL 16216 52990	Post-Medieval	A 17th century house, thought to have been an Inn, with later reworking, The building is two storeys in a T-plan; the right wing has substantial timber framing exposed with colour washed brick infilling while elsewhere the building is encased in colour washed brick. **Grade II listed.**
1311945	TL 16238 53027	Post-Medieval	A pair of 18th century cottages. They are single storey with colour washed rough cast render over timber frame with a thatched roof. **Grade II listed.**

Reference	Grid Reference	Period	Description
1114095	TL 16254 53071	Post-Medieval	The Wheatsheaf, an 18th-19th century public house. The building is two storeys with attics with colour washed rough cast render, apparently containing some timber framing, and clay tile roofs. **Grade II listed.**
1114096 MBD1136, 1136	TL 16192 53032	Medieval	Church of St Peter dated to the 14th and 15th centuries, and repaired in 1621 and 1874. Constructed of coursed iron stone, cobbles and clunch with ashlar dressings. It consists of a chancel, nave, north and south aisles, north and south porches, and west tower. **Grade II* listed.**
1311917	TL 16201 53072	Medieval/ Post-Medieval	Remains of a cross, approximately 25m north of the Church of St Peter. The remains comprise the base and the bottom section of octagonal shaft. Reset on 19th century square stone base. **Grade II listed,**
1114098	TL 16153 53022	Post-Medieval	The Old Rectory, a 16th century house, substantially extended in the late 19th century. The original structure has substantial timber frame exposed to the rear elevation and with colour washed infill. The original structure is two storeys and of two room plan. **Grade II listed.**
1138245	TL 16030 53055	Post-Medieval	An 18th century, single storey house of colour washed rough cast over timber frame with thatched roof. **Grade II listed.**
1114097	TL 16196 53249	Post-Medieval	Cottage Farmhouse, an 18th-19th century house consisting of two storeys and of yellow brick, partly colour washed with hipped clay tile roof. **Grade II listed.**
1138237	TL 16119 53313	Post-Medieval	Ouse Farmhouse, an 18th century house, extended in the 19th century. It consists of two storeys with attics, mainly of colour washed brick, and the rear elevation has colour washed rough cast render, apparently covering timber framing. **Grade II listed.**
7367	TL 1525 5427	Post-Medieval	Bakehouse & 3 dwellings (site of). The buildings stood from 1813 until 1862 when they were demolished.
8614	TL 1629 5650	Post-Medieval	Buildings (site of) E of Dovehouse Farm recorded as Farm Homestead and Close on enclosure map, 1799. Site now part of arable land.
8613	TL 1612 5666	Post-Medieval	Four buildings W of Dovehouse Farm shown on the 1799 map. Site now part of arable land.
8618	TL 1624 5671	Post-Medieval	Buildings (site of) opposite Dovehouse Farm. Farm homestead and close shown on 1799 enclosure map. Site now part of arable land.
MBB18908	TL 1650 5670	Medieval	Barn adjacent to 44 Great North Road, Wyboston, a large timber framed barn with weatherboarding and pantiles.
5992; 1114092	TL 1622 5404	Post-Medieval	A 17th – 18th century house, formerly the Anchor Inn before the modern inn was built. A two storey, timber frame building, cased in colour washed brick. **Listed Building Grade II**
12953	TL 1625 5395	Post-Medieval	The Anchor public house first mentioned in 1794 and rebuilt in 1831. It is a large two bay construction with a central entrance way porch.

Reference	Grid Reference	Period	Description
18001	TL 1623 5454	Modern	The site of WWII anti-tank traps of the angle iron type. Concrete blocks with a socket were discovered extending across the road when the bridge was repaired in 1994.
14474	TL 1685 5485	Post-Medieval	161 Station Road, a brick, 2 bay plan house, deemed to be of local interest.
5980; 1114099	TL 1641 5390	Post-Medieval	Stonebridge Farmhouse, Station Road, a two storey, 18th century neo-classical style house with 19th century reworking and 20th century alterations. Red brick with stucco to the front and west elevations. **Grade II listed**
9738	TL 1625 5395	Post-Medieval	The site of Tempsford Pound, shown on the 1825 map. The site is now occupied by the present Anchor Inn.
17966	TL 1560 5458	Modern	The site of a WWII pillbox on School Lane in Roxton.
12475	TL 1505 5426	Post-Medieval	A range of 19th century outbuildings to rear of Roxton House. Whitewashed brick construction with a gabled tiled roof.
12468	TL 1540 5423	Post-Medieval	A range of 19th century barns, Poplar Farm. Weather boarded with gabled slate roofs.
2396	TL 1528 5430	Post-Medieval	Site of 57 High Street, a 17th century, timber framed house with a thatched roof. Now demolished.
12461	TL 1524 5437	Post-Medieval	The Chequers Inn Public house, High St. A 19th century, two storey public house of brick construction with a gabled slate roof.
10533	TL 1518 5457	Post-Medieval	The site of demolished 19th century timber framed barns, Park Rd.
16395	TL 152 545	Post-Medieval	The Royal Oak Pub, High Street. A 19th century brick building, with a two bay elevation with a porch, and tile roof.
12472	TL 1528 5471	Post-Medieval	8 High Street, an 18th century cottage of painted brick with a thatched roof.
15624	TL 1521 5618	Post-Medieval	Chawston Manor Farm buildings, built of brick in the 19th century. The buildings are arranged around a central yard, typical of Model Farms.
5892	TL 1575 5618	Post-Medieval	Site of Chawston House, a two storey building built in 1718 of whitewashed brick and a red tile roof. It was demolished in 1965.
5893	TL 1579 5617	Post-Medieval	Stables belonging to Chawston House, demolished in 1965.
12469	TL 1574 5614	Post-Medieval	An 18th century cottage west of Holly Cottage, Chawston. Rendered and timber-framed with a gabled cross slate roof.
5894	TL 158 561	Post-Medieval	Colesden Grange Farmhouse, a 19th century farmhouse, made of brick with tiled roof. Formerly grade II listed but removed from list in 1983.
12457	TL 163 562	Post-Medieval	18th century 1 storey + attic cottage. Gabled thatched roof. Thatched gabled porch. Gabled tile roof to 1 storey extension. Dormers to attic. Central brick chimney stack. Of rendered brick construction.

Reference	Grid Reference	Period	Description
12456	TL 163 562	Post-Medieval	1 storey rendered brick cottage of 18th century origins. Gabled thatched roof with central and Gable end chimney stacks.
12460	TL 162 562	Post-Medieval	18th century cottage, L shaped in plan, 2 storey cottage with wing of 1 storey + attic. 18th century in origin with 20th century additions. Partly rendered brick partly timber framed construction. Gabled thatched roofs. 1 storey lean-to addition with tile roof. Centrally located chimney stacks. With dormer windows to attic level.
879	TL 1636 5659	Post-Medieval	4 The Lane, Wyboston, a two storey, timber framed building. Construction date unknown.
1714	TL 1646 5667	Post-Medieval	Old Post Office, 40 Great North Road Wyboston. A 17th century house, formerly the village post office. Two storey, built of colour washed brick with a tiled roof.
18225	TL 1643 5664	Post-Medieval	A 19th century former Methodist Chapel located on the Great North Road. A large brick built structure with a slate gabled roof.
12473	TL 1643 5656	Post-Medieval	20 Great North Road, Wyboston. An 18th century rendered cottage with a gabled tile roof, consisting of one storey and an attic.
877	TL 1644 5706	Post-Medieval	Timber-framed cottage, Great North Road possibly built in the 18th century.
12463	TL 158 568	Post-Medieval	83 The Lane, Rookery Farmhouse Wyboston. An 18th century farmhouse with two storeys and an attic partly rendered brick and part plain brick construction.
8616	TL 1577 5685	Post-Medieval	The site of demolished 19th century buildings, Wyboston. Shown on the 1799 enclosure map but demolished by 1978 when the site was visited.
8615	TL 1578 5688	Post-Medieval	The site of three demolished post-medieval buildings, east of Heddings Farm. Described on the enclosure map and award c.1800.
15461	TL 1525 5455	Post-Medieval	Parish Hall, 37 High Street. A timber framed building clad in weatherboarding with a pantile roof.
880	TL 164 565	Post-Medieval	Timber framed cottage, Wyboston. Now demolished.
2407	TL 1526 5461	Post-Medieval	31 High Street, a 17th century timber framed cottage with later alterations. Demolished in 1982.
DBD3406	TL 1636 5343	-	Tempsford (Church End) Conservation Area.
DBD3415	TL 1522 5446	-	Roxton Conservation Area
DBD6476	TL 1664 5386	-	Tempsford (Langford End) Conservation Area
14844 – MBD15020	TL 157 538	Bronze Age	Bronze Age flint scatter, found during excavation at Redlands Gravel Pit, 1995. The site is located adjacent to a Bronze Age cemetery site. The flints are thought to probably be associated with the ring ditches previously excavated in 1972.

Reference	Grid Reference	Period	Description
16029 – MBD15983	TL 1 5	Early Medieval; Medieval; Post-Medieval	Anglo-Saxon strap ends, one made of silver and the other of Bronze, a brooch, as well as a bronze medieval seal die and a post-medieval purse were recorded in Roxton.
15901 – MBD15855	TL 154 543	Palaeolithic	A Palaeolithic flint core was found at Roxton
16193 – MBD16147	TL 155 562	Roman; Medieval; Post-Medieval	Remains including a Roman strap end, a late medieval belt tag and a knob from a 16th – 17th century buckle were found near Chawston in Roxton.
MBB18928	TL 1644 5653	Unknown	Human remains of at least two skeletons, an adult and a child, were discovered at 18A Great North Road.
16181 – MBD16135	TL 160 540	Roman; Early Medieval; Post-Medieval	A Roman bow brooch, five Anglo-Saxon long brooches and a fragment of a post-medieval pewter plate were identified during metal detecting near the Anchor Public House in Roxton.
2025 – MBD2025	TL 161 543	Iron Age; Roman; Early Medieval; Medieval	A group of finds were retrieved from the River Ivel in dredging operations, prior to 1939. Finds included Roman, Anglo-Saxon and medieval pottery, animal bone and red deer antler, a triangular clay loom weight and an iron ring thought to be an Iron Age currency ring.
8801 – MBD8801	TL 1563 5417	Palaeolithic	Palaeolithic hand axe found by field walking.
7001	TL 166 534	Post-Medieval	Tempsford Hall Park, the site of an 18th- 19th century landscape park. Tempsford Hall was built some time prior to 1787. Much of the park is under ridge and furrow and there is a derelict ornamental cottage in the grounds and a pair of fallen cast iron gate posts.
9726	TL 164 537	Early Medieval-Medieval	Moat and Medieval Settlement, North West corner of Tempsford Park. A square moat, largely backfilled. A structured settlement comprising a series of rectilinear plots that underwent later development, thought to be late Saxon – Medieval. This was followed by the construction of a substantial manor house within a moated enclosure.
8804	TL 1617 5421	Post-Medieval	Tempsford Staunch, the site of a former staunch over Tempsford ford, before the construction of a bridge. Yellow brickwork complete with cemented over islands.
8803	TL 1613 5405	Medieval – Post-Medieval	Site of a medieval- post-medieval ford across the Ouse is shown on Ogilbys road map of 1675.
9736	TL 162 543	Post-Medieval	Place name evidence for gravel extraction pit recorded by 1825 map and 1829 estate book. Recorded as Gravel pit field.

