A47 Wansford to Sutton

EIA Scoping Report

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1 Introduction

1.1 Purpose of the Report

1.1.1 Scoping is an important part of the Environment Impact Assessment (EIA) process and determines which environmental topics are to be examined during the course of the assessment and reported in the Environmental Statement (ES).

1.1.2 This Scoping Report describes how the EIA will be undertaken, and identifies the technical environmental disciplines that will be considered. Defining the environmental scope is one of the most critical parts of the study, as it sets out the method for the detailed assessment. This EIA Scoping Report will be submitted to the Planning Inspectorate in order to inform its scoping opinion. The Planning Inspectorate may not adopt a Scoping Opinion in response to a request until it has consulted the person who made the request and the consultation bodies or notifies the person making the request that it requires additional information to adopt an opinion. The ES will be submitted as part of the application for a Development Consent Order (DCO).

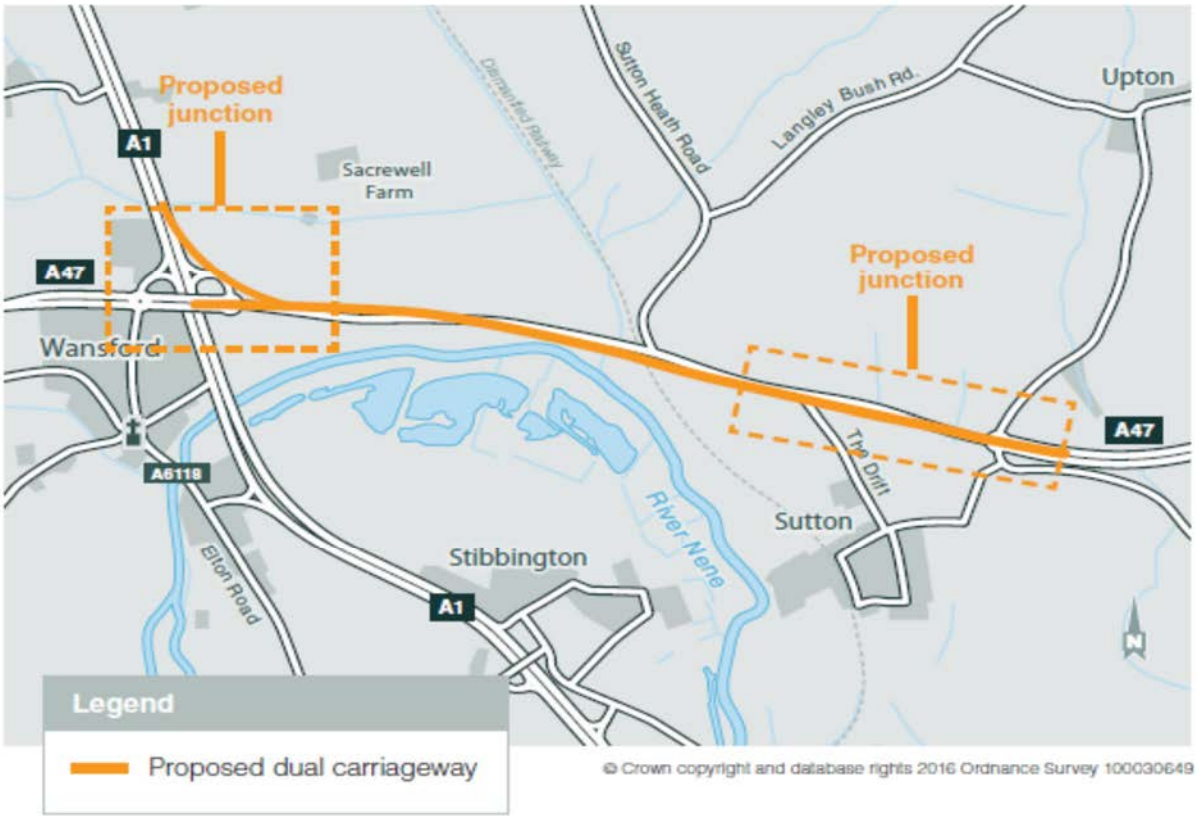
1.1.3 The scope of the EIA may be amended following receipt of the scoping opinion or if understanding of environmental conditions change. The final version of this EIA Scoping Report will be issued as a technical appendix of the ES. This will provide a full audit trail for the EIA process that is undertaken.

1.2 Proposed Scheme Location

1.2.1 The A47 trunk road forms part of the strategic road network (SRN) and provides for a variety of local, medium and long-distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 210,000) and Peterborough (population over 180,000) and the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft.

1.2.2 The Proposed Scheme is located at Wansford and extends eastwards to Sutton and forms a section of single carriageway that is part of the main arterial highway route connecting Norwich and Great Yarmouth to the east (see Figure 1.1).

Figure 1.1: Proposed Scheme Location



Source: PRA document

1.3 Proposed Scheme Overview

1.3.1 The Proposed Scheme consists of a new 2.5km dual carriageway, which would be constructed partially off-line to the north and part off-line to the south of the existing A47. The new dual carriageway would tie in to the existing carriageway at the eastern roundabout at the A1 / A47 interchange and at the Nene Way Roundabout at the eastern end of the Proposed Scheme. At the western end, the Proposed Scheme would also include a free flow link between the A1 southbound carriageway and the new eastbound carriageway of the A47. The existing Wansford east roundabout, would be enlarged as part of the proposals to accommodate A47 westbound traffic.

1.3.2 This scheme will henceforth be described as the Proposed Scheme. The DCO site boundary is shown on Plan A.1 in appendix A.

1.4 Approach to EIA scoping

1.4.1 The main aims of this EIA Scoping Report are as follows:

- To identify and report the baseline conditions of the existing environmental asset
- To determine which (if any) environmental topics are to be further examined during the EIA and hence reported in the ES

- To identify all relevant environmental constraints present as part of the iterative design process, thereby ensuring adverse effects can be minimised
- To identify if there are opportunities for environmental enhancement associated with the site of proposed works that could be incorporated into the design

1.4.2 The environmental constraints identified within this EIA Scoping Report have been mapped and shown in appendix B.

1.4.3 This scoping exercise has been completed in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11 and The Planning Inspectorate (PINS) Advice Note 7, to a Scoping Level for all environmental topics contained within Highways England's Interim Advice Note (IAN) 125/15.

1.5 Legislative Context and the need for Environmental Impact Assessment

1.5.1 The Proposed Scheme is defined as a Nationally Significant Infrastructure Project (NSIP) under Section 14(1)(h) and Section 22 of the Planning Act 2008 (PA 2008) (as amended)) by virtue of the fact that:

a) It comprises the construction / alteration of a highway
b) The highway to be constructed is wholly in England
c) The Secretary of State will be the highway authority for the highway
d) The speed limit for any class of vehicle on the highway is to be 50 miles per hour or greater, and the area of development is greater than 12.5 hectares

1.5.2 In accordance with the legislation, a DCO is therefore required to allow the construction and operation of the Proposed Scheme.

1.5.3 The Proposed Scheme falls under schedule 2, part 10 Infrastructure Projects (f) Construction of roads of The Infrastructure Planning (EIA) Regulations 2017. The threshold at which part 10 (f) schemes need to screen for EIA is where the area of works exceeds 1 hectare (ha). The area of works associated with the Proposed Scheme does exceed 1ha and Highways England have determined that EIA is required on the basis that there is a potential for significant effects on the environment.

1.5.4 In accordance with Regulation 8(1)(b) of the EIA Regulations, Highways England notifies the Secretary of State for Transport (Secretary of State) that an environmental statement will be submitted with the DCO Application for this project.

1.5.5 The Localism Act 2011, appointed the Planning Inspectorate (the Inspectorate) as the agency responsible for operating the DCO process for NSIPs. In its role, the Inspectorate will examine the application for the Proposed Scheme and then will make a recommendation to the Secretary of State who will make the decision on whether to grant or to refuse the DCO.

1.5.6 In accordance with section 104(2) of the PA 2008, the Secretary of State is required to have regard to the relevant National Policy Statement (NPS), amongst other matters, when deciding whether or not to grant a DCO. The relevant NPS for the Proposed Scheme is the National Networks National Policy Statement (NNNPS) which was designated in January 2015.

1.5.7 Other matters that the Secretary of State would consider important and relevant include national and local planning policy. The National Planning Policy Framework (NPPF) published in March 2012 (Ref 8) is the relevant national planning policy.