Reference	Grid Reference	Period	Description
17156 – MBD17109	TL 169 538	Medieval	Langford End Medieval settlement, a linear settlement set along both sides of Station Road. The village has not expanded much outside of the medieval limits.
1671	TL 167 542	Roman	Cropmarks and Roman finds, S of Tempsford Sewage Works comprising a north-south running trackway, bordered by rectilinear and sub-rectangular enclosures. Occupation evidence includes beam slots, post holes and pits as well as Roman pottery observed in the topsoil.
9732	TL 172 560	Post-Medieval	Osier ground shown on the 1829 map in the corner of a field called Friar Pits.
1387	TL 171 559	Prehistoric	A small ring ditch and linear features recorded from aerial photographs. After topsoil stripping for a pipeline in 1993, a total of 59 flint objects were recovered from the area but no features were recorded. Most of the flints were flakes and are interpreted as indicating extraction and initial working rather than occupation; they ranged in date from the early Neolithic to the mid Bronze Age.
16799	TL 168 547	Roman	A small rectangular enclosure, on the E slope of S-facing spur is thought to be associated with a Roman villa and its industrial area, the latter of which was excavated in 1994. The main settlement is thought to be located around the site of the cropmark.
8802	TL 1573 5398	Unknown	Cropmarks visible on aerial photography but the site has since destroyed by quarrying.
16784	TL 160 542	Medieval	Trackway, North of Ford Lane of medieval date, consisting of a double linear cropmark running east-west. A possible pre-cursor to the modern route from Roxton village to the footbridge over the River Ouse.
1653	TL 156 543	Prehistoric	Cropmarks, East of Roxton village, comprising linear features.
1832	TL 161 548	Prehistoric	Cropmarks indicating a block of sub-rectangular enclosures thought to be prehistoric, visible on aerial photographs.
1833	TL 155 549	Prehistoric?	An area of sub-rectangular enclosures and other linear features, probably prehistoric in origin. Archaeological trenching in the area uncovered very few features, none of which were datable.
13413	TL 152 552	Early Medieval	A site containing evidence for Saxon occupation, primarily due to one probable structure, found while trial trenching. It contained 3 roughly parallel gullies and 11 pits or postholes, 4 of which may make a rectangular structure. One of the larger pits may have been the southern end of a Grubenhaus, this is due to its large width and shallow depth, as well as containing a posthole.
15047	TL 148 550	Prehistoric	Cropmarks around Round Hill, consisting of an agglomeration of irregular enclosures with some outlying sub-rectangular and rectilinear features. Nearby excavations also revealed a small Roman enclosure system.
7009	TL 149 543	Post-Medieval	Roxton Park, a 19th century landscape park. The park comprises pasture with many trees and a lodge.
16785 – MBD16740	TL 148 540	Prehistoric	Faint cropmarks, South of Roxton Park of a possible group of rectilinear enclosures.

Reference	Grid Reference	Period	Description
8958	TL 1534 5453	Post-Medieval	St Mary's Churchyard, a post-medieval parish churchyard.
17154 – MBD17107	TL 152 544	Medieval	The historic core of the medieval settlement of Roxton.
15046 – MBD15117	TL 142 555	Prehistoric	Cropmarks, East of Colesden Hill Farm, consisting of an agglomeration of irregular enclosures, with outlying enclosures to the north and south.
7096	TL 1471 5598	Post-Medieval	The site of a demolished post-medieval farm house. The site comprised a dump of building material and pottery with a date range from the 15th to 19th century.
2831	TL 1480 5593	Medieval	Suggestions of a moated site, although uncertain as no moat is shown on the 1813 enclosure map and the alignment of the stream shown on the map suggests canalisation.
1836	TL 152 557	Prehistoric	A number of irregular linear features, thought to be prehistoric, and part of a possible ring ditch, recorded as cropmarks from aerial photographs.
8799	TL 1521 5602	Post-Medieval	Pound Close, Chawston. The Roxton enclosure award mentions a common pound at Chawston, dating 18th/19th century. Now demolished.
8806	TL 1563 5610	Modern	Gravel Pit, Chawston. The site of a disused 20th century gravel extraction pit, shown on the 1960 OS map.
17144 – MBD17097	TL 154 561	Medieval	The historic centre of the linear medieval settlement of Chawston.
745	TL 157 556	Iron Age/ Roman	A linear block of linked sub-rectangular enclosures visible on aerial photographs, one or more contained circular structures possibly of some status. Archaeological investigations just to the south of the cropmarks uncovered peripheral features relating to late Iron Age or Roman occupation.
1651	TL 161 559	Prehistoric	Linear irregular cropmarks; part of a possible sub-rectangular enclosure
8816	TL 164 559	Post-Medieval	Gravel pit shown on 1st edition OS 1" map (1834) Not shown on maps of 1817 or 1882.
1793	TL 165 563	Prehistoric	Cropmarks representing two probable ring ditches, one containing a rectangular feature, were recorded on aerial photographs taken in 1959. Subsequent photographs taken in 1968 showed that the area had been quarried away. The ring ditches were probably the remains of late Neolithic or Bronze Age barrows.
8629	TL 1642 5678	Post-Medieval	Gravel Pit Close marked on enclosure map, 1799. Place-name evidence for presence of post-medieval gravel extraction pit.
17149-MBD17102	TL 159 567	Medieval	The medieval roadside settlement of Wyboston, located along the Great North Road and The Lane.

Reference	Grid Reference	Period	Description
3407	TL 153 567	Medieval	Moat site, Manor Farm, Wyboston. A rectangular moated site shown on the 1799 Enclosure Map, but now ploughed out. At the time of the map it partially enclosed buildings, which were still extant in 1856, but were subsequently demolished.
5136	TL 149 544	Medieval	Earthworks within Roxton Park include ridge and furrow, a pre-enclosure roadway and park boundary.
5209	TL 1627 5699	Medieval	Ridge and furrow, Eaton Socon historic parish recorded on aerial photography.
MBD21767	TL 1594 5566	Medieval	Ridge and furrow adjacent to Black Cat Roundabout. Evidence comprises northwest-southeast aligned, weakly positive parallel linear trends.
9735	TL 1624 5414	Post-Medieval	Osier ground, the site of a former post-medieval osier bed. Shown on the map of 1825, now pasture fields.
3204	TL 1667 5348	Medieval	Ridge and furrow, Tempsford parish. Recorded on aerial photography although much has been ploughed flat since.
8621	TL 1626 5660	Medieval-Post-Medieval	Wyboston Green, the site of a former medieval village green, enclosed c.1799. The Green was divided into six allotments, and by 1977 the eastern end had been developed and the remainder now pasture.
8815	TL 1491 5606	Post-Medieval – Modern	A 19th-20th century gravel extraction pit, now disused. Recorded on the 1813 enclosure map, and shown as 'Old Gravel pit' on 1884 map.
8818 – MBD17147	TL 1599 5639	Bronze Age	Cropmarks, North of Chawston comprising ring ditch, linear features and possible small rectangular enclosure.
2664	TL 161 552	Iron Age/ Roman	Cropmarks of a probable group of sub-rectangular enclosures. Ditches and pits of late Iron Age/Early Roman and later Roman date were found during investigation, along with two pits containing cremation burials dated to the Roman period
8808	TL 160 546	Post-Medieval	Limestone milestone set in verge. Roadside face has inscription; "52 miles from London – Roxton, opposite face has some legend.
8810	TL 153 551	Post-Medieval	Former site of destroyed Post medieval milepost, "Bedford 3, St. Neots 4, shown on map of 1884
14447	TL 1535 5456	Post-Medieval	Tombstone, Roxton Churchyard dated to 1866, above which is a moulded horseshoe with the name inscribed on and a scroll in the middle. The bottom of the gravestone contains a poem, which is damaged and part missing.
8446	TL 151 546	Modern	20th century cast iron, standard Lion's head standpipe.
3526	TL 1478 5602	Modern	An iron standpipe with a Lionhead spout probably set up in the 1930s.
17182 – MBD17135	TL 158 554	Post-Medieval	The foundations of a 17th – 18th century wall, recovered during trenching for a gas pipeline. Thought to be for agricultural use.

Reference	Grid Reference	Period	Description
8809	TL 163 561	Post-Medieval	Milestone, defaced shown on map of 1884. Milestone London 53 shown on 1902 map. Site visit c.1978; Presumably removed during road improvements, site now part of dual carriageway.
8587	TL 1644 5665	Modern	A 20th century Lionhead Standpipe with pail rest, Great North Rd Wyboston.
8589	TL 1596 5683	Modern	A 20th century standard cast iron Lionhead standpipe.
MBB19368	TL 15 54	Unknown	A bead of light blue opaque glass of uncertain date.
MBB19387	TL 15 54	Medieval	A medieval strap fitting, made of gilt copper alloy. Its precise purpose is uncertain.
MBB19824	TL 15 55	Roman	A copper alloy Roman strap fitting, likely of 2nd- 3rd century date.
MBB19827	TL 15 55	Roman	An incomplete copper alloy barbarous radiate Roman coin, c. AD275-285.
MBB19828	TL 15 55	Roman	A copper alloy Roman coin, a nummus of Constans (AD333-350).
MBB19829	TL 15 55	Roman	A copper alloy barbarous radiate of c. AD275-285.
MBB20032	TL 16 56	Post-Medieval	A 17th century coin, a half groat of the Commonwealth period, 1649-1660.
MBB20036	TL 14 55	Post-Medieval	A 16th-17th century copper alloy decorative mount.
MBB20037	TL 14 55	Post-Medieval	A 16th-17th century copper alloy, double-oval buckle.
MBB20038	TL 14 55	Post-Medieval	An early post-medieval copper alloy hooking tag.
MBB20039	TL 14 55	Post-Medieval	An early post-medieval copper alloy sword or dagger scabbard chape.
MBB20040	TL 14 55	Medieval	A copper alloy medieval harness fitting.
MBB20044	TL 14 55	Roman	A copper alloy Roman coin, thought to be a 2nd century Sestertius.
MBB20062	TL 14 55	Roman	An incomplete copper alloy radiate or nummus of c. AD260-402.
MBB20063	TL 14 55	Roman	A copper alloy nummus, minted AD324-330.
MBB20064	TL 14 55	Roman	A copper alloy nummus, minted AD 388-395.
MBB20065	TL 14 55	Roman	A copper alloy radiate or nummus of c. AD260-402.
MBB20066	TL 14 55	Roman	A copper alloy barbarous radiate or nummus of AD275-402.
MBB20067	TL 14 55	Roman	A copper alloy nummus of the House of Valentinian, minted AD364-378.
MBB20151	TL 15 55	Post-Medieval	A post-medieval Nuremberg Rose/Orb jetton of Hans Krauwinckel II. Copper alloy, probably struck 1586-1635.
MBB20152	TL 15 55	Iron Age	A gold quarter stater of Tasciovanus c. 20BC-AD10.
MBB21181	TL 15 56	Early Medieval	A cast lead object of uncertain date and function, but may be an early medieval gaming piece.
MBB21183	TL 15 56	Medieval – Post-Medieval	A fragment of late medieval – early post-medieval copper alloy spoon bowl.

Reference	Grid Reference	Period	Description
8575	TL 161 565	Post-Medieval	Dovehouse Close marked on the 1799 map. Place name evidence for the presence of a post-medieval dovecote.
627	TL 172 545	Prehistoric; Modern	Cropmarks of a rectilinear enclosure and a small curvilinear enclosure to the north of Tingey Farm, Langford End. Cropmarks to the east are thought to represent a series of Second World War bomb craters.
628	TL 169 540	Prehistoric/ Roman	Cropmarks of a trackway running east to west bordered by rectilinear enclosures at Lambcourt End Farm. An excavation in the north of the enclosures in 2012 revealed a ditch dating from the 2nd century AD.
3008	TL 1667 5388	Post-Medieval	A small, brick-built, 19th century Wesleyan Association chapel, located within the Tempsford (Langford End) Conservation Area.
5981; 1114100	TL 1677 5385	Post-Medieval	The Old Bakery, 63 Station Road. A 17th century house with later alterations, formerly a bakery. Colour washed roughcast over timber frame, **Grade II listed.**
5982; 1114101	TL 1679 5385	Post-Medieval	Clematis Cottage, 65 Station Road. An 18th century colour washed rough cast over timber frame house with 19th century additions. **Grade II listed.**
5983; 1138262	TL 1698 5388	Post-Medieval	Lambcourt Farmhouse, 95 Station Road. A 17th century house with 20th century alterations and additions. Colour washed roughcast render over timber frame. **Grade II listed.**
5984; 1321636	TL 1731 5393	Post-Medieval	139 Station Road, a 17th century house with later additions. Colour washed roughcast over timber frame, with a thatched roof. **Grade II listed.**
5985; 1114102	TL 1698 5384	Post-Medieval	88 Station Road, a 16th century timber frame house with colour washed plaster infill, as well as 20th century alterations. It contains two storeys and three-room plan. **Grade II listed.**
5986	TL 1716 5386	Post-Medieval	52 Langford End, a former timber frame cottage. Consisted of one storey and attic, one dormer and some exposed timber framing. Now demolished.
5987; 1114103	TL 1723 5387	Post-Medieval	Biggin Farmhouse, 126 Station Road. A 17th/18th century house with 19th century extension. Two storey building, timber framed with colour washed roughcast render and partly rebuilt in brick. **Grade II listed.**
5988; 1138264	TL 1726 5389	Post-Medieval	A 17th century dovecote at Biggin Farm, 126 Station Road. Timber framed with red brick infill. **Grade II listed.**
9737	TL 1682 5394	Medieval/ Post-Medieval	Dove House Close, place name evidence for the presence of a medieval/ post-medieval dovecote, recorded on 1825 map and in the 1829 survey book.
9874	TL 1708 5378	Post-Medieval	Pound Close, place-name evidence for a site of a demolished 19th century pound. Recorded as 'First Meadow' in the enclosure award of 1778, and 'Pound Close' on the map of 1829.

Reference	Grid Reference	Period	Description
14470; 1138250	TL 1685 5383	Post-Medieval	62 Station Road, an 18th century timber frame house with colour washed roughcast render. **Grade II listed.**
15370	TL 172 539	Medieval	Earthworks, Tingey's Farm, Station road of a possible shrunken medieval settlement.
19765	TL 1638 5372	Iron Age	Ditches, beam slots, post settings and post-holes dated as Iron Age and likely to represent division and use of land adjacent to a structure. Located at the north-west corner of Tempsford Park.
19766	TL 1632 5376	Early Medieval	Saxon activity including ditches, post holes, pottery and inhumations revealed through a series of archaeological works in Tempsford Park.
20438	TL 1646 5458	Bronze Age	Cropmarks of a ring ditch, possibly a ploughed out Bronze Age round barrow and a probable north-south trackway.
20526	TL 1645 5389	Post-Medieval	Farm buildings at Stonebridge Farm, consisting of two threshing barns, a storage shed, four shelter sheds/stores for animals and a probable stable.
20567	TL 1742 4988	Post-Medieval	The route of a former turnpike road from Biggleswade to Alconbury Hill, whose alignment is now mostly followed by the A1.
20571	TL 1691 5513	Post-Medieval	A part of the former turnpike road, which ran from Tempsford Bridge to Godmanchester.
7180	TL 1622 5363	Post-Medieval	Tempsford Primary School constructed c.1870.
14471; 1311931	TL 1686 5386	Post-Medieval	81 Station Road, Langford End. A timber frame house with 16th century origins but extended in the 18th century and refaced in the 19th century. **Grade II listed.**
15795	TL 1655 5380	Post-Medieval	Demolished outbuildings to the rear of 42 and 44 Station Road. The site has since been redeveloped.
19769	TL 1633 5368	Roman	Linear ditches and curvilinear ditch dated as Roman found during archaeological investigations at the north-west corner of Tempsford Park.
3076	TL 1761 5424	Post-Medieval	The site of a gravel pit shown on the 1901 Ordnance Survey map at Mossbury Manor.
3128	TL 1767 5419	Medieval	The site of a probable moat at Mossbury Manor. The moat has been altered by ploughing and later building and is still visible to the south of the manor, while the south-east and north-east sides are now deep drainage ditches.
16802	TL 183 550	Prehistoric	Cropmarks, E of Rectory Farm. A scatter of small curvilinear enclosures with a large sub-rectangular one to the south.
9072	TL 177 562	Roman	A mixture of rectilinear and polygonal enclosures. Area cut by pipeline. The site was first located after topsoiling as a single ditch with Roman pottery being found in the topsoil up to 40m north of the ditch. A small amount of pottery and bone was found in another ditch. All ditches were aligned E-W. The site is located on a gravel terrace.
17148	TL 180 568	Medieval	Little Barford Medieval Village. The current village is still contained within the area of the medieval settlement.

Reference	Grid Reference	Period	Description
3538	TL 1756 5664	Medieval	Area of ridge and furrow, Little Barford parish, recorded from aerial photography.
9059	TL 1951 5595	Post-Medieval	High Barns, farmstead shown on the 1840 tithe map. The building has since been demolished and the site covered with shrubs.
9060	TL 1909 5625	Post-Medieval	Sheepfold in Bunker's Hill, located in field south of Top Farm depicted on the OS map. Now demolished, and land used for arable production.
9065	TL 1913 5641	Post-Medieval	An 18th century timber-framed barn, Top Farm. Now demolished.
12335	TL 190 564	Post-Medieval	The site of a range of stone, brick and weather boarded barns with gabled corrugated iron roofs at Top Farm. Now demolished.
16800	TL 183 554	Prehistoric	Cropmarks, South of Alington Hill consisting of rectilinear enclosures that abut a former stream course.
13225	TL 195 554	Unknown	Sir John's Wood, an ancient woodland of local interest.
9070	TL 189 557	Post-Medieval	The site of a demolished 19th century kiln building, shown on the map of 1826.
14032	TL 200 558	Prehistoric	Cropmarks, east of High Barns, representing a number of enclosures of different shapes and sizes.
16821	TL 197 563	Prehistoric	Cropmarks, east of Top Farm, consisting of a conjoined group of small sub-rectangular enclosure cropmarks.
13994	TL 190 572	Prehistoric	Cropmarks, north of Top Farm, comprising an extensive area of mainly rectilinear enclosures either side of a former watercourse.
3578	TL 203 561	Modern	Gipsy Corner, a 19th century field name, with circular cropmarks from Second World War structures have been reported on the site.
473	TL 1969 5638	Post-Medieval	Giants Parlour, a field name shown on the 1840 Tithe Map. Thought to relate to a local myth of a giant stood on earthworks of the site of a Roman fort.
9725	TL 193 548	Post-Medieval	A duck decoy pond constructed in the early 18th century located on the Tempsford Estate. Identified as earthworks.
9734	TL 1915 5467	Medieval	Cran Green, possible site of medieval manor house/ settlement. Referred to on the 1825 estate map and 1829 survey book.
16803	TL 185 544	Prehistoric	Cropmark of a sub-rectangular enclosure, west of Cold Arbour.
16804	TL 188 545	Prehistoric	Cropmark of a sub-rectangular enclosure, north-west of Cold Arbour.
505; MCB17569	TL 2084 4614	Roman	Sandy to Godmanchester Roman road. A section cut across the road at Sandy in 1954 revealed it to have been 17ft wide, surfaced with rammed gravel. Pottery finds beneath the road suggests a 1st century construction date.

Reference	Grid Reference	Period	Description
MCB19080	TL 2013 5641	Unknown	Cropmark enclosure complex, Eynesbury Hardwick, consisting of several enclosures of rectangular forms plus adjacent ditches and pits. Mapped from Bedfordshire 1996 aerial photography.
00800; MCB1023	TL 2017 5648	Roman	Roman coin, Eynesbury Hardwicke, a brass of Maxentius or Urbs Roma. Found in the 1930s.
MCB18837	TL 1959 5711	Medieval	Ridge and furrow (levelled), Eynesbury Hardwicke. Mapped from Bedfordshire 1996 aerial photography.
00618; MCB801	TL 197 594	Roman	Roman pit and 3ft wide metalled path, St. Neots. A coin of Claudius was found in spoil.
00618A; MCB802	TL 197 594	Post-Medieval	Three C15th and C16th silver French coins, St. Neots found in spoil.
MCB19825	TL 1973 5954	Iron Age-Roman	Large Iron Age-Roman settlement at Wintringham Park, St Neots. The site measures approximately 162 hectares and consists of evidence of enclosures and structures. The earliest evidence is of Iron Age roundhouses, as well as enclosures and a crouched inhumation. In the south of the site is a further late Iron Age enclosure complex with a rectilinear building, roundhouse as well as finds of pottery, animal bones and daub.
05690; MCB6927	TL 188 580	Unknown	Gallow Hill, a sub-rectangular enclosure and other ditches.
00514; MCB670	TL 196 593	Mesolithic	Flint implements, St. Neots comprising 16 cores, 29 blades and flakes, five scrapers and three other implements.
00616; MCB799	TL 1982 5744	Roman	Roman coins found at Parkers Farm, one of Constantinus II or Constans, one dated to the 3rd century and the other indecipherable.
MCB21095	TL 2001 5752	Unknown	Enclosure features and possible holloway, Parkers Farmhouse
11991; MCB14116	TL 211 577	Medieval	Medieval pottery and a thimble discovered over a ‘cobbled area’ on Lansbury Farm. Aerial photography showed a rectilinear pattern of cropmarks, diagonal to road and ploughlines.
MCB18836	TL 1967 5798	Unknown	Ditches, Eynesbury Hardwicke forming possible enclosure plus adjacent ditches. Mapped from Bedfordshire 1996 aerial photography.
MCB19052	TL 2119 5797	Medieval	Levelled ridge and furrow, Eynesbury Hardwicke mapped from 1996 aerial photography.
MCB19086	TL 2113 5781	Medieval	Medieval settlement, Lansbury Farm. Consisting ditched features that may form a series of fields or small enclosed areas with a possible settlement area near the east end.
MCB21136	TL 1962 5785	Unknown	Enclosures, adjacent to Rectory Farm Cottages, Abbotsley recorded from 2013 aerial photography.
MCB24568	TL 1937 5770	Post-medieval	Rectory Farm, Abbotsley illustrated om 1st edition OS map. Buildings remain extant.
01307; MCB1680	TL 193 583	Prehistoric	Flint core, Eynesbury Hardwicke found on surface scraped for carriageway.
03543; MCB4355	TL 192 583	Prehistoric	Two flint scrapers were found in a drainage ditch, Eynesbury Hardwicke.

Reference	Grid Reference	Period	Description
MCB17211; ECB2121	TL 1943 5795	Medieval; Unknown	Undated and medieval features, Potton Lane, Eynesbury Hardwicke, found during a watching brief and evaluation. Feature consisted of three undated gullies and the furrows of a medieval ridge and furrow field system. Also finds of a single prehistoric flake and a small quantity of medieval pottery.
MCB18834	TL 2032 5811	Unknown	Ditches, Eynesbury Hardwicke forming a possible enclosure plus pits. Mapped from Bedfordshire 1996 aerial photography.
MCB18833	TL 2000 5815	Unknown	Ditches, Eynesbury Hardwicke forming a possible enclosure. Mapped from Bedfordshire 1996 aerial photography.
MCB18832	TL 1976 5815	Unknown	Pits, Eynesbury Hardwicke mapped from Bedfordshire 1996 aerial photography.
MCB18835	TL 2016 5836	Medieval	Ridge and furrow (levelled), Eynesbury Hardwicke. Mapped from Bedfordshire 1996 aerial photography.
01115; MCB1417	TL 2084 5804	Medieval	Homestead moat, Eynesbury Hardwicke, which may represent the site of the manor of Launcelynsbury.
MCB23451	TL 1908 5835	Medieval	Possible archaeological features, St Neots Road, St Neots including traces of ridge and furrow and former field boundaries. An undated pit and ditch were also identified through evaluation. Pottery sherds were recorded including a late medieval sherd from the furrows and post-medieval sherds, fragments of brick and peg-tile.
MCB24569	TL 1972 5811	Post-medieval	Eynesbury Fields Farm illustrated on the 1st edition OS map. No longer extant.
01319; MCB1697	TL 1968 5861	Prehistoric	A flint blade, Eynesbury Hardwicke found in a drainage ditch.
01562; MCB2007	TL 196 585	Prehistoric	Flint implements, Eynesbury Hardwicke comprising three flakes and a scraper found in a drainage ditch.
MCB18829	TL 1924 5856	Unknown	Enclosure, Eynesbury Hardwicke. Rectangular enclosure with adjacent ditches forming another enclosure/ field division. Mapped from Bedfordshire 1996 aerial photography.
MCB18830	TL 2068 5869	Unknown	Circular enclosure and adjacent ditches plus pits, mapped from Bedfordshire 1996 aerial photography.
MCB18828	TL 1910 5862	Unknown	Enclosure group, Eynesbury Hardwicke. Several enclosures of rectangular forms plus adjacent ditches and pits, mapped from Bedfordshire 1996 AP
MCB18831	TL 1991 5855	Unknown	Possible parallel ditches, Eynesbury Hardwicke mapped from Bedfordshire 1996 aerial photography.
MCB21094	TL 1893 5829	Unknown	Cropmark features north of A428, Eynesbury consisting of a series of linear features noted by aerial photography.
MCB24594	TL 2110 5871	Unknown	Rectilinear Enclosure, Abbotsley visible on aerial photography. The enclosure appears to have sub divisions within it, measures roughly 68m x 55m.
MCB18826	TL 1929 5894	Unknown	Ditches, Eynesbury Hardwicke forming a possible enclosure plus adjacent features. Mapped from Bedfordshire 1996 AP