1.5.8 The layout of the ES will comprise three volumes for ease of reading as follows:

- Non-technical Summary
- Volume 1 - main body of the ES
- Volume 2 - Figures
- Volume 3 - Technical appendices

1.5.9 Volume 1 will provide the main body of the ES, and explain the details of the Proposed Scheme. It will contain the technical chapters documenting the baseline position assessment methodologies and assessment results using qualitative and quantitative data (where applicable). This volume contains the following chapters:

- Chapter 1 Introduction
- Chapter 2 The proposed scheme
- Chapter 3 Consideration of alternatives
- Chapter 4 Construction and programme
- Chapter 5 EIA methodology
- Chapter 6 Air quality
- Chapter 7 Cultural heritage
- Chapter 8 Landscape
- Chapter 9 Biodiversity
- Chapter 10 Geology & soils
- Chapter 11 Materials
- Chapter 12 Noise & vibration
- Chapter 13 People and communities
- Chapter 14 Road drainage and the water environment
- Chapter 15 Climate
- Chapter 16 Combined and cumulative effects
- Chapter 17 Conclusion

1.6 Approach to Assessment

1.6.1 The environmental assessment will be undertaken in accordance with the requirements presented in the DMRB, Volume 11, Section 3, Interim Advice Note 125/15 Environmental Assessment Update (IAN 125/15) and Major Project

Instruction Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive), for each of the relevant environmental topics:

- Air quality
- Cultural heritage
- Landscape
- Biodiversity
- Geology & soils
- Materials
- Noise & vibration
- People and communities
- Road drainage and the water environment
- Climate
- Combined and cumulative effects

1.6.2 The output of the environmental assessment is to report the likely significance of environmental effects using established significance criteria, as presented within DMRB Volume 11, Section 2, Part 5. This requires an assessment of the receptor or resource's environmental value (or sensitivity) and the magnitude of change (impacts).

1.6.3 DMRB states that the approach to assigning significance of effect relies on reasoned argument, professional judgement and taking on board the advice and views of appropriate organisations. For some disciplines, predicted effects may be compared with quantitative thresholds and scales in determining significance.

1.6.4 Assigning each effect to 1 of the 5 significance categories enables different topic issues to be placed upon the same scale, to assist the decision-making process. These 5 significance categories are set out in Table 1.1.

Table 1.1: Descriptions of the significance of effect categories

Significance category	Typical descriptors of effects
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 very important considerations and are likely to be material in the decision-making process
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effect on a resource or receptor.

Significance category	Typical descriptors of effects
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 or variation or within the margin of forecasting error.

Source: DMRB Volume 11, Section 2, Part 5, Table 2.3

1.6.5 The environmental value will be identified for each of the individual topics that have been carried forward from the scoping exercise for further environmental assessment, along with the magnitude of change. In this way, the potential significance of environmental effects will be determined for each relevant environmental topic. Five significance categories can result from the assessment, as defined in Table 1.2. It is important to note that significance categories are required for positive (beneficial) as well as negative (adverse) effects. The greater the magnitude of impact, the more significant the effect. For example, the consequences of a highly valued environmental resource suffering a major detrimental impact would be a significant adverse effect. Impacts that are Moderate or above, Beneficial, or Adverse, will be considered significant.

Table 1.1: Assessing significance of potential effects

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

Source: DMRB Volume 11, Section 2, Part 5, Table 2.4

1.7 Population and Human Health

1.7.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for 'the direct and indirect significant effects of the proposed development on the following factors… population and human health' (Regulation 5(2(a)) to be assessed within EIAs.

1.7.2 There is no consolidated methodology or practice for this topic, however the scope of the assessment is considered to be covered by existing Highways England Guidance as set out below. This recognises the specific requirements of the NNNPS for consideration of health, specifically within paragraphs 4.79 - 4.82. This will address health by utilising the following guidance:

- Air quality: HA 207/07, IAN 185/15, IAN 175/13, IAN 174/13, IAN 170/12
- Noise and vibration: HD 213/11, IAN 185/15
- Road Drainage & The Water Environment HD 45/09
- Equestrians, Cyclists, and Community Effects: DMRB Volume 11 Section 3 Part 8

1.7.3 It is considered that these assessments, conducted principally in isolation as is required by their methodologies, will not provide a sufficient analysis of the effects of the Proposed Scheme. To enable such conclusions to be drawn, a qualitative assessment of information collated via the topic assessment listed above will be undertaken and presented within the Cumulative Effects section of the ES.

1.8 Major Accidents and Disasters

1.8.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for 'expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development' (Regulation 5(4)) to be assessed within EIAs.

1.8.2 For the Proposed Scheme, a separate chapter assessing the potential impacts of major accidents and disasters during the construction and operation phases is not required for the following reasons:

- The Proposed Scheme is not considered to have high vulnerability to major accidents or disasters. Whilst the legislation is not explicit, the language of the revised Infrastructure Planning Regulations 2017 is aimed towards hazardous industries or operations (those with a high vulnerability to major accidents)
- The design, construction and operation of the Proposed Scheme must comply with legal requirements, codes and standards, such as:
    - Health and Safety at Work etc. Act 1974 (HSWA)
    - The Management of Health and Safety at Work Regulations (1999)
    - Construction (Design and Management) (CDM) 2015 Regulations
    - The Workplace (Health, Safety and Welfare) Regulations 1992
    - Design Manual for Roads and Bridges (DMRB)
    - IAN 191/16, Safety Governance for Highways England
- The term major accidents and disasters refers to events both within and external to the Proposed Scheme that have the potential to cause significant harm to the environment (including but not limited to populations, biodiversity, land, soil, water, air, material assets, cultural heritage)

1.8.3 The impact of any unplanned events (accidents or disasters) will be considered against the current baseline conditions. The volume and type of traffic using the Proposed Scheme will not change significantly from that using the current road

alignment, and therefore it is reasonable to conclude that there is no general increase in risk.

1.8.4 Notwithstanding the following specific issues have been reviewed:

- The potential for construction-related accidents, causing harm to construction workers, are not within the scope of the EIA, unless these could also cause harm to an environmental receptor including members of the public beyond the boundaries of the construction site. Existing legislation around safe working practices and CDM will ensure that such risks are mitigated appropriately without the need for further assessment.
- The potential for extreme weather events, combined with the presence of the Proposed Scheme (for example, the Proposed Scheme affecting flood patterns) will be adequately assessed within the road drainage and the water environment chapter, the separate Flood Risk Assessment (FRA) and the climate chapter, without the need for further assessment.
- The potential for other external hazards to impact the Proposed Scheme, such as earthquakes, landslides, mine collapse or sinkholes, will, where relevant, be covered within the design requirements of the DMRB and the geology & soils chapter and will not require further assessment.
- Accidental spillage of contaminants such as hydrocarbons and their subsequent release into the drainage system will be considered in the road drainage and the water environment chapter.
- There are no registered COMAH sites with three miles of the Proposed Scheme and therefore no need to consider any associated risks.
- The safety of the Proposed Scheme will be evaluated through a road safety audit, which will be undertaken during design, at the end of construction and post-construction, to identify road safety problems and to suggest measures to eliminate or mitigate any concerns.

1.8.5 A table will be included in the ES which identifies where this has been considered in respect of relevant technical chapters (e.g. road drainage and the water environment in respect of flood risk and culvert design).

1.8.6 In summary, the independent assessment of the likely significant environmental effects arising from the vulnerability of the Proposed Scheme to major accident and/or natural disaster is scoped out of this EIA. As justified above, major accidents and disasters will be sufficiently addressed within the scheme design and relevant technical chapters.

1.9 Heat and Radiation

1.9.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for ‘A description of the likely significant effects of the development on the environment resulting from, inter alia - …heat and radiation’ (Schedule 4, part 5(c)) to be assessed within EIAs.

1.9.2 Due to the nature of the Proposed Scheme as a highway scheme, it is considered unlikely that heat and radiation effects associated with the proposals are likely to arise. Further assessment has therefore been scoped out.

1.10 Transboundary Screening Matrix

1.10.1 Regulation 32 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires Planning Inspectorate to notify other European Economic Area (EEA) States and publicise an application for development consent if it is of the view that the proposed development is likely to have significant effects on the environment of another EEA Member State, and where relevant to consult with the EEA State affected.