Reference	Grid Reference	Period	Description
MCB18827	TL 1941 5889	Medieval	Ridge and furrow, Eynesbury Hardwicke (levelled), mapped from Bedfordshire 1996 AP
09008; MCB10797	TL 197 594	Roman	Roman coin, St. Neots, a second brass of Claudius.
MCB20853; 11862	TL 2177 6701	Post-medieval	Great Northern Railway originally proposed in 1827. The London to Peterborough section opened in 1850. The service is currently known as the East Coast Mainline.
MCB19055	TL 2134 5800	Unknown	Enclosure complex, Eynesbury Hardwicke, comprising a series of abutting rectangular enclosures with internal and external ditches and pits, mapped from aerial photography. Possibly more than one phase, from superimposed ditches.
09972; MCB11831	TL 192 585	Unknown	Rectilinear enclosures, Eynesbury Hardwicke recorded on aerial photography as two enclosures with attached linear features.
1290249; DCB3188; MCB23435	TL 20959 57620	Post-Medieval	Lansbury Farmhouse, c.1800 farmhouse. Gault brick with hipped, slate roof and boarded eaves. Two storeys. **Grade II listed.**
1331024	TL 17416 61201	Post-Medieval	A 17th century timber frame house, refronted in the early 18th century with later alterations. The building is two storeys with attics, tiled roof with gable coping and stacks and an architraved doorway. **Grade II* listed.**
1330437	TL 16520 62079	Medieval	Church of St Nicholas, dated to the 13th century with a 14th century timber-framed tower, restored in the 19th century. It is built of pebble-rubble and some stone with limestone and clunch dressing. **Grade II* listed.**
1309874	TL 17331 60802	Post-Medieval	An early-mid 19th century farmhouse, consisting of two storeys of gault brick. It is double fronted with three windows and a rounded arch doorway with wooden doorcase with pilasters carrying cornice. **Grade II listed.**
1454154	TL 16454 61869	Post-Medieval	Milestone 57 on the B465 is dated to 1754-58. It is tall, stone, roughly hewn and with a rounded top with a broken top-left corner. **Grade II listed.**
1130274	TL 16589 62222	Post-Medieval	Manor Farmhouse, a 17th century timber framed and plastered farmhouse, consisting of two storeys in a hall and crosswing plan. It also has an early 19th century, single storey painted brick bakehouse to the east. **Grade II listed.**
1162365	TL 16651 62270	Post-Medieval	A 17th century timber frame and plastered farmhouse, with two later, possible 18th century, extensions to the west of the original hall and cross wing. **Grade II listed.**
MCB19042	TL 2089 5940	Unknown	Ditches forming a possible curvilinear enclosure, Abbotsley. Mapped from Bedfordshire 1996 aerial photography.
01270b; MCB1642	TL 2177 5971	Medieval	Moat and Medieval chapel site, Wintringham. Traces of a moated enclosure are seen to the west of the house, rectangular shaped. No trace of chapel found during trenching.

Reference	Grid Reference	Period	Description
02359; MCB2973	TL 217 590	Post-Medieval	Wind pump, Wintringham, recorded on OS mapping.
02385; MCB3006	TL 2178 5973	Post-Medieval	Possible Tanning vat, Wintringham. A rectangular structure of rubble faced on the inside with red tiles measuring 10ft by 8ft.
03535; MCB4342	TL 2075 5987	Prehistoric	Flint flake, St. Neots Rural found in a drainage ditch.
03539; MCB4349	TL 2088 5992	Prehistoric	Prehistoric flint flake, St. Neots found broken in a drainage ditch.
04062; MCB4930	TL 2070 5980	Unknown	V-shaped undated ditches, St. Neots bypass were observed in section 1m wide and 40cm deep below top of subsoil.
04063; MCB4931	TL 2091 5995	Unknown	Pit, St. Neots Bypass observed in section, 1.4m long and 0.4m deep below ploughsoil.
04064; MCB4932	TL 2048 5967	Unknown	Pit, St. Neots Bypass observed in section measuring 6m long and 0.5m deep.
MCB19043	TL 2174 5953	Unknown	Possible ditch, Abbotsley. Mapped from Bedfordshire 1996 aerial photography.
MCB18821	TL 2034 5988	Medieval	Ridge and furrow, St Neots, mapped from Bedfordshire 1996 aerial photography.
MCB18822	TL 2065 5994	Unknown	Pit, St Neots Rural, mapped from Bedfordshire 1996 aerial photography.
02388; MCB3010	TL 200 591	Roman	Roman metalled surface and pottery revealed during a small excavation at Eynesbury Hardwicke.
MCB24570	TL 2160 5898	Post-medieval	Lower Wintringham Farm illustrated on 1st edition OS map. Farm remains in use although unclear how many original buildings are extant.
03532; MCB4339	TL 2021 5932	Prehistoric	Flint scraper, St. Neots found in a drainage ditch.
MCB18824	TL 2056 5940	Unknown	Ditches, Abbotsley forming a possible enclosure. Mapped from Bedfordshire 1996 aerial photography.
MCB19045	TL 2190 5884	Unknown	Enclosure group, predominately rectilinear, within of forming a broad ditched enclosure which also has external features, Abbotsley. Mapped from Bedfordshire 1996 aerial photography.
MCB19041	TL 2101 5990	Unknown	Ditches that may be part of an irregular enclosure and adjacent features and possible pits nearby, Abbotsley. Mapped from Bedfordshire 1996 aerial photography.
MCB18823	TL 2047 5971	Unknown	Ditches, St Neots forming a possible enclosure/ field division. Mapped from Bedfordshire 1996 aerial photography.
1006849; DCB103; 02364	TL 22941 59650	Medieval	Deserted village (site of) at Weald. The manor site is clearly visible to the north east of the scheduled area and the church stood in the chapel yard. The site was deserted in the last 200 years. **Scheduled monument**
1006815; DCB108; 01117	TL 22123 59325	Medieval	Deserted village at Wintringham. Earthworks comprising a rectangular pattern of sunken roads and rectangular house platforms typical of deserted medieval villages. **Scheduled monument.**

Reference	Grid Reference	Period	Description
1210919; DCB2892 MCB24577	TL 23397 60050	Post-Medieval	North Farmhouse about 1/4 Mile North East of Weald House. C18 L-plan farmhouse. Local brick, originally painted or plaster rendered. Thatched, hipped roof with end stacks. Two storeys. **Grade II listed.**
1211324; DCB2933	TL 21902 59766	Post-Medieval	Barn about 100 yards South of Wintringham Hall, C17 aisled barn of nine bays. Timber framed on brick sill. Modern roof. **Grade II listed.**
1211327; DCB2935; MCB19834;	TL 21034 60270	Post-Medieval	Farm buildings at Tithe Farm, Mid C19 model farm buildings on L-plan. Gault brick and hipped, slate roofs with dentil cornice. East range: cartshed of eight bays with grainstore above. South range: stable incorporating granary. Five horizontal sliding sashes and two doorways to stables. **Grade II listed.**
1211328; DCB2936;	TL 21065 60288	Post-Medieval	Tithe Farmhouse about 1 Mile East of Railway Bridge, Farmhouse dated 1773 on bell shaped rainwater head to east gable end. Gault brick. Double pile plan with two linked mansard roofs. Tiled. Two storeys and attics. **Grade II listed.**
1290056; DCB3165;	TL 21889 59808	Post-Medieval	Granary South West of Wintringham Hall, c.1830 granary with three cart bays at ground floor. Gault brick. Hipped, slate roof with louvred ventilation opening at apex. **Grade II listed.**
MCB23486	TL 2364 6138	Unknown	Rectilinear enclosures, 1km south of Wayside Farm, Toseland, shown as cropmarks of linear features on 2009 aerial photographs.
MCB1421; 01117a	TL 220 594	Medieval	Wintringham Medieval Great Hall
01117b ; MCB1422	TL 220 594	Roman	Twelve sherds of Roman pottery were found, Wintringham
12190; MCB14315	TL 220 598	Post-Medieval	Wintringham Hall Park, consisting of mostly lawns and trees.
01270a; MCB1641	TL 219 598	Post-Medieval	Wintringham Hall, a late 19th century brick building surrounded by a rectangular moat, thought to have replaced a previous Elizabethan manor on the site.
02406; MCB3033	TL 2210 5965	Modern	The site of a Second World War searchlight, Wintringham, recorded as a circular cropmark on aerial photography.
06094; MCB7417	TL 225 593	Medieval	Ridge and furrow, Eynesbury Hardwicke indicating medieval agricultural activity.
MCB15790; ECB1482	TL 20098 60302	Iron Age	Middle Iron Age settlement activity, E of St. Neots, consisting of shallow ditches and pits containing occupational debris, recorded through trial trenching.
MCB15791	TL 2029 6035	Iron Age	Iron Age coin, E of St. Neots, revealed during trial trenching. A coin of Cunobelin was found in the South-west corner of the site.

Reference	Grid Reference	Period	Description
MCB19036	TL 2125 6064	Unknown	A series of adjacent or linked enclosures of mainly sub-square forms. Mapped from Bedfordshire 1996 aerial photography.
MCB19039	TL 2230 6046	Unknown	Possible enclosure, Abbotsley. Enclosure-like form but possibly a mixture of natural and agricultural marks. Mapped from Bedfordshire 1996 aerial photography.
MCB19037	TL 2103 6044	Medieval	Ridge and furrow (levelled), St Neots. Mapped from Bedfordshire 1996 aerial photography.
MCB20140; ECB3667	TL 2069 6043	Roman/ Medieval	Field walking finds at Love's Farm, St Neots, consisting of occasional pot sherds of roman and medieval date. The Roman pottery was broadly dateable to the 1st and 2nd centuries. Also found were a possible Roman pot mend, a fragment of an intaglio ring and a single Roman coin.
MCB19035	TL 2130 6082	Unknown	Rectilinear Enclosure with internal and external ditches and pits, St Neots. Mapped from Bedfordshire 1996 aerial photography.
02472; MCB3102	TL 221 611	Roman	Roman earthworks, Monks Hardwick Farm situated on an elevated position some 400 yards north of Fox Brook. Possibly representing a temporary camp, with earthworks recorded in the 19th century supposedly showing fortifications. Not visible on aerial photography, and no trace of earthworks seen from ground.
MCB24564	TL 2257 6127	Post-Medieval	High Barn, Abbotsley illustrated on the 1st edition Huntingdonshire OS map, 1885. The buildings are still extant.
02357; MCB2971	TL 236 594	Roman	Roman cemetery site, Eynesbury Hardwicke reported by G T Rudd.
02358; MCB2972	TL 236 596	Roman	Roman finds, Eynesbury Hardwicke consisting of coins and pottery sherds as well as a carved stone block.
02364a; MCB2979; ECB355	TL 229 596	Early Medieval	Saxon finds, Weald DMV consisting of pottery was found during excavations north west of Chapel yard. Late Anglo-Saxon structures of a domestic nature were found during excavation in 1942 below the church.
02346b; MCB2980	TL 229 596	Post-Medieval	Post-medieval architectural remains at the site of the deserted village at Weald. Brick foundations of a house look 17th century but there are little or no remains of other buildings shown. One cottage along the road recorded on the 1902 map, thought to be deserted during the 19th century.
MCB24572	TL 2331 6064	Medieval	An area of ridge and Furrow, Abbotsley visible on LiDAR imagery, 2015. The features appear to be heavily grown over in an area known as New Gorse. Further ridge and furrow is also recorded as cropmarks directly to the south on aerial photography, 2009.
MCB24573	TL 2327 6083	Unknown	Linear cropmarks forming several rectilinear enclosures, Abbotsley visible on aerial photography, 2009. The cropmarks are situated in a line on a broadly NE-SW alignment. The cropmarks cover and area measuring c.190m east-west.
MCB24574	TL 2299 6087	Unknown	Cropmarks of a rectilinear enclosure, Abbotsley are visible on aerial photography, 2009. The enclosure measures roughly 50m by 65m and a second enclosure is possibly visible to the south.