1.10.2 The closest international land boundary is over 200km from the Proposed Scheme.

1.10.3 The study areas for the various ES topics define the extent of effects anticipated and are described fully in chapters 5 to 14 and are summarised below as follows:

- Air quality: 200m around the works
- Cultural heritage: 600m around the works
- Landscape: 1km around the works
- Biodiversity: various – see Section 8.2
- Geology & soils: 1km around the works
- Materials: determined through professional judgement by the influence of the Proposed Scheme
- Noise & vibration: 1km around the works; potentially further depending on extent of noise impact due to changes in traffic flow
- People and communities: various see section 12.2
- Road drainage and the water environment: 1km around the works but extended where there are features that may be affected by pollutants transported downstream
- Climate: not applicable

1.10.4 As none of these reach other EEA Member States, no transboundary effects are anticipated and are therefore scoped out of the assessment process.

1.10.5 A Habitats Regulation Assessment (HRA) screening exercise will be undertaken in accordance with Advice Note 10: Habitat Regulation Assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2012b). The screening exercise will assess the potential for adverse impacts on European sites and therefore the need for HRA Appropriate Assessment.

1.11 Planning Policy Context

National Policy Framework

1.11.1 The national policy is particularly relevant to developments that will be promoted as a NSIP. When the DCO application for a scheme is to be progressed as an EIA development, an environmental assessment will be undertaken in compliance with national policies and regulations and will also consider whether legal duties and obligations set out within the Road Investment Strategy (RIS) and Highways England Licence would be met. A summary of key policies that are included in the NNNPS and in the RIS is provided in sections 1.11 to 1.11.5.

National Networks National Policy Statement

1.11.2 The NNNPS sets out the need for, and Government's policies to deliver development of, NSIPs on the national road network in England and sets out the primary basis for making decisions of development consent for NSIPs in England. The Government recognises in the Appraisal of Sustainability accompanying the NNNPS that some developments will have some adverse local impacts on noise, emissions, landscape / visual amenity, biodiversity, cultural heritage and water resources. The significance of these effects and the effectiveness of mitigation is uncertain at the strategic and non-locational specific level of the NNNPS. Therefore, whilst applicants should deliver developments in accordance with Government policy and in an environmentally sensitive way, including considering opportunities to deliver environmental benefits, some adverse local effects of development may remain.

1.11.3 Outside the NSIP regime, Government policy is to bring forward targeted works to address existing environmental problems on the SRN and improve the performance of the network. This includes reconnecting habitats and ecosystems, enhancing the settings of historic and cultural heritage features, respecting, and enhancing landscape character, improving water quality, and reducing flood risk, avoiding significant adverse impacts from noise and vibration and addressing areas of poor air quality.

Road investment strategy

1.11.4 In December 2014, the Department for Transport (DfT) published the RIS for 2015-2020. The RIS sets out the list of schemes that are to be developed by Highways England over the period covered by the RIS.

1.11.5 Highways England, as the strategic highways company and appointed by the Secretary of State must, in exercising its functions and complying with its legal duties and other obligations, act in a manner which it considers best calculated to, among others:

- Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment
- Conform to the principles of sustainable development

Highways England policy

Highways England licence

1.11.6 The Highways England Licence document sets out key requirements which must be complied with by the Licence holder as well as statutory guidance. In exercising its functions and complying with its legal duties and obligations, the Licence holder must act in such a manner which it considers best calculated to:

- Ensure the effective operation of the network
- Ensure the maintenance, resilience, renewal, and replacement of the network
- Ensure the improvement, enhancement and long-term development of the network
- Ensure efficiency and value for money
- Protect and improve the safety of the network
- Co-operate with other persons or organisations for the purposes of co-ordinating day-to-day operations and long-term planning
- Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment
- Conform to the principles of sustainable development

1.11.7 In complying with section 4.2 (g) and its general duty under section 5(2) of the Infrastructure Act 2015 to have regard for the environment, the licence holder must:

- Ensure that protecting and enhancing the environment is embedded into its business decision-making processes and is considered at all levels of operations
- Ensure the best practicable environmental outcomes across its activities, while working in the context of sustainable development and delivering value for money
- Consider the cumulative environmental impact of its activities across its network and identify holistic approaches to mitigate such impacts and improve environmental performance
- Where appropriate, work with others to develop solutions that can provide increased environmental benefits over those that the Licence holder can achieve alone, where this delivers value for money
- Calculate and consider the carbon impact of road projects and factor carbon into design decisions, and seek to minimise carbon emissions and other greenhouse gases from its operations
- Adapt its network to operate in a changing climate, including assessing, managing and mitigating the potential risks posed by climate change to the operation, maintenance and improvement of the network

- Develop approaches to the construction, maintenance and operation of the Licence holder's network that are consistent with the government's plans for a low carbon future
- Take opportunities to influence road users to reduce the greenhouse gas emissions from their journey choices

Highways England Delivery Plan

1.11.8 The Highways England delivery plan sets out Highways England's long-term plans for the modernisation and renewal of our road network over the 5-year period from 2015 - 2020. It provides a brief outline of what Highways England have delivered during 2015 - 2016 and sets out a clear programme of activity for 2016 - 2017, as well as annual and future commitments. It complements the original delivery plan (Highways England Delivery Plan 2015 - 2020), outlining progress made with this work.

1.11.9 Key performance indicators (KPI) and other Performance Indicators (PI) have been set out from the January 2016 Operation Metrics Manual produced in collaboration with DfT and Office of Rail and Road (ORR). Environmental KPIs include:

- Number of Noise Important Areas (NIAs) mitigated. Highways England aim to mitigate 1,150 NIAs through interventions, to reduce the noise exposure of the population within the NIA.
- Delivery of improved biodiversity, as set out in Highways England's Biodiversity Plan. Highways England aim to reduce the net loss of biodiversity by the end of the first road period, on an on-going annual basis.
- Helping cyclists, walkers, and other vulnerable users of the network through several new and upgraded crossings. The measure of success is an increase in the number of completed new crossings and upgraded crossings.

1.11.10 Furthermore, a series of ring fenced funds for actions beyond business as usual are available across environmental disciplines, including cultural heritage, landscape, biodiversity, road drainage and water environment and geology & soils. There are also separate funds available for air quality, noise & vibration and people and communities.

2 The Proposed Scheme

2.1 The need for the Proposed Scheme

2.1.1 The section of A47 between Wansford and Sutton is currently a single-carriageway. This acts as a bottleneck, resulting in congestion, leading to longer journey times and a poor safety record. The Proposed Scheme will relieve congestion, reduce journey times, encourage economic growth, and improve the driver experience.

2.1.2 If nothing is done to improve capacity and connectivity, these delays are forecast to get worse in future years. In developing the Proposed Scheme Highways England aim to address these issues by a high quality dual carriageway link which is intended to improve the traffic flow, reduce journey times on the route and increase the route safety and resilience. The Proposed Scheme is also intended to support economic growth by making journeys safer and more reliable.

2.2 Proposed Scheme Objectives

2.2.1 The objectives of the proposed A47 Wansford to Sutton improvement scheme are:

- Supporting economic growth

Contributing to sustainable economic growth by supporting employment and residential development opportunities. The Proposed Scheme aims to reduce congestion-related delay, improve journey time reliability, and increase the overall capacity of the A47.

- A safe and serviceable network

Improving road safety for all road users through being designed to modern highway standards appropriate for a strategic road.

- A more free-flowing network

Increasing the resilience of the junction in coping with incidents such as collisions, breakdowns, maintenance, and extreme weather. The improved A47 Wansford to Sutton section would be more reliable, reducing journey times and providing capacity for future traffic growth.

- Improved environment

Protecting the environment by minimising adverse impacts and where possible deliver enhancements by improving the environmental impact of transport on

those living along the existing A47 and by minimising the impact of new infrastructure on the natural and built environment.

- An accessible and integrated network

Ensuring the proposals take into account local communities and access to the road network, providing a safer route between communities for cyclists, walkers, equestrians, and other non-motorist groups.

- Value for money

Ensuring that the Proposed Scheme is affordable and delivers good value for money.

2.3 Proposed Scheme Location

2.3.1 The Proposed Scheme is located on the single-carriageway section of the A47 the runs from the A1 in the west (near Wansford) to the dual-carriageway section near the village of Sutton in the east, as shown in the Red Line Boundary drawing in appendix A. Peterborough lies approximately 9km east of the link. Beyond Peterborough, the A47 continues to Norwich and towards the east coast at Great Yarmouth. The corridor intersects with key strategic routes including the A1, A10 and A11, which provide links to other urban centres including Cambridge, Ely and London.

2.3.2 The Proposed Scheme lies adjacent to the River Nene and the Nene Valley. Arable farmland is the predominant land cover in the area, divided into relatively small agricultural enclosures interconnected by narrow rural lanes, and defined by hedgerows and ditches throughout the landscape. The fields are interspersed with fragmented patches of woodland and clusters of farms and residential settlements.