Reference	Grid Reference	Period	Description
MCB24576	TL 2337 6040	Unknown	Linear features, Abbotsley are visible as cropmarks on aerial photography, 2009. The cropmarks may form several enclosures although it is difficult to determine their exact relationship.
MCB24579	TL 2266 5967	Post-Medieval	Weald Farm, Weald illustrated on 1st edition Huntingdonshire OS map, 1885. The buildings appear to still be extant.
01270; MCB1640	TL 218 598	Medieval	Moated site at Wintringham Hall. The moat is sharply defined and wet on the north and east but deteriorated on the west side. Much of the south arm has been obliterated by farm buildings.
MCB19040	TL 2224 6006	Unknown	Ditched features that include rectangular forms, irregular shapes and a possible ditch running to a pond, Abbotsley. Mapped from Bedfordshire 1996 aerial photography.
MCB19044	TL 2239 5977	Post-Medieval	Metalled track, presumably once linking the road to its north with a building and possible ditches, Abbotsley. The possible ditches on its south side mapped from Bedfordshire 1996 aerial photography.
MCB19038	TL 2183 6038	Unknown	Ditches, Abbotsley possibly parts of enclosure group recorded through aerial photography.
MCB19032	TL 2226 6120	Unknown	A series of mainly straight ditches, Abbotsley. Possibly part of a field system, mapped from 1996 aerial photography.
MCB24578	TL 2389 5999	Unknown	Series of features visible as cropmarks east of North Farm, Abbotsley and Croxton, on aerial photographs 2009. Consists of two sets of linears that run parallel and form two roughly rectangular shapes, one wholly within the other. There are also two oval shaped features also visible.
MCB24562	TL 2401 6085	Post-Medieval	Site of Barn Farm, Toseland, illustrated on the 1st edition Huntingdonshire OS map, 1885. The building is no longer extant.
02431; MCB3060	TL 239 596	Medieval	Weald medieval church (site of), Croxton, evident through earthworks, the churchyard can still be traced.
1019176; DCB273; MCB1482; 01143	TL 27285 59713	Medieval	Moated site at Pond Farm, a roughly rectangular island which measures 50m north-south by up to 46m east-west and which is raised by approximately 1.5m above the surrounding ground surface. This is defined on three sides by a water-filled moat, measuring up to 8m wide and at least 2m in depth. A shallow linear depression indicates the position of the west arm of the moat which was partly infilled in the late 19th century and now survives as a buried feature. **Scheduled monument.**
1019638; DCB274; 01142a	TL 2732 5931	Medieval	Moated site at Manor Farm. It is located 600m to the south east of the parish of Eltisley. It consists of a roughly rectangular island, measuring up to 74m north-south by 64m east-west. There is a water-filled moat measuring an average 12m in width. Manor Farm House is located on a building platform on the southern side of the island. **Scheduled monument.**
1006783; DCB243; 02334	TL 25149 59537	Medieval	Croxton deserted medieval village and 16th-17th century garden remains. The post-medieval remains consist of a circular enclosure and a pond. **Scheduled monument.**

Reference	Grid Reference	Period	Description
1163501; DCB5025; 01143a	TL 27273 59714	Post-Medieval	Pond Farmhouse, late C15 or early C16 with C19 and C20 alterations. Timber-frame exposed and plastered or covered at first floor by asbestos sheeting; painted brick. Low pitched hipped early C19 slate roofs. Two storeys with main north-south range and crosswing to north. **Grade II listed.**
1127171; DCB4404; 02329	TL 24829 59990	Post-Medieval	The Downs, an early to mid C19 Villa. Gault brick, low pitched hipped slate roof. Two storeys with lower, rear service wing. **Grade II listed.**
1127175; DCB4405	TL 24934 59697	Post-Medieval	Gatehouse Lodge, A C17 2 storey cottage with C19 lean-to to left hand. Timber-framed and plastered. Plain tile roof. Tall square red brick ridge stack. **Grade II listed.**
1127177; DCB4406	TL 27234 59562	Post-Medieval	Village Pump to North of Number 18, C19. Long case of wood with cast iron cistern and spout and lever. **Grade II listed.**
1127178; DCB4407	TL 27618 59269	Post-Medieval	122 & 124 Caxton End. Cottage. Early C19. Gault brick, timber-framed and plastered, slate roof. Central ridge stack. Two storeys. **Grade II listed.**
1127181; DCB4409	TL 27097 59778	Post-Medieval	Kent Cottage, early C19. Painted brick; long straw thatch roof, end stacks. Two storeys. Symmetrical façade. **Grade II listed.**
1127205; DCB4420	TL 24674 59464	Post-Medieval	Westbury Farmhouse, early C16 open hall with later C17 or C18 axial additions, early C19 brick casing and double pile wing to west. Timber-framed and plastered, soft red brick and C19 gault brick. Plain tile hipped roofs, side stack to west and rear stack. **Grade II listed.**
1163272; DCB4995	TL 24851 59808	Post-Medieval	The House on the Hill, Pair of late C17 or early C18 cottages with C19 brick casing. Long straw thatched roof. Two local red brick ridge stacks. One storey and attics. **Grade II listed.**
1163308; DCB4999	TL 24888 59815	Post-Medieval	Chefs' Cottage, C17. Timber-framed and plastered. Hipped long straw thatched roof. Central gault brick ridge stack. One storey and attic. **Grade II listed.**
1163469; DCB5022 02344	TL 26966 59652	Post-Medieval	The Old House, exposed timber-frame with plain tile roofs and plastered plinth. Two storeys and attics; dated 1612 on the door lintel. **Grade II listed.**
1163520; DCB5026	TL 27129 59788	Post-Medieval	South View, Cottage. C17 with C19 alterations. Timber-framed and plastered. Corrugated iron roof; red brick ridge stack. One storey and attic. **Grade II listed.**
1163524; DCB5027	TL 26947 59726	Post-Medieval	52, The Green, C17 cottage. Timber-framed and plastered. Long straw thatched roof with central red brick ridge stack. One storey and attic. **Grade II listed.**
1223662; DCB5224	TL 27191 59750	Modern	K6 Telephone Kiosk, designed 1935. Cast iron. Square kiosk with domed roof. Unperforated crowns to top panels and margin glazing to windows and door. **Grade II listed.**
1309206; DCB5347; 01142b	TL 27339 59301	Medieval/ Post-Medieval	Manor Farmhouse, built in the late C15 with C17 insertions and C18 and C19 alterations and additions. Timber-frame cased in late C19 red brick. Plain tile roofs. **Grade II listed.**

Reference	Grid Reference	Period	Description
1331393; DCB5655	TL 24889 59800	Post-Medieval	Myrune Cottage, C17. Timber-framed and plastered. Half hipped long straw thatched roof, with original red brick stack with grouped shafts set diagonally. One storey and attic, three unit plan. **Grade II listed.**
1331396; DCB5656; 02297	TL 27103 59618	Medieval/ Post-Medieval	Green Farmhouse, House formerly a farmhouse. Possibly late C15 or early C16 (qv Manor Farmhouse and No. 18 The Green), remodelled and partly rebuilt C17 with later alterations. Timber-frame exposed and plastered with plain tile roofs. Ridge stack with grouped diagonal shafts; two side stacks to left hand. Two storeys and attics, hall with crosswings to east and west. **Grade II listed.**
1127172; DCB5690	TL 24854 59838	Post-Medieval	Rose Cottage, Late C17 or early C18. Timber-framed and plastered with long straw thatched roof. Stack behind ridge with upper courses rebuilt. One storey and attic, three unit plan. **Grade II listed.**
02328; DCB5691; 1127173	TL 24894 59698	Medieval/ Post-Medieval	The Manor House, late C15 or early C16. Timber-frame exposed and plastered with C17 red brick plinth and walls. C19 brick casing to rear. Plain tile roofs with pantiles to rear elevations. One storey and attic hall range with jettied cross wings of two storeys. **Grade II listed.**
1163289; DCB584	TL 24872 59719	Post-Medieval	Forge Cottage and Ivy Cottage, a pair of C18 cottages subdivided into four small dwellings early C19. Timber-frame on soft red brick plinth with front walls cased with weatherboarding and pebble dashed; plastered gables. **Grade II listed.**
1331398; DCB5996	TL 27089 59444	Medieval/ Post-Medieval	Late C15 or early C16 with later alterations. Timber-framed with roughcast render and long straw thatched roofs. Ridge stack and end stack to right hand. One storey and attic, L-plan with hall range to right hand originally single storeyed. **Grade II listed.**
1127174; DCB6008	TL 24880 59839	Post-Medieval	Village Pump outside Chefs' Cottage, C19. Cast iron stand with spout and lever. **Grade II listed.**
1127176; DCB6009	TL 27233 59539	Post-Medieval	Pump Cottage, Late C16 or early C17. Timber-framed and cased with painted brick. Long straw thatched roof. One storey and attic, three unit plan. **Grade II listed.**
1331370; DCB6322	TL 24673 59490	Post-Medieval	Barn to North of Westbury Farmhouse, C16. Timber-framed and weather boarded with asbestos covering to modern roof. **Grade II listed.**
1331370; DCB6323; MCB18052	TL 24410 60080	Post-Medieval	Mile Post, to North West of Spread Eagle Public House, C19. Cast iron, triangular with chamfered top. Painted white, with black painted letters in relief. ‘Camb. 14, St Neots 4, Oxford 75’ **Grade II listed.**
1163314; DCB6491	TL 24896 59779	Post-Medieval	Lindsey Cottage Immediately South of Myrune Cottage, Late C17, timber-framed and cased in early C19 brick. Long straw hipped thatched roof. Local red brick ridge stack. One storey and attic, three unit plan. **Grade II listed.**

Reference	Grid Reference	Period	Description
1318237; DCB6589; MCB2904	TL 27620 59243	Post-Medieval	Jesus College Farmhouse, a house formerly a farmhouse. Early C17 originally extended further to east of existing building. C20 extension to west. Timber-framed and plastered, hipped plain tile roof. **Grade II listed.**
1331392; DCB6650	TL 24871 59760	Post-Medieval	Orchard Cottage and Two Cottages to North. Row of three cottages, now a single dwelling. C17 with timber-frame cased in C19 brick and cottage to south possibly rebuilt. Timber-frame partly plastered in north gable, C19 brick. **Grade II listed.**
1331394; DCB6651; MCB18069	TL 27411 60086	Post-Medieval	Mile Post, C19. Cast iron with three angled faces. Painted white with black painted raised inscription 'Oxford 75, St Neots 6, Cambridge 12, Eltisley'. **Grade II listed.**
1331395; DCB6652	TL 27378 59489	Post-Medieval	Pear Tree House, Early C19. Timber-framed with pebble-dashed render, red brick gables extended to right hand with gault brick by one bay. Pantile roof. Two storeys. **Grade II listed.**
1127180; DCB6665	TL 26905 59693	Post-Medieval	Lych Gate to North East of Parish Church, commemorating 1914-18 war. Limestone walls with two inset plaques inscribed with war dead. Oak frame inscribed 'Death Swallowed Up in Victory'; plain tile gable roof. The lych gate marks a C20 extension to the churchyard. **Grade II listed.**
1163346; DCB6817	TL 27206 59560	Post-Medieval	12 Caxton End, a late C16 or early C17 Cottage with C20 alterations. Timber-framed with roughcast render. Long straw thatched roofs. Ridge stack. One storey and attic with roof perhaps raised to right hand unit of original three unit plan. **Grade II listed.**
1163409; DCB6819	TL 27456 59460	Post-Medieval	Mistletoe House, a cottage and shop extension. Dated EN 1826 on ridge stack. Timber-frame cased in gault brick with corrugated iron roofs. Two storeys with single storey shop to north-east. **Grade II listed.**
1163534; DCB6820; MCB18059	TL 27207 60052	Post-Medieval	Milestone, C19 or earlier. Limestone block with pyramidal cap. Inscriptions incised and painted black 'Eltisley, St Ives 8, Potton 8'. **Grade II listed.**
1309225; DCB6915	TL 25311 59712	Post-Medieval	Well Head to North of Croxton Park, C19. Timber-framed and weather boarded with hipped long straw thatched roof with central projecting structure. Entrance facing south. **Grade II listed.**
1309327; DCB6920	TL 24653 59503	Post-Medieval	Barn to North West of Westbury Farmhouse, C16. Timber-framed and weather boarded on ironstone and brick foundations. Corrugated iron covering to modern roof. **Grade II listed.**
1331397; DCB7000; 02316	TL 27145 59796	Medieval/ Post-Medieval	The Old Post House, Late C15 with early C17 and C19 and C20 additions and alterations. Timber-framed with C20 pargetted cement render, plain tile roofs hipped to left hand with gablet. Single storeyed open hall and service bay to right hand with jettied crosswing to left hand. **Grade II listed.**