2.3.3 The land potentially required temporarily and/or permanently for the construction, operation and maintenance of the Proposed Scheme (hereafter referred to as the DCO site boundary), is shown on Figure A.1 in appendix A. It is important to note that the current proposed draft DCO site boundary may be subject to change, but currently captures what is thought to be a reasonable worst-case land take.

2.4 Proposed Scheme Description

2.4.1 The Proposed Scheme consists of a new 2.5km dual-carriageway to the east of Wansford and would be constructed largely off-line, crossing from the north to south side of the existing A47, just east of the existing filling station on the A47.

2.4.2 The proposals include providing 2 traffic lanes in each direction between the Wansford west and Wansford east roundabouts where the A47 crosses the A1.

2.4.3 At the western end of the Proposed Scheme, a new southbound slip road from the A1 would be constructed to provide a free flow link between the A1 southbound carriageway and the new eastbound carriageway of the A47. As

part of the proposals the existing Wansford east roundabout would be enlarged to accommodate the A47 westbound traffic.

2.4.4 A new link road connection to Sacrewell Farm and Country Centre would be provided from the Wansford east roundabout and would pass under the new A47 via a new underpass. This link road would also provide access to the existing Wansford picnic area.

2.4.5 Access to the Wansford service area (fuel station) would be maintained for A47 westbound traffic only.

2.4.6 At the existing priority junction of the A47 with Sutton Heath Road, the alignment of the Proposed Scheme is sufficiently south of the existing road to allow the existing road to be retained as a link for local traffic between Sutton Heath Road and the Sutton Roundabout (A47) at the eastern end.

2.4.7 To prevent rat-running through the village of Sutton, the existing connection between The Drift and the A47 has been severed although a turning head will be provided at the end of Drift Road to accommodate any errant vehicles. Traffic instead will be required to access the A47 at the Sutton Roundabout.

2.4.8 At the eastern end, the Sutton Roundabout would be enlarged to accommodate the alignment of the Proposed Scheme but would retain connections with both Peterborough Road (Nene Way) and the Upton Road. The retained section of the A47 would be locally realigned to form a new priority junction with the Upton Road, and in doing so provide a connection between Sutton Health Road and the A47.

2.5 Timescales

2.5.1 Subject to successfully passing through the DCO process, the key timescales for the Proposed Scheme are as follows:

- Start of construction work - 2020
- Estimated duration of construction – 16 months
- Open for traffic – 2021 - 2022

3 Consideration of Alternatives

3.1 Alternative Options Considered

3.1.1 Initial feasibility work identified that dualling of the section of A47 between Wansford and Sutton represented an appropriate solution to solve the identified transportation problem. As part of this work, broad solutions were reviewed to ensure that dualling of the route represented a suitable and economically cost-effective solution. Two potential options were therefore developed during feasibility, which were as follows:

- Part on-line, part off-line to the north of the existing carriageway plus free flow from A1 southbound (refined Option 2 below)
- Off-line to the north of the existing carriageway plus free flow from A1 southbound (refined Option 5 below)

3.1.2 These 2 options were refined and further options were developed. Nine potential route options were identified, and are as follows:

- Option 1 – On-line dualling plus free flow slip from the A1 southbound
- Option 2 – Part on-line, part off-line to the north plus free flow slip road from the A1 southbound
- Option 3 – Off-line to the south plus free flow slip road from the A1 southbound
- Option 4 – Off-line to the south of the River Nene
- Option 5 – Off-line to the north plus free flow slip road from the A1 southbound
- Option 6 – Off-line to the north plus free flow slip road from the A1 southbound
- Option 7 – Off-line to the north plus free flow slip road from the A1 southbound]
- Option 8 – Part off-line to the north, part off-line to the south plus free flow slip road from the A1 southbound
- Option 9 – Part on-line, part off-line to the south plus free flow slip road from the A1 southbound

3.1.3 The initial comparative assessment of the nine options was undertaken using the DfT's Early Assessment and Sifting Tool (EAST) and Highways England's KPI Assessment. The EAST sifting process rates the options against the economic, financial, managerial and commercial aspects of EAST. The Highways England KPI Assessment involved scoring the nine options against the Highways England KPIs from one to five, where one is poor and five is good. For further information on this sifting process, refer to the A47 Wansford to Sutton Scheme Assessment Report (A47IMPS2-AMY-WS-ZZ-DO-L-0006).

3.1.4 Options 4 and 6 performed marginally worse than all other options during the initial sift due to Option 4 crossing the River Nene in 2 places, and Option 6

traversing a site of special scientific interest (SSSI). However, as the sifting assessments did not differentiate sufficiently between the nine options, it was agreed that further detailed assessment should be undertaken.

3.1.5 Initially for each option a qualitative Appraisal Summary Table (AST) was completed based on available information. The assessment work was then developed to allow assessment and ranking of the nine options against the following criteria:

- Environment
- Transportation
- Engineering
- Economics

3.1.6 For more information on the further sifting assessment methodology, refer to the A47 Wansford to Sutton Scheme Assessment Report (Ref: A47IMPS2-AMY-WS-ZZ-DO-L-0006).

3.1.7 The assessment rankings from this further sifting assessment were combined to give overall rankings for each of the nine options, and reviewed.

3.1.8 Options 4 and 7 ranked the lowest score. Option 4 crosses the River Nene in two places and traverses through the floodplain, and Option 7 takes local residents through a longer more convoluted route and therefore scored poorly on the transport and economic assessment. Therefore, these options were not taken forward for further assessment. In addition, Option 6 traverses through a SSSI, so it was decided that this option should not be taken forward for further assessment.

3.1.9 Option 3 ranked the highest, followed by Option 8. As the route of Option 3 passes closer to the fuel station, and Option 8 moves away from the fuel station, Option 8 was selected for further assessment.

3.1.10 Options 5 and 2 were ranked 3rd and 4th, respectively, however, they were considered to be very similar within the tolerance of design evolution. Therefore, the decision was made to modify Option 5 so that it moves slightly further north and to re-name this Option 10. Option 10 was selected for further assessment.

3.1.11 Options 1, 2, and 9 all have either part or the entire route on-line, therefore, it was decided that these can be grouped together as they were considered within the tolerance of design evolution. Option 1 was selected to be taken forward for further assessment as it would have the lowest impact on designated sites.

3.1.12 Therefore, the three options taken forward for further assessment were:

- Option 1 – On-line dualling plus free flow link to A1 southbound
- Option 8 – Part off-line to the north, part off-line to the south plus free flow link from A1 southbound
- Option 10 – Off-line to the north plus free flow from A1 southbound

3.2 Option Taken Forward – The Proposed Scheme

3.2.1 Options 1, 8 and 10 were subject to further environmental, economic, and technical assessment. These options were taken forward to non-statutory public consultation in March / April 2017. For the simplicity in gathering public comment and for presentation at the consultation, it was decided that the 3 options should be renumbered 1 to 3, as follows:

- Option 1 renamed Option 1
- Option 8 renamed Option 2
- Option 10 renamed Option 3

3.2.2 The non-statutory public consultation was attended by over 171 people and Highways England received 170 responses. Around 86% of respondents supported the need to improve the section and agreed the proposals would be beneficial in reducing congestion and improving journey times. Concerns were raised about the access to Sacrewell Farm and the villages of Wansford and Sutton, the need for infrastructure to support the local cycling community and the potential for noise and disruption to traffic during construction.

3.2.3 Having reviewed the feedback following the consultation and the results of the further environmental, economic and technical assessment, it was identified that Option 2 solves the main traffic and safety problems along the route. Previous design and development also concluded that Option 2 would have significant advantages in terms of environmental impact when compared to Option 3, and would have less impact during construction when compared to Option 1. Option 2 was therefore identified as the preferred route.

3.2.4 However, key concerns raised during the non-statutory consultation have influenced an amendment to the original Option 2 proposal. The new dual carriageway would be moved as close as possible to the southern edge of the existing A47 at the eastern end of the Proposed Scheme. This would:

- Increase the distance from the new road to both the River Nene and the village of Sutton
- Reduce the amount of land take required
- Allow for the easiest connection of existing side roads to the new A47
- Allow for most of the existing A47 to remain in place for local traffic and walkers, cyclists and horse riders

3.2.5 The amended version of Option 2 will be further developed, and will be subject to further assessment and statutory consultation as part of the design development and EIA process.