Reference	Grid Reference	Period	Description
1127179; MCB339; DCB4408; 00252	TL 2684 5966	Medieval	Saint Pandionia and Saint John the Baptist's Church, Eltisley. The earliest parts of the church are the nave and aisles which were built c.1200, with the clerestorey remodelled and the tower added in the later medieval period. Rebuilding work took place in the 19th century including of the chancel and much of the north chapel and general restoration between 1875-1879. **Grade II* listed.**
1127206; MCB12357; DCB6343; 10406	TL 2473 5948	Post-Medieval	Dovecote, Westbury Farm, Croxton, a late 17th – early 18th century, a rebuilding of a former timber framed dovecote. Red brick walls with plain tiled pyramidal roof. One storey, square planned with about 300 blocked nesting boxes constructed in brick. **Grade II listed.**
12280; MCB14404	TL 2519 5944	Post-Medieval	Croxton Park, an early 16th century deer park which incorporates earthwork remains of 16th century garden features, as well as a mid-18th century house and walled garden set within the park. The area was enlarged and landscaped in the early 19th century. **Grade II* registered park and garden.**
MCB24582	TL 2668 6134	Unknown	Ridge and furrow and curvilinear features at Fair View Farm, Yelling
10020; MCB11884	TL 2700 5940	Medieval	Medieval earthworks, Eltisley, comprising series of banks, ditches, ponds and potential house plots.
02317; MCB2928	TL 2722 5982	Post-Medieval	Leeds Arms, Eltisley, a late 18th century public house. Two storey with attics, made of redbrick with tiled roofs.
02318; MCB2929	TL 271 594	Post-Medieval	Post-medieval barn, Eltisley, framed and boarded, with a suggested C16 origin.
02343; MCB2954	TL 261 594	Post-Medieval	Eltisley windmill
02351; MCB2962	TL 271 595	Medieval	Earthworks, Eltisley
02352; MCB2963	TL 272 595	Medieval	Medieval pottery finds, Eltisley. A twisted pottery handle, grey in colour. Well-fired, fine fabric.
02380; MCB2999	TL 2687 5963	Early Medieval/ Medieval	Eltisley Abbey, St. Pandiona's Well (site of). The traditional site of a 9th century Benedictine nunnery, with possibly post-medieval moat and water garden.
02380a; MCB3000	TL 2687 5963	Post-Medieval	Post Medieval house and moat, The Old House, Eltisley, dated 1612 are thought to be a water garden connected to the house.
02403; MCB3030	TL 266 595	Iron Age	Three parallel rows of pits, Eltisley presumed to be Iron Age in date.
02411; MCB3038	TL 2740 5928	Unknown	Earthwork bank, Eltisley following a hedge line marked on the OS map to the south of the moated site at Manor Farm. The bank is rounded and measures 10-15ft wide and 1 ½ ft high, with an outer ditch which crosses a series of ridge and furrow.
MCB22620	TL 2635 5984	Post-Medieval	Rectory, Eltisley, recorded on the 1st edition OS map. The building is still extant.
MCB22621	TL 2725 5954	Post-Medieval	Blacksmiths workshop, Eltisley illustrated on the 1st edition OS map.

Reference	Grid Reference	Period	Description
MCB22622	TL 2632 5934	Medieval	Ridge and furrow, Croxton, area levelled. Visible on aerial photography 2013.
MCB23573	TL 2717 6117	Unknown	Cropmarks of at least four rectilinear enclosures, Eltisley visible on aerial photography.
MCB24563	TL 2520 6097	Post-medieval	High Hayden, Yelling, the site of a house or farm illustrated on the 1st edition OS map. No longer extant.
MCB24566	TL 2562 5988	Post-medieval	School, Croxton built in 1869. No longer in use.
MCB24583; ECB4675	TL 2673 6084	Unknown	Curvilinear and linear features at Fair View Farm, Yelling recorded through geophysical survey thought to represent an enclosure, ditches, paths or tracks. A east-west track is shown on historic mapping so features may relate to this.
MCB24584	TL 2629 6005	Unknown	Possible enclosure, Croxton visible as cropmarks. The linear features form at least three separate sides of the possible enclosure, measuring roughly 40m x 46m.
MCB24585	TL 2722 6057	Unknown	Enclosure Complex, Eltisley shown on aerial photography. At least four separate enclosures with several linear features cutting them, suggesting multiple phases of activity. Three circular features are also visible.
MCB24586	TL 2718 6038	Unknown	A single enclosure, Eltisley is visible as cropmarks. Measures roughly 37m x 26m and is likely related to the enclosure complex visible to the north.
MCB24587	TL 2734 6022	Unknown	A Single enclosure, Eltisley visible as cropmarks. Measures roughly 65m x 55m.
CB15602; MCB15602; ECB1261	TL 27241 59516	Roman; Medieval	Evaluation at Newton County Primary School, Eltisley, 2003 revealed a ditch and pit containing a fragment of human hip bone. Both of these features were cut by a large medieval pit, dated c. AD1200-1300. The feature is thought may represent back plots to houses fronting the roadway.
MCB16718	TL 2740 5943	Neolithic	An early Neolithic unpolished axe find, Caxton End, Eltisley.
MCB17175	TL 2704 5965	Post-Medieval	Primitive Methodist chapel, Eltisley. It was built facing the Green in 1846, and rebuilt in brick in 1879.
MCB17254	TL 2680 5962	Medieval	Ridge and furrow, Church End, Eltisley revealed during magnetic survey.
MCB18912	TL 2600 5970	Post-Medieval	Ditched boundaries and possible quarries or ponds, Croxton. Mapped from Bedfordshire 1996 aerial photography.
02387; MCB3009	TL 253 597	Bronze Age	A Middle Bronze Age rapier, found in Croxton Park. The blade has a broad, flat mid-rib and two notches in the butt, which provide the only means of securing the blade to the grip.
MCB19662	TL 2683 5960	Post-Medieval	Ditches and mounds as part of garden at Old House, Eltisley.
MCB19980; ECB3672	TL 2732 5932	Medieval – Modern	Roman and Medieval to Modern features at Manor Farm, Eltisley. Trial trenching revealed a mound/ platform that probably supported a larger building to the east of the present building. There also appeared to have been a trackway to the north of the moat.

Reference	Grid Reference	Period	Description
MCB21441	TL 2691 5972	Post-Medieval	Corn Mill, Church End, Eltisley recorded on the 1st edition OS map, comprising a detached house and square courtyard.
MCB21442	TL 2740 5947	Post-Medieval	Wesleyan Methodist Chapel, Eltisley recorded on the 19th century OS maps.
MCB18907	TL 2519 6162	Unknown	Enclosure group, Yelling. D-shaped enclosure plus adjacent enclosures and fields mapped from Bedfordshire 1996 aerial photograph transcription.
02517; MCB3165	TL 246 601	Medieval	Ridge and furrow, Croxton measuring 140 yards long. This area was formerly all old enclosures but this is all that now remains.
02451; MCB3080	TL 2450 6009	Post-Medieval	White Hall, Croxton, a complex of buildings visible on the 1st edition OS map. The building survives as a red brick L-shaped building with later additions. The front façade is symmetrical with two bay windows and a central entranceway with a porch. The rest of the complex has been destroyed.
MCB24565	TL 2439 5959	Post-Medieval	Croxton Kennels, Croxton, illustrated on the 1st edition Huntingdonshire OS map 1885. The buildings remain extant and are now used as a private residence.
MCB24581	TL 2464 5986	Medieval/ Post-Medieval	An area of ridge and furrow, Croxton, visible as extant earthworks on aerial photographs, 2009, which follow several different alignments.
09592; MCB11414	TL 2455 5935	Roman	Roman knife handle, Croxton found in spoil from a field ditch in 1960. The handle is made of bronze, ornamented with the grey hound-and-hare motif and slotted to receive the hinged iron blade, as in a mod pen-knife. Part of the blade can in fact still be seen in the slot.
MCB18909	TL 2599 6128	Medieval	Rectangular enclosures and medieval ridge and furrow, Yelling. Mapped from Bedfordshire 1996 aerial photography.
02349; MCB2960	TL 2723 5894	Medieval	Deer park, documented in Eltisley parish, its position is indicated by a large area of woodland. The massive bank of the park pale can be seen defining exactly the suggested boundaries of the park.
01137; MCB1474	TL 2470 5947	Medieval	Moated site, Westbury Farm, Croxton. A stretch of wet ditch measuring 408ft long, 30-40ft wide and 3ft deep may be the surviving north side of a large rectangular moat around Westbury Farm. The west side is masked by a depression and there are no signs of the south or east sides.
02463; MCB3091	TL 278 604	Post-Medieval	The site of a post-medieval windmill marked as 'Mill Hill' and surrounded by a wet moat on early 19th century OS maps. Only a pile of rubble is still visible.
MCB23487	TL 2762 5945	Medieval-Post-Medieval	Earthwork remains of ridge and furrow, north of Jesus College Farm, Eltisley in an east-west alignment. Visible on 2009 aerial photography.
MCB23488	TL 2781 5920	Medieval-Post-Medieval	Earthwork remains of ridge and furrow, south of Jesus College Farm, Eltisley in an east-west alignment. Visible on 2009 aerial photography.
MCB23489	TL 2758 5912	Medieval-Post-Medieval	Earthwork remains of ridge and furrow, south of Jesus College Farm, Eltisley in an east-west alignment. Visible on 2009 aerial photography.

Reference	Grid Reference	Period	Description
MCB24539	TL 2761 6133	Post-Medieval	Papley Grove, Eltisley recorded on the 1st edition OS map. Parts of the original house appear to still be extant, although significant extension work has been added.
MCB24588	TL 2780 6052	Unknown	Oval Enclosure, Eltisley visible as cropmarks. Measures roughly 40m x 27m.
MCB24589	TL 2757 6119	Unknown	Enclosures south of Papley Grove, Eltisley visible as cropmarks. Situated directly south of Papley Grove, with at least three separate enclosures visible.
02541; MCB3190	TL 2785 6039	Post-Medieval	Probable windmill mound, Papworth Everard, consisting of a ditched mound. No surface finds have been made and the mound has been levelled.
05753; MCB14776	TL 27723 60569	Medieval	Extensive ridge and furrow, Eltisley indicative of medieval agricultural activity in this area.
MCB17255	TL 2774 5937	Roman	A complex of ditch and pit anomalies which is thought may represent a possible small Roman settlement, Caxton End, Eltisley
MCB23574	TL 2759 6159	Medieval/ Post-Medieval	An area of ridge and furrow, Eltisley, located 130m north of Papley Grove Farm. It is visible on 2009 aerial photographs and 2016 LiDAR.
01049A; MCB1326	TL 276 614	Medieval	Papley Grove deserted medieval settlement, deserted by 1100 although the manor house continued to be occupied well into the 13th century.
01049; MCB1325	TL 276 613	Medieval	Moated site at Papley Grove, Eltisley the site of manor house. The enclosed island measures 130ft north, 110ft east, 115ft south and 110ft west. The ditch is between 15-20ft wide and 2ft deep, with the south side extended into a pond.
01179; MCB1522	TL 2772 5931	Medieval	Moated site, NE of Jesus Farm, Eltisley. The moat is trapezoidal, measuring 85ft NE by 135ft E by 135ft S by 170ft NW and is surrounded by a 25ft-35ft wide ditch. Medieval pottery dated to the 11th and 12th centuries has also been recorded on the site.
02350; MCB2961	TL 279 594	Medieval	Ridge and furrow, Eltisley
1019177; 12045; DCB275; 01180; MCB14170	TL 29147 59911	Medieval	Moated site at Pastures Farm, roughly square shaped island which measures up to 150m wide. This is contained by a seasonally water-filled moat which is up to 9m wide and 1.5m deep. Near the western corner the moat has been enlarged to form a sub-circular pond, with a diameter of approximately 22m. Part of the moat immediately to the north east of this pond has been filled in and now survives as a buried feature. The moated site, which is also known as Caxton Pastures, may be the site of the manor of Brockholt which is known to have been separated from the main manor of Caxton from 1154 until 1400. **Scheduled monument.**
1331369; DCB5644; MCB18049	TL 30521 60665	Post-Medieval	Mile Post near Junction with Elsworth Road. C19, Cast iron with three angled faces. Painted white with black painted raised inscription. 'Oxford 77, St Neots 8, Cambridge 10'. **Grade II listed.**