4 Consultation

4.1 Consultation Undertaken to Date

4.1.1 An extensive stakeholder mapping exercise was undertaken to identify relevant stakeholders and their key interests. This list was used to inform the participants of a 6-week non-statutory public consultation, which was held between 13 March and 21 April 2017.

4.1.2 At all public information exhibition events, members of the Highways England management team, the design engineers and council officials were available to discuss the proposed options with stakeholders.

4.1.3 An additional static panel was set up at Peterborough Town Hall, and following the public information events the key display material was left on show at Sacrewell Farm Centre until the end of the consultation period. The panel provided details of the proposed non-statutory public consultation events along with details of how to access the consultation material and respond to the questionnaire. Copies of the consultation brochure and questionnaire were also made available at this event for the general public to pick up if they were unable to attend one of the scheduled information events.

4.1.4 The Highways England website made the non-statutory consultation documents available to stakeholders for viewing and downloading, and included the facility to complete and return the questionnaire on-line. The website was kept up to date with information on all the non-statutory public consultation events and public information points.

Engagement with Local Authorities

4.1.5 As part of the consultation process, Highways England actively sought to discuss the proposals with parties directly affects by the proposals, such as landowners and those with business interests or development proposals within the vicinity of the Proposed Scheme. A number of meetings took place and consultation with those affected parties will continue as the design progresses.

4.1.6 Consultation has commenced with Peterborough City Council and the local councils.

Engagement with Statutory Environmental Bodies

4.1.7 Highways England has not formerly engaged with any Statutory Environmental Bodies (SEBs) during the optioneering process nor during the non-statutory public consultation period.

Engagement with Landowners

4.1.8 As part of the consultation process, Highways England actively sought to discuss the proposals with parties directly affected by the proposals, such as landowners and those with business interests or development proposals in the scheme area.

Engagement with the Community

4.1.9 The Public Information Exhibitions (PIEs) were held on 23, 24 and 25 March 2017. Details are shown in Table 4.1 below, including the number of visitors that attended. The exhibition was attended by staff from Highways England and its consulting engineers, who were available to answer questions on the proposals from members of the public.

Table 4.1 Public consultation details

Venue	Date	Opening Times	Number of Visitors
Peterborough Town Hall	14 March 2017	9.00 – 17.00	MPs, Councillors and stakeholder preview – numbers not recorded
Haycock Hotel Wansford	23 March 2017	15.00 – 20.00	68
Sutton Church, Sutton	24 March 2017	10.00 – 17.00	70
Sacrewell Farm Centre, Wansford	25 March 2017	10.00 – 17.00	33

4.1.10 An additional static panel was set up at Peterborough Town Hall, and following the PIE the key display material regarding the options were left on show at Sacrewell Farm Centre until the end of the public consultation. The panel provided details of the proposed PIE events along with details of how to access the consultation material and respond to the questionnaire. Copies of the brochure and questionnaire were also made available at this event for the general public to pick-up.

4.2 Proposed Consultation

4.2.1 A consultation strategy has been developed which outlines the organisations who will be consulted, methods through which we will consult and the proposed timeline for the consultation. Consultation required to support individual technical assessments is set out within each chapter of this report.

Engagement with hard to reach groups

4.2.2 The Proposed Scheme's Equality Impact Assessment will identify the relevant hard to reach groups. Host local authorities will be consulted about identification of relevant groups. Categories identified and contacted include non-motorised user (NMU) groups, ethnic organisations, local Traveller communities', disability groups and groups representing children and the elderly.

5 Air Quality

5.1 Introduction

5.1.1 This chapter presents the baseline air quality in the vicinity of the Proposed Scheme and describes the proposed approach for the assessment of air quality.

5.1.2 It has been prepared in accordance with the requirements of DMRB Volume 11, Section 2, Part 4 (HA 204/08), DMRB Volume 11, Section 3, Part 1 (HA 207/07), and associated Interim Advice Notes (IANs), namely IANs 170/12v3, 174/13, 175/13 and 185/15. This chapter encompasses two sub-topics, as follows:

- Local air quality – emissions of pollutants that are of concern in relation to human health and ecosystems, at a local level
- Regional air quality – total emissions of pollutants that can disperse over longer distances, affecting both human health and ecosystems

5.1.3 The potential requirement for further assessment to either Simple or Detailed Level will be identified within this chapter. Where necessary, further assessment will be presented within an ES**.**

5.2 Study Area

5.2.1 The Proposed Scheme is one of six schemes identified within the A47 corridor where improvements are proposed. The location of the Proposed Scheme key environmental constraints is shown on the Environmental Constraints Plan in Appendix B.

5.2.2 The study area for the local air quality assessment covers human health receptors and ecologically designated sites within 200m of roads that are expected to be affected by the Proposed Scheme.

5.2.3 Under DMRB Volume 11, Section 3, Part 1(HA 207/07), affected roads for the assessment of local air quality are defined where:

- Road alignment will change by 5m or more
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more
- Daily average speed will change by 10km/hr or more
- Peak hour speed will change by 20km/hr or more

5.2.4 The local air quality assessment involves estimating the change in pollutant concentrations at sensitive receptors resulting from the operation of the Proposed Scheme. The regional air quality assessment measures the change in emissions resulting from the Proposed Scheme. This is required as emissions not only affect local air quality, but also have an impact on a regional,

national and international scale. Affected roads for the assessment of regional air quality include those that meet the following criteria:

- A change of more than 10% AADT
- A change or more than 10% to the number of HDVs
- A change in the daily average speed of more than 20km/hr

5.2.5 As traffic data for the Proposed Scheme is not yet available, it is not possible to describe in further detail the areas which meet the above criteria.

5.3 Existing and Baseline Knowledge

Overview

5.3.1 Information on air quality in the UK can be obtained from a variety of sources including Local Authorities, national network monitoring sites and other published sources. For the purpose of this assessment, data has been obtained from Peterborough City Council (PCC), Department for Environment, Food and Rural Affairs (Defra), and Highways England. The most recent full year of monitoring data available from PCC is for 2015.

Local Authority Review and Assessment

5.3.2 PCC declared an Air Quality Management Area (AQMA) in 2007 due to exceedances of the SO_2 15-minute mean air quality objective associated with emissions from a brickworks in this location. The AQMA is located approximately 14.5km east of the Proposed Scheme and is for SO_2 and therefore will not be affected as a result of the Proposed Scheme.

Local Authority Monitoring

5.3.3 No automatic monitoring is undertaken within the vicinity of the Proposed Scheme.

5.3.4 PCC currently undertakes diffusion tube monitoring at 17 sites. Table 5.1 presents results from the closest diffusion tube sites to the Proposed Scheme for recent years. Annual mean NO_2 concentrations at these sites have been well below the objective in recent years. The location of the monitoring sites in relation to the Proposed Scheme is presented in Figure 5.1.

Figure 5.1: PCC Monitoring Sites in Relation to the Proposed Scheme

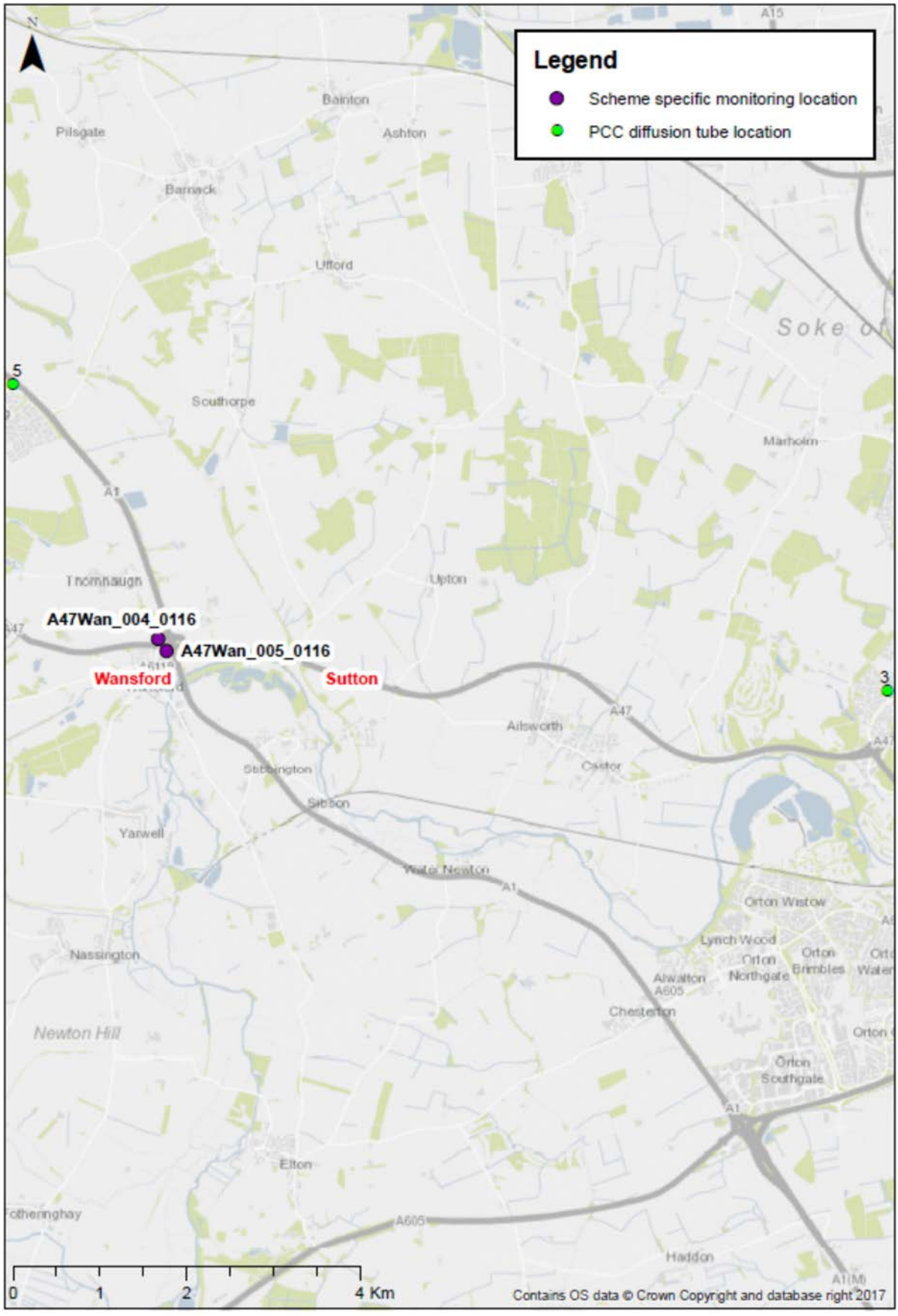


Table 5.1: PCC NO_2 diffusion tube data for 2013 - 2015

Site name	Site classification	National Grid reference		Annual mean NO_2 concentration ($\mu g/m^3$)		
		X	Y	2013	2014	2015
5	Roadside	505698	302775	25.0	23.2	21.9
3	Urban Background	515782	299220	16.9	15.8	15.1

Source: PCC

Note: Annual mean objective is 40 $\mu g/m^3$

Highways England Monitoring

5.3.5 A six-month air quality monitoring survey was undertaken by Highways England from January 2016 to June 2016. The results from monitoring were bias adjusted and annualised in accordance with Defra's Local Air Quality Management Technical Guidance (TG16). This monitoring survey concluded that NO_2 concentrations within the vicinity of the Proposed Scheme are well below the annual mean NO_2 air quality objective; the greatest annual mean NO_2 concentration within the vicinity of the Proposed Scheme of 28.2$\mu g/m^3$ was recorded at the "A47Wan_005_0116" monitoring site, on Black Swan Spinney. This monitoring site is representative of sensitive receptors in close proximity to the existing junction at the A47 and A1 and is therefore considered representative of a worst-case concentrations.

5.3.6 The bias adjusted and annualised results from this monitoring survey are presented in Table 5.2. The locations of these monitoring sites in relation to the Proposed Scheme alignment is presented in Figure 5.1.

Table 5.2: Scheme specific diffusion tube monitoring data for NO_2

Site ID	Location	Site classification	National Grid reference		Annualised NO_2 ($\mu g/m^3$)
			X	Y	2016
A47Wan_004_0116	Slip road between A1 and A47	Roadside	507380	299826	22.3
A47Wan_005_0116	Black Swan Spinney	Roadside	507474	299689	28.2

Source: Highways England

Note: Annual mean objective is 40 $\mu g/m^3$

Defra Projected Background Concentrations

5.3.7 In addition to the data above, Defra provides estimates of background pollution concentrations for NO_X, NO_2 and PM_{10} across the UK for each one kilometre grid square, for every year from 2013 to 2030. Future year projections have been developed on the base year for the background maps, which is currently 2013. The maps include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2013 UK monitoring data. This data can be used to provide specific background pollutant concentrations at receptors included within the assessment and to supplement local monitoring data.

5.3.8 Table 5.3 presents the maximum background concentrations for the areas covered by the Proposed Scheme for the year 2016.

Table 5.3: Defra projected background concentrations for the Proposed Scheme (2016)

NO_x	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
21.5	15.2	18.6	12.4

Note: Proposed Scheme covers multiple Ordnance Survey (OS) grid squares. Therefore, the results presented above are taken from the grid squares which have the greatest pollutant concentrations for 2016. Grid squares used = 507500, 299500, 508500, 299500, 509500, 299500 and 510500, 299500.

EU Limit Value Compliance

5.3.9 Defra's Pollution Climate Mapping (PCM) is used to report compliance with the EU limit values and provides NO_2 concentrations for a number of roads across the UK for a selection of future years. The current PCM model outputs were released in August 2017, following the release of Defra's Air Quality Action Plan.

5.3.10 Based on projected roadside NO_2 concentrations in the current version of the PCM model, there are no PCM links within 10km of the Proposed Scheme exceeding 40µg/m^3 for the year of 2017. The PCM link closest to the Proposed Scheme, (on the A47) is located approximately 5.5km from the Proposed Scheme and has a reported annual NO_2 concentration in 2017 of 38µg/m^3, which is below the annual mean limit value of 40µg/m^3 for NO_2. Therefore the Proposed Scheme is unlikely to cause a non-compliance with the Air Quality Directive.

5.3.11 The ES will identify any affected road network (ARN) links that overlap with the PCM model and will assess compliance with the Air Quality Directive in accordance with IAN 175/13.

Summary

5.3.12 Monitoring results from recent years showed no exceedances of the NO_2 air quality objective at any of the monitoring locations located close to the Proposed Scheme. In addition, there are no AQMAs located within the vicinity of the Proposed Scheme. There is no monitoring data available for PM_{10}, however, Table 5.3 indicates that background concentrations are well below the air quality objective in the study area.

5.4 Assumptions and Limitations

5.4.1 Air quality modelling predictions will be based on the most reasonable, robust, and representative methodologies in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with model predictions, including:

- Uncertainties with traffic forecasts
- Uncertainties with vehicle emission predictions

- Uncertainties with background air quality data
- Simplifications made within calculations or post processing of the data that represent atmospheric dispersion or chemical reactions

5.4.2 In order to best manage these uncertainties, the air quality assessment to be undertaken as part of the ES and will be verified using the air quality measurements from the Highways England monitoring survey and any local authority or AURN (Automatic Urban and Rural Network) data that is within the ARN study area and has suitable data capture. The verification process will be undertaken in line with best practice guidance produced by Defra

5.5 Guidance and Best Practice

5.5.1 The air quality assessment will take account of the best practice guidance provided by the DMRB 207/07, the Defra technical guidance for undertaking air quality assessments (LAQM-TG (16)), and the following IANs published by Highways England:

- IAN 170/12 'Updated air quality advice on the assessment of Future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1, Air Quality'
- IAN 174/13 'Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality'
- IAN 175/13 'Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Proposed Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07)'
- IAN 185/15 'Updated traffic, air quality and noise advice on the assessment of traffic data into speed-bands for users of DMRB Volume 11, Section 3 Part 1 Air Quality'

5.5.2 Further updates to the IANs may be published before work commences on the environmental assessment; the assessment will be undertaken in accordance with the latest IANs available at the time.

5.5.3 Table 5.4 presents the relevant air quality objectives that the Proposed Scheme will be assessed against.

Table 5.4: Air quality objectives and limit values

Pollutant	**Averaging period**	**air quality objectives and limit values**		**Attainment date**	
		Concentration	**Allowance**	**Air quality objectives**	**EU limit values**
Nitrogen dioxide (NO_2)	Annual	40 µg/m^3	-	31 December 2005[(a)(b)]	1 January 2010[(c)]

Pollutant	Averaging period	air quality objectives and limit values		Attainment date	
		Concentration	Allowance	Air quality objectives	EU limit values
	1 Hour	200 µg/m^3	18	31 December 2005[a)(b)]	1 January 2010[(c)]
Nitrogen Oxides (NO_X)[(d)]	Annual	30 µg/m^3	-		31 December 2000[(c)]
Particulates (PM_{10})	Annual	40 µg/m^3	-	31 December 2004[a)(b)]	1 January 2005[(c)]
	24 Hour	50 µg/m^3	35	31 December 2004[a)(b)]	1 January 2005[(c)]

Notes: (a) Air Quality (England) Regulations 2000 as amended in 2002
(b) Air Quality Strategy 2007
(c) EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations
(d) Designated for the protection of vegetation and ecosystems and referred to as the 'critical level' for NO_x

5.6 Consultation

5.6.1 Consultation will be undertaken with PCC to discuss the assessment approach and the study area for the ES once traffic data for the Proposed Scheme is available.