Reference	Grid Reference	Period	Description
1162760; DCB6155; MCB18044	TL 28902 60528	Post-Medieval	Mile Post South of Pembroke Farm and West of Caxton Gibbet Inn. C19, Cast iron with three angled faces. Painted white, with black painted raised inscription. 'Oxford 76, St Neots 7, Cambridge 11.' **Grade II listed.**
1163004; DCB6487; 01180B	TL 29162 59995	Post-Medieval	Dovecote to North East of Caxton Pastures Farmhouse. Late C18, altered to small dwelling in C19. Red brick with plain tile hipped roof with gablets. Two storeys, square plan with outshut. **Grade II listed.**
1127202; DCB6669; MCB18047	TL 29781 60240	Post-Medieval	Milestone to South of Caxton Gibbet Inn. C19 or earlier. Stone block painted white with black painted incised lettering. 'London 51, Huntingdon 8, Royston 13'. **Grade II listed.**
1127144	TL 32406 60256	Post-Medieval	New Inn Farm, a late 18th-early 19th century farmhouse, consisting of two storeys with a cellar in a U-plan, built of red brick with a hipped slate roof. **Grade II listed.**
1331400	TL 32425 60291	Post-Medieval	Farm buildings forming an L-plan including two barns linked by rebuilt lower range to the north and a stable range to the south. Built of red brick with slate and pantile roofs. **Grade II listed.**
02470; MCB3100	TL 29673 60590	Medieval	Caxton Gibbet, which stood on Caxton Common, a piece of land around the crossing of the two main roads, and the gibbet timbers are in fairly good condition. It is suggested that the gibbet may have been a Royal Gallows and was in use until the last hanging in 1753. A possible row of burials, found by dowsing in 1986, but no confirmation.
CB15017; MCB15017	TL 30656 60703	Medieval	Ridge and furrow, Cambourne Elsworth Turn revealed during excavation.
MCB19660; ECB3602	TL 3094 6002	Iron Age-Roman	Iron Age and Roman remains at Cambourne Secondary School. Archaeological features mostly associated with land division and possibly drainage were uncovered during evaluation. Early Roman pottery was recovered from boundary and enclosure ditches, mostly locally produced domestic course wares.
MCB20864	TL 3145 6094	Post-Medieval	Former site of Rectory Farm, Elsworth. A complex of farm buildings set around a farm yard, now completely demolished.
MCB24004	TL 3064 6002	Iron Age	Pit or water hole at Land West of Cambourne, Caxton with a large amorphous feature measuring approximately 6m wide and over 1.1m deep.
CB15131; MCB15131	TL 30374 60376	Modern	RAF Caxton Gibbet, a WWII military airfield used for training. Also an associated picket post and pillbox.
MCB24005	TL 3107 6016	Unknown	Cropmark features at Land West of Cambourne, Caxton representing small and large pits, some fragmentary ditches and a former plough headland.

Reference	Grid Reference	Period	Description
MCB22308	Tl 2888 6085	Post-Medieval	Pembroke College Farm, Eltisley recorded on the 1st edition OS map and still in use. Consisted of three detached buildings in a U-shaped courtyard.
MCB19981	TL 2998 6048	Iron Age-Roman	Middle Iron Age to Early Roman remains at Land West of Cambourne, Caxton. Curvilinear ditch with mid Iron Age pottery, also a cremation with grave goods dated AD30-60. Grace goods include two butt beakers, two channel rim jars, one everted rim jar and a closed vessel.
MCB24003	TL 2989 6018	Iron Age-Roman	Ring ditch and enclosure at Land West of Cambourne, Caxton. Measuring 0.47m wide by 0.34m deep and no finds recorded. The sub-square enclosure revealed 12 sherds of late iron age- Roman pottery. A further ditch found mid iron age pottery, fired clay, and animal bone.
MCB24590	TL 2870 6122	Unknown	Possible double ditched enclosure, Eltisley. The circumference of the feature measures at roughly 80m.
MCB24592	TL 2917 5958	Unknown	Oval Enclosure, Caxton visible as cropmarks. Measures approximately 40m by 35m.
00278; MCB372	TL 308 616	Medieval	Ridge and furrow, Elsworth running east-west on either side of a north-south hollow way which measured 40ft wide by 2ft deep. Traces of curving ridge and furrow can be seen on air photographs over much of the parish, all belonging to the former open fields.
03429; MCB4233	TL 3076 6135	Medieval	Medieval earthworks, Elsworth with medieval potsherd recovered from the site.
02494; MCB3137	TL 294 609	Neolithic	Neolithic find spot, north west of Caxton Gibbet, consisting of a brownish-grey patinated, polished celt (axe).
03502; MCB4305	TL 3029 6118	Post-Medieval	Common Farm, Elsworth, a c.1800 farmhouse, consisting of two storeys with attics, partly white brick and partly framed and plastered with tiled roofs. Still extant.
MCB4320	TL 303 608	Roman; Medieval	Linear cropmarks, Elsworth, which during evaluation revealed a series of ditches, one of which contained a sherd of 1st-3rd century Roman pottery. The ditches are thought to be part of an extensive field system, and they are overlain with medieval furrows.
01087; MCB14724	TL 30510 60230	Medieval	Swansley Wood Farm, a moated site of the manor house of Swansley which belonged to St Neots Priory from the 11th century to the 16th century. On a rectangular area measuring 85ftx70ft surrounded by a moat 15ft wide and 6ft deep, with a causeway across on the SW side. The area is now occupied by two modern cottages and their gardens.
MCB16333	TL 29880 60700	Medieval	Ridge and furrow, Elsworth identified through a series of NW-SE aligned ditch type anomalies.
MCB17322	TL 285 606	Post-Medieval	Hare Park, Eltisley, a possible rabbit warren shown on the tithe map 1841, no evidence of which survives.
MCB19627	TL 2895 6039	Unknown	Group of rectilinear enclosure cropmarks identified on the Cambridgeshire County Council, Huntingdon aerial photography data set, directly south of the A428 near Caxton.

Reference	Grid Reference	Period	Description
MCB20881	TL 2969 6063	Post-Medieval	Former site of Gibbot Inn, off Ermine Street, Elsworth, illustrated on the 1st edition OS map. Now demolished.
CB15034; MCB15034	TL 22859 70634	Roman	Ermine Street Roman Road visible as a gravel track without agger. Fragmentary remains of a possible roman road and flanking ditch recorded during excavation.
MCB19542	TL 3085 5974	Iron Age/ Roman	Middle Iron Age to Roman settlement area at Land West of Cambourne, Caxton consisting of a cropmark complex.
MCB22309	TL 3112 6074	Iron Age/ Roman	Probable Iron Age to Roman settlement, field adjacent to the Bungalow, Elsworth visible as cropmarks, a series of ditches to the western end indicate a possible trackway and several rectilinear fields with the main cluster of activity is located at the eastern end.
MCB22310	TL 3105 6114	Iron Age/ Roman	Possible Iron Age to Roman enclosures, Elsworth visible as cropmarks from aerial photography suggestive of settlement activity. Consists of a D shaped enclosure measuring 50mx 53m, a small U shaped feature, 9m x 7.5m and a second D shaped enclosure, 48m x 40m. Two entry points were noted to the D shaped enclosures.
MCB19541	TL 3028 5956	Iron Age/ Roman	Middle Iron Age to Roman activity at Land West of Cambourne, Caxton. Small curvilinear and rectilinear enclosures in the southern part of the site, revealing 1st and 2nd date with Roman pottery. A number of ditches with Iron Age pottery were also recorded, including a large enclosure ditch hand internal post holes with mid iron age pottery.
MCB15957	TL 30574 59712	Medieval	Features including headlands and traces of a now-levelled ridge and furrow, at Swansley Wood identified during aerial photography.
MCB21798	TL 2903 6177	Post-Medieval	Crows Nest Farm, Pawpworth Everard, an 18th century house recorded on the first edition OS map, 1885. It comprises a U-shaped courtyard complex and is still in use.
MCB24591	TL 2842 6146	Unknown	Cropmarks, Eltisley consisting of several linear cropmarks visible on aerial photography.
11873; MCB13973	TL 2960 6060	Bronze Age	Two early Bronze Age flints, Swansley Wood, found during field walking.
11874; MCB13974	TL 305 598	Bronze Age	Bronze Age flint scatter, Swansley Wood comprising mainly of waste flakes was found during field walking.
01180; MCB1524	TL 291 600	Post-Medieval	Pastures Farm, an 18th century, T-shaped house of two storeys with attics and cellar. Partly brick built and partly framed. Located within the moated site.
MBD11439	TL 1442 5387	Post-Medieval	Site of a 19th century milepost. No longer extant.
MBD9935	TL 123 534	Medieval/Post-Medieval	Brickfield Lane. The line of a discussed medieval/post-medieval lane shown on enclosure and pre-enclosure maps. No longer extant.

Reference	Grid Reference	Period	Description
MBB22309	TL 1617 5768	Unknown	Two parallel linear ditches of uncertain date and function are visible as cropmarks on historic aerial photographs. The ditches were noted as approximately 100m long and 1.4m wide. Not noted on the 2008 photographs.
MBD15118	TL 148 550	Iron Age/Romano-British	An Iron Age or Romano-British rectilinear enclosure identified through cropmarks with some outlying sub-rectangular and rectilinear features. Part of the rectilinear enclosure was excavated prior to construction of the Great Western Bypass, and was dated to the Roman period, along with other features not visible on the aerial photographs, such as an internal Roman round house.
MBD15267	TL 168 581	Roman	Cropmarks of an enclosure and a large number of surface finds suggest that this is the site of a high status Roman settlement. Surface finds have include: Roman brooches, a Roman dagger chape, Roman coins, a pendant, a casket handle, a bronze strip, pins, a bracelet, a decorative buckle, Anglo-Saxon brooches, a Roman miniature axe blade, a ring, and a lead eagle figurine.
MBD15550	TL 131 531	Unknown	A group of irregular linear and curvilinear features visible to the west of Great Barford House.
MBD15551	TL 1332 5323	Unknown	Enclosure cropmark west of Great Barford House.
MBD1794	TL 170 580	Roman	Cropmarks near Bell Farm Wyboston, recorded from aerial photographs, showing a probable trackway with enclosures attached. The area has produced coins and other metalwork of Roman date.
MBD1881	TL 164 579	Roman	A double-ditched rectilinear enclosure and attached ditched boundaries of probable Roman settlement is visible as cropmarks on aerial photographs.
MBD1882	TL 161 576	Unknown	A cluster of around 36 pits of uncertain date and function which are visible as cropmarks on historic aerial photographs. Located in fields east of the nurseries on Rookery Road.,
MBD18879	TL 1255 5317	Iron Age and Roman	Iron age and Roman pottery and Roman features indicative of occupation were discovered as part of archaeological works for the Great Barford Flood Attenuation Scheme.
MBD480	TL 168 576	Iron Age/Roman	Two rectangular enclosures and at least four circles, thought to have been ring ditches or barrows of Iron Age or Roman date, are visible as cropmarks on historic aerial photographs. No longer extant.
MBD482	TL 142 539	Roman	A group of sub-rectangular enclosures set within a large sub-rectangular/curvilinear outer boundary. Small outlying sub rectangular enclosure to west. Believed to be Roman in date. Recorded during road widening works in 1969.
MBD5136	TL 149 544	Medieval	Earthworks within Roxton Park include ridge & furrow, a pre-enclosure roadway and the park boundary.
MBD629	TL 167 578	Unknown	Two indistinct rectangular enclosures, with another around a circular mark to the east.
MBD9916	TL 124 532	Medieval	East End deserted medieval settlement. Old enclosures & pightles, shown on 1824 Enclosure Map, potentially indicating a medieval settlement.