5.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

5.7.1 The main risks to sensitive receptors during the construction stage include on-site dust emissions arising from construction activities and vehicle movements. Dust can be mechanically transported (either by wind or re-suspension by vehicles). It can also arise from wind erosion on material stock piles, earth moving etc.

5.7.2 These impacts are expected to be restricted to within 200m of construction activities (as stated in DMRB Volume 11, Section 3, Part 1), and will be controlled through appropriate mitigation measures included within the Construction Environmental Management Plan (CEMP) which would be prepared for the Proposed Scheme. Mitigation measures could include minimising the use of dust generating activities, the use of water as a dust suppressant where appropriate, and keeping stockpiles for the shortest time possible.

Operation

5.7.3 The operational phase of the Proposed Scheme on local air quality has the potential to affect air quality due to:

- Changes in emissions associated with changes in traffic flows (including composition and speed) on the local road network
- Changes in road layout which may bring road traffic emission sources closer to, or further away from, sensitive receptors

5.7.4 The key pollutants for consideration within the assessment of operation phase local air quality effects are:

- Nitrogen oxides (NO_x), including NO_2
- Fine particles (particulate matter defined as those less than 10 microns in diameter; PM_{10})

5.7.5 The key pollutants for consideration within the assessment of operation phase regional air quality effects (if the assessment criteria are met) are:

- Nitrogen oxides (NO_x), including nitrogen dioxide (NO_2)
- Fine particles (particulate matter defined as those less than 10 microns in diameter; PM_{10})
- Carbon dioxide (CO_2)

5.7.6 No assessment is considered necessary for emissions of any pollutants other than those identified above, as no significant emission sources of these pollutants are introduced or affected by the Proposed Scheme or because concentrations are expected to be well below air quality objectives within the study area.

Summary

5.7.7 Table 5.5 provides a summary of the potential construction and operational air quality effects for the Proposed Scheme.

Table 5.5: Summary of potential air quality effects

Potential construction effects	Potential operation effects
Significant direct effects are unlikely with mitigation measures in place.	Dependant on traffic impacts which are yet to be determined.

5.8 Proposed level and scope of assessment

5.8.1 The scope of assessment during the construction phase will include emissions of NO_2 and PM_{10} from construction plant and vehicles, and dust arising from construction activities. A qualitative assessment of construction phase effects will be undertaken.

5.8.2 For the operational stage effects, a simple level assessment will be undertaken, once scheme specific traffic data is available. In accordance with DMRB, a simple level assessment has been deemed sufficient as no exceedances of the air quality objectives / EU Limit Values have been identified within the vicinity of the Proposed Scheme and the initial assessment as undertaken indicated that impacts where not significant in accordance with IAN 174/13.

5.9 Proposed Methodology including Significance

Construction Phase

5.9.1 Key stages of the construction phase and the locations and types of sensitive receptors will be identified in accordance with DMRB 207/07. Appropriate mitigation measures which could be incorporated into the CEMP will be identified in accordance with Best Practicable Means (BPM).

5.9.2 If construction traffic is predicted to last for longer than six months, traffic management measures and the effect of additional construction vehicles will be assessed qualitatively.

Operational Phase

5.9.3 A simple level assessment will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 1 (HA 207/07) and associated IANs, and Defra's Local Air Quality Management Technical Guidance (LAQM.TG(16)), which will include:

- An assessment of air quality effects using the DMRB Screening Tool
- Verification of model outputs with local monitoring data
- Prediction of NO_2 and PM_{10} concentrations in the 'base year' and the opening year, 'do minimum' and 'do something' scenarios at sensitive human health receptors and designated sites

5.9.4 For regional air quality impacts, the change in mass emissions that would result from the operation of the Proposed Scheme will be quantified. Emissions with and without the Proposed Scheme will be compared for opening year and design year (opening year + 15 years) as well as the base year scenario.

Determination of Significant Effects

5.9.5 IAN 174/13 provides advice for evaluating significant local air quality effects for public exposure and designated sites. Evaluation of the significance of local air quality effects will be undertaken in accordance with IAN 174/13, a summary of which is provided here.

5.9.6 Receptors that have a reasonable risk of exceeding an air quality threshold will be assessed in both a Do Minimum and Do Something scenario. The difference in pollutant concentration between the two scenarios is used to describe the magnitude of change in accordance with Table 5.6.

Table 5.6: Magnitude of change criteria

Magnitude of change in concentration	**Value of change in annual average NO_2 and PM_{10}**
Large (>4)	Greater than full MoU value of 10% of the air quality objective (4µg/m^3)
Medium (>2 to 4)	Greater than half of the MoU (2 µg/m^3), but less than the full MoU (4 µg/m^3) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective (0.4 µg/m^3) and less than half of the MoU i.e. 5% (2 µg/m^3). The full MoU is 10% of the air quality objective (4 µg/m^3)
Imperceptible (</= 0.4)	Less than or equal to 1% of objective (0.4 µg/m^3)

Notes: MoU = Measure of Uncertainty (10% of the objective)

5.9.7 The number of receptors where changes are greater than imperceptible, and where concentrations exceed the air quality objectives in the Do Minimum or Do Something scenario will be compared to the guideline bands presented in Table 5.7.

Table 5.7: Guideline to number of properties constituting a significant effect

Magnitude of change in concentration	**Number of receptors with:**	
	Worsening of air quality objective already above objective or creation of a new exceedence	**Improvement of an air quality objective already above objective or the removal of an existing exceedence**
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

5.9.8 Table 5.7 presents guideline bands, setting an upper level of likely non-significance and a lower level of likely significance, for the number of receptors affected by the Proposed Scheme. Between these two levels are the ranges where likely significance is more uncertain, therefore professional judgment would be required. If the Proposed Scheme is above the lower level of likely significance, consideration should be given to all the evidence that may support or detract from the conclusion of a significant effect. The information compiled to complete Table 5.7 will then be used along with the following key criteria to determine the overall evaluation of local air quality significance:

- Is there a risk that environmental standards would be breached?
- Is there a high probability of the effect occurring?
- Would there be a large change in environmental conditions?
- Would the effect continue for a long time?
- Would many people be affected?
- Is there a risk that protected sites, areas, or features would be affected?
- Would it be difficult to avoid, or reduce, or repair, or compensate for the effect?

5.9.9 The Proposed Scheme's compliance with EU limit values will be assessed using IAN 175/13.

5.10 Conclusion

5.10.1 A qualitative assessment of receptors within 200m of construction activities will be undertaken and relevant measures to minimise the air quality impact of construction activities will be included in the CEMP.

5.10.2 The operational air quality impacts will be determined through a simple level assessment as part of the EIA process as no exceedances of air quality objectives / EU Limit Values have been identified within the vicinity of the Proposed Scheme and considering the results presented in the Air Quality assessment undertaken. This will be reviewed again once traffic data is available and the ARN for the Proposed Scheme have been determined.

5.10.3 Further assessment of air quality effects of the Proposed Scheme will be undertaken in accordance with DMRB HA207/07 and associated IANs, and will be presented in the form of an ES.

6 Cultural Heritage

6.1 Introduction

6.1.1 This chapter provides an overview of the baseline heritage assets in the vicinity of the Proposed Scheme and describes the proposed approach for the assessment of cultural heritage within the study area. For the purpose of this assessment, this includes Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Battlefields, Registered Historic Parks and Gardens and non-designated features of national, regional or local archaeological, historic or architectural interest and value. These features include archaeological remains, paleoenvironmental deposits, historic buildings, historic open spaces, historic features and the wider historic landscape. Such sites can make an important contribution to the local distinctiveness of an area and its sense of place.

6.1.2 This chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 2, to a Scoping Level. Further assessment will be presented within an ES.

6.2 Study Area

6.2.1 The study area includes all cultural heritage assets within 1km of the Proposed Scheme. The western end of the Proposed Scheme is situated on a high point on the northern side of a valley therefore there are potential effects from any new structures upon assets on the southern side of the valley.