Reference	Grid Reference	Period	Description
MCB13867, 11778	TL 169 582	Roman?	Cropmarks North of 'The Bell' Public House, Roads and field boundaries shown on RAF aerial photographs. Roman coins and pottery also found in the same field.
MCB13868, 11779	TL 169 579	Roman and Early Medieval	Roman pottery scatter and Saxon brooch, St. Neots
MCB15261, CB15261	TL 16951 58188	Post-Medieval	Post-medieval and undated features, Evaluation revealed a few undated features and post-medieval agricultural beds. Residual Iron Age and Roman pottery was recovered.
MCB16504	TL 16799 58209	Roman	Archaeological evaluation identified a concentration of Romano-British activity dating to the 2nd – 4th centuries. The evidence comprised a large number of ditches, forming field systems, enclosures and a droveway. Other features included a large number of quarry pits, as well as two ring gullies and a small rectangular enclosure, thought to represent animal windbreaks or enclosures.
MCB16505	TL 1684 5805	Roman	Archaeological work identified features of Roman date. A series of ditched field systems and enclosures were identified, dating from the mid-late 2nd century to later 3rd/4th centuries.
MCB16709	TL 1709 5799	Neolithic	An area of 1310 m square was excavated in advance of development, revealing two Neolithic pits which contained pottery, worked and burnt flint and hazelnut shells and carbonised plant remains. The pottery was identified as coming from early Neolithic plain bowls and the flint comprised 108 fragments of flint working waste with some utilised pieces.
MCB16710	TL 1709 5799	Romano-British	An area of 1310 m square was excavated in advance of development. One ditch with a V-shaped profile was identified, containing two sherds of Romano-British pottery and a small quantity of animal bone. A further six parallel ditches were also found running east-west across the site, containing no dating evidence, but suggested to be the remains of a cultivation system, of possible Romano-British date.
MCB16788	TL 167 580	Roman	A bronze bracelet found on former archaeological site at Bell Farm.
MCB18206	TL 1677 5805	Neolithic	Evaluation revealed a pit containing an antler pick, suggested to be of Neolithic date. A further programme of archaeological recording was undertaken in advance of development, revealing a moderate level of preservation. The earliest evidence on the site comprised a pit containing a red antler pick, and struck flints of Palaeolithic and Neolithic date. A recut of the pit also yielded Neolithic flint artefacts and an auroch's horn core. Three other pits produced fragments of red deer antler and bone, and a single abraded flint flake, suggested also to be of prehistoric date.,
MCB18207	TL 1670 5813	Early Medieval	A strip, map and record was undertaken in advance of development, revealing a large pit with associated post-holes, representing a further sunken feature building. The occurrence of this, and another possible SFB at the west of the site, suggests that significant Saxon settlement activity is likely to exist to the north and/or west of Alpha Park.

Reference	Grid Reference	Period	Description
MCB18208	TL 1674 5802	Medieval and Post-Medieval	A programme of strip, map and record was undertaken in advance of development. An enclosure, which cut a Roman ditch and was associated with ceramic building material, may date to the medieval period or later. A number of undated features were also recorded, some of which may be of medieval or post-medieval date.
MCB18768	TL 1672 5806	Medieval and Post-Medieval?	Ridge and furrow mapped from Bedfordshire 1996 aerial photography.
MCB18769	TL 1685 5817	Unknown	Ditches forming possible square enclosure mapped from Bedfordshire 1996 aerial photography.
MCB18770	TL 1704 5803	Unknown	Ditches forming possible field divisions mapped from Bedfordshire 1996 aerial photography.
MCB20473	TL 1690 5808	Roman to Post-Medieval	Archaeological trial trenching identified evidence of later Roman settlement activity in the form of pits and ditches and ritual activity in the form of a placed structural finds deposition. Late Saxon to medieval pottery and medieval pits, postholes and ditches were also identified.
MCB667, 00511	TL 16 57	Palaeolithic	Palaeolithic flakes and remains of a mammoth found at Eaton Socon.
MCB11928, 10064	TL 173 580	Unknown	Conjoined square enclosures plus pits mapped from Bedfordshire 1996 aerial photography.
MCB13866, 11777	TL 1705 5820	Roman	Roman pottery scatter,
MCB18771	TL 1732 5806	Unknown	Parallel ditches forming possible track, mapped from Bedfordshire 1996 aerial photography.
MCB24750	TL 1694 5842	Post-Medieval	Site of a brewery illustrated on the 1st edition Bedfordshire Ordnance Survey map dated c.1884. The building is no longer extant.
MCB484, 00369	TL 1683 5834	Neolithic	Neolithic hearth found at Little End, Eaton Socon. A hole was found dug into gravel below the greenhouse, filled by large fire blackened stones and black soil and wood ash.
MCB487, 00372	TL 173 584	Prehistoric	A barbed and tanged arrowhead found in1957.
MBD9860, 9860	1608 5338	Post-Medieval	Tempsford Little Staunch. Only the weir wall on the right back survived in 1970. Now demolished.
MBD9868, 9868	TL 162 534	Post-Medieval	The site of Tempsford Hall. A former 18th century (and potentially medieval) ‘old mansion’ which preceded the present Tempsford Hall.
MBD5977, 5977, 1311945	TL 1623 5303	Post-Medieval	36 & 38 Church Street, A pair of 18th century cottages with later additions. **Grade II listed building.**
MBD14473, 14473	TL 1626 5304	Post-Medieval	40 Church Street. A post medieval brick construction with a tile roof with the Conservation Area.
MBD803, 1311917	TL 1620 5304	Medieval	Base and stump of a medieval cross in Tempsford Churchyard. **Grade II listed building.**

Reference	Grid Reference	Period	Description
MBD9859	TL 1609 5307	Medieval	Site of The Chantry House. A 15th century house, now demolished.
MBD5990, 1114097	TL 1619 5325	Post-Medieval	Cottage Farmhouse on Church Street. An 18th to 19th century house with later additions. **Grade II Listed Building.**
MBD9867	TL 1607 5324	Post-Medieval	Lime House. Site of former 19th century wharf with associated buildings.
MBD5993, 1138237	TL 1611 5331	Post-Medieval	Ouse Farmhouse. 18th century house with 19th century extension, **Grade II listed building.**
MBD3077	TL 1651 5352	Modern	Tempsford Hall. Built in 1903 in an Elizabethan style to replace an earlier hall which burned down in 1889.
MBD9733	TL 1645 5306	Post-Medieval	Site of post-medieval cottages, now demolished. Recorded from a map of 1829.
MBD9865	TL 1646 5310	Post-Medieval	Site of the demolished Tempsford Workhouse. Recorded from a map of 1829
MBD9866	TL 1657 5334	Post-Medieval	The Elms, Tempsford Park. The site of a 19th century red brick cottage or summerhouse, Now demolished.
MBD5978, 1114095	TL 1624 5306	Post-Medieval	The Wheatsheaf Public House. A 18th century building, in use as an inn or public house by 1776. **Grade II listed building.**
MBD21209, 19368	TL 16 53	Early Medieval	The find spot of a copper-alloy strap-end, dating from the Early Medieval period.
MBD9729	TL 1623 5319	Post-Medieval	Milestone. "51 Miles From London – Tempsford"
MBD14666	TL 1620 5180	Palaeolithic	A small Palaeolithic hand axe.
MBD15860, 15906	TL 161 518	Roman, Medieval and Post-Medieval	Three Roman coins, a medieval token and five post-medieval finds recorded from near to the River Ivel.
MBD9894	TL 1632 5158	Post-Medieval	Milestone. "50 Miles from London – Girtford"
MBD14663	TL 1592 5167	Neolithic	Two Neolithic flint axes found in gravel pits.
MBD14668	TL 1611 5211	Palaeolithic and Neolithic	Palaeolithic and Neolithic axes found to the north of Zwetsloot Nurseries in Tempsford.
MBD490	TL 1583 5239	Mesolithic	Mesolithic flakes were found in the remains of a sand mound.
MBD15179, 15114	TL 1593 5219	Post-Medieval	Brickgate Bridge. An 18th century bridge over the River Ivel. The alignment of a nearby road was changed during the period of enclosure around the 1730's and as such the bridge is thought to be of an early 18th century date.
MBD17958	TL 1669 5174	Modern	The site of a World War II heavy anti-aircraft battery.

Reference	Grid Reference	Period	Description
MBD23069, 20690	TL 16 51	Post-Medieval	An incomplete strap fitting/slide dating to the early post medieval period.
MBD3539	TL 1603 5317	Medieval	Deserted Settlement. Close boundaries and building platforms surviving as slight earthworks.
MBD9727	TL 1615 5352	Post-Medieval	An 18th century fishpond north of Church End.
MBD3232	TL 165 530	Unknown	A cropmark.
MBD17108	TL 161 529	Medieval	Medieval settlement of Church End, Tempsford. Excavations at the rear of Mill Lane Cottage did not reveal any archaeological finds or features, although this may be due to the ground having previously been disturbed.
MBD15382, 15320	TL 1666 5314	Medieval	A substantial linear earthwork/hollow way within woodland running along the south boundary of Tempsford Park.
MBD18743, 13491	TL 16250 53469	Modern	War Memorial and Stuart Memorial Hall. The hall was built by Stuart family in memory of those from Tempsford who were killed in the First World War with freestanding stone memorial placed in front.
MBD21963, 8979	TL 1619 5304	Early Medieval	St Peter's parish churchyard.
MBD8804,	TL 1617 5421	Post-Medieval	Site of former staunch over Tempsford ford, from before construction of bridge.
MBD22736, 20438	TL 1646 5458	Prehistoric?	Cropmarks of ring ditch, possibly a ploughed out Bronze Age round barrow, and of a probable north-south trackway.
MBD10281,	TL 165 517	Unknown	Three enclosures noted from cropmarks.
MBD16751, 16796	TL 1674 5189	Unknown	An isolated ring ditch cropmark.
MBD14672	TL 1583 5190	Prehistoric	A number of pieces of animal bone found at the Tempsford Gravel pits.
MBD14671	TL 1616 5206	Prehistoric	Worked flints found near Zwetsloot Nurseries in Tempsford.
MBD17144, 801	TL 1635 5207	Roman	A Roman site identified either side of the A1 just south of Tempsford. Evidence of Roman occupation recorded on the western side of the road. On the eastern side of the A1 aerial photographs have shown a large rectangular enclosure, apparently with internal features. Tessarae have been found in the area, and it is thought that there is a building with a mosaic floor nearby.
MBD14673	TL 1592 5223	Roman	Roman pottery found north of Brickgate Bridge on the Great North Road.
MBD9730	TL 1610 5236	Post-Medieval	Site of levelled gravel pit.
MBD16753, 16798	TL 166 528	Unknown	Cropmarks of a possible large rectilinear enclosure east of Church Farm.
MBD9857	TL 157 520	Post-Medieval	Site of former gravel pit.

Reference	Grid Reference	Period	Description
MBD1776	TL 156 526	Bronze Age	At least eight ring ditches, set within a loop of the River Ivel, along with other cropmarks, including a pit alignment and linear features. Recorded from aerial photographs.
MBD16741, 16786	TL 160 523	Prehistoric	Cropmarks of three small enclosures in a line around 100m apart: One ovel-shaped, a ring ditch and three sides of a sub-rectangular enclosure, possibly a long barrow.
MBD1661	TL 165 512	Prehistoric	A scatter of cropmarks, including enclosures and two parallel ditches.
MBD2408, 1321206	TL 1480 5440	Post-Medieval	Early 19th century lodge cottage belonging to Roxton House. **Grade II Listed Building.**
MBD876, 1146453	TL 1682 5790	Post-Medieval	Crown Inn. A public house dating from the 17th century with 19th century alterations. **Grade II Listed Building**.

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