6.2.2 In addition, the Zone of Visual Influence (ZVI), which will be produced as part of the Landscape Visual Impact Assessment (LVIA), will be used to identify any designated assets that would be affected by the construction of the Proposed Scheme.

6.3 Existing and Baseline Knowledge

6.3.1 The information presented within this Scoping Report is largely based on the previous stages of design and development.

6.3.2 Data detailing nationally designated cultural heritage assets in the UK has been obtained from Historic England's National Heritage List. Information concerning designated and non-designated heritage assets was obtained from the Peterborough and Cambridgeshire Historic Environment Records (HER).

6.3.3 References used in this section refer to the National Heritage List for England list entry numbers (NHLE numbers) and Peterborough HER reference numbers (PCCHER numbers for Peterborough; CHER numbers for Cambridgeshire). References for buildings of local importance are presented as Buildings of Local Importance (BLI) numbers and are taken from Peterborough City Council's inventory.

6.3.4 Table 6.1 summarises the existing baseline specifically for the Proposed Scheme.

Table 6.1: Summary of Existing Baselines

Existing Baseline
Designated assets There are five scheduled monuments within 1km of the Proposed Scheme: • "Site revealed by aerial photography West of Sutton Heath", NHLE 1006796, situated on the northern side of the A47, to the west of Sutton Heath Road. • "Roman fort and enclosure at Sutton Cross", NHLE 1006837, 300m to the east of the new A47 Sutton junction. • "Wansford Bridge", NHLE 1006835/ NHLE 1003810, 550m south of the Wansford A1/A47 junction. • "Wansford Roman site", NHLE 1006836, 800m to the south of the A47/A1 junction. • "Sutton Heath, Romano-British site", NHLE 1006880, 1km to the north of the A47, situated on the eastern side of Sutton Heath Road. There are 85 listed buildings within 1km of the Proposed Scheme. Seven grade I listed structures as follows: • Church of St Mary the Virgin, NHLE 1127442, 550m to the south-west of the A1/A47 Wansford Junction, in Wansford village centre. • Church of St Michael, NHLE 1127517, 650m south of the A47, in Sutton village. • Church of St Andrew, NHLE 1225298, 640m north-east of the A1/A47 Wansford Junction, in the village of Thornhaugh. • Wansford Bridge, NHLE 1127445 and NHLE 1274654, 600m south-east of the A47/A1 Junction, in the village of Wansford (this is recorded as two separate assets as it covers two counties). • Stibbington Hall, NHLE 1222241, 840m south of the A47 in the village of Stibbington. • Gateway and boundary wall to forecourt of Stibbington Hall, NHLE 1274861, 850m south of the A47, in the village of Stibbington. Seven grade II* assets as follows (one of which appears to be a duplicated record): • Great North Road Bridge carrying north bound carriageway over the River Nene, NHLE 1274340 and 1331276, 350m to the south of the A47/A1 Junction, in Wansford. • Sacrewell Mill and Mill House and Stables, NHLE 1127493, 550m to the north-east of the A47/A1 Junction. • The Haycock Hotel, NHLE 1237866, 680m south-west of the A47/A1 Junction in Wansford. • Parish church of St John the Baptist, NHLE 1274862, 850m to the south of the A47, in the village of Stibbington. • Manor House, NHLE 1127458, 800m north-west of the A47/A1 Junction, in the village of Thornhaugh. • The Old Rectory, NHLE 1222331, 850m to the south-west of the A47, in the village of Stibbington. The remaining listed buildings are all grade II and are largely situated within the centres of the surrounding villages of Thornhaugh, Wansford, Stibbington and Sutton. There are three conservation areas within the study area, centred on the historic centres of Wansford, Sutton and Stibbington.

Existing Baseline
There are no historic parks and gardens, historic battlefields or World Heritage Sites within 1km of the Proposed Scheme.
Recent archaeological fieldwork: The proposed route passes 20m to the south of the scheduled monument (NHLE 1006796). A geophysical, magnetometer survey conducted to inform the Environment Assessment Report revealed a series of subterranean features; ring ditches characteristic of Bronze Age (1800-600 BC) barrows (funerary monuments).
Non-designated assets A small number of prehistoric findspots are recorded within 1km of the Proposed Scheme and date from the Mesolithic period through to the Iron Age. Neolithic and Bronze Age flints have been recovered over the past 40 years from the field to the south-west of Sacrewell Farm (PCCHER 01976), to the east of the Wansford A47/A1 junction. Bronze Age human remains in a cist were identified to the north of the A47 (PCCHER 00176), west of scheduled monument NHLE 1006796. No further contextual details are recorded. A possible Iron Age pit alignment is recorded through aerial photographs to the south of the A47, north of Sutton (PCCHER 08368). The alignment appears to follow a north-west to south-east course, to the west of The Drift Road. There are a number of Roman findspots in the area. The A47 is reported to run along the alignment of a Roman road, probably Margary's route 25, the Fen Causeway[1]. The Roman road, Ermine Street, ran north-westwards to the east of the Sutton end of the Proposed Scheme. An ironworking site was recorded at Sacrewell Farm (PCCHER 50343) and excavations to the south of Sacrewell Farm, east of the A47/A1 junction, recorded a building with a decorative surface, suggestive of a property with some status (PCCHER 01991). Early medieval and medieval records are largely confined to the villages, as are the majority of post-medieval records, indicating that the surrounding land was most probably agricultural. Two buildings of local importance are situated adjacent to the Proposed Scheme at Sutton Heath: Heath House (BLI S1) and the Former Railway Station (BLI S2). Both buildings date to 1867. Post-medieval drains are recorded and a World War Two Royal Observer Corps site was reputedly located to the south-east of Sacrewell Farm, north of the A47 (PCCHER 50635).
Historic Landscapes The Proposed Scheme is situated largely in drained fenland, and is characterised by rectilinear field systems created during the 18th and 19th centuries. Substantial loss of the boundaries of these field systems occurred during the late 20th century, though the general layout remains, although the integrity of the historic character of the landscape has been detrimentally affected.

6.4 Assumptions and Limitations

6.4.1 The scoping exercise is based upon the Proposed Scheme route alignment only. Detailed design will be undertaken at a later stage and will include the location of associated features such as, compound locations, drainage and landscaping. As such further development has the potential to alter the predicted effects of the construction and operation of the Proposed Scheme.

6.4.2 Information provided by HERs can be limited because it depends on previous opportunities for research, fieldwork, and discovery. Where nothing of historic

interest is shown in a particular area; this can be down to a lack of targeted research or investigation rather than the genuine absence of sub-surface archaeological deposits.

6.4.3 Documentary sources are rare before the medieval period, and many historic documents are inherently biased. Older primary sources often fail to accurately locate sites and interpretation can be subjective.

6.4.4 Where archaeological sites have been identified solely from aerial imagery without confirmation from archaeological excavation or supporting evidence in the form of find-spots etc., it is possible the interpretation may be revised in the light of further investigation.

6.5 Guidance and Best Practice

6.5.1 The method for determining and appraising baseline conditions involved a desk-based study and was undertaken in accordance with the published standards and guidance set out below:

- DMRB Volume 11, Section 3, Part 2 Cultural Heritage
- Historic England (2008) Conservation Principles: Policies and Guidance
- Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2 (GPA2) - Managing Significance in Decision-Taking in the Historic Environment
- Historic England (2015) Historic Environment Good Practice Advice on Planning Note 3 (GPA3) - The Setting of Heritage Assets,
- Standard and Guidance from the Chartered Institute of Archaeologists

6.6 Non-statutory Consultation

6.6.1 Non-statutory public consultation was undertaken between 13 March and 21 April 2017 for the Proposed Scheme. Peterborough City Council (PCC) expressed concern that heritage sites would be affected by the Proposed Scheme stating that they do not believe that buildings of local importance and character should be sacrificed to facilitate the construction of the Proposed Scheme. Further concerns were raised referring to Heath House and the old station building with respondents suggesting that the buildings, if demolished, should be ‘carefully relocated nearby’ or subjected to historic building recording. Others suggested that any impact to heritage assets should be kept to a minimum.

6.6.2 Cambridgeshire County Council (CCC) and PCC requested that archaeological assessments are undertaken in consultation with Historic England and PCC.

6.6.3 A meeting with Historic England, PCC, Highways England and their nominated Heritage Consultants was held on 10 May 2017. At that meeting it was agreed that geophysical survey of the southern part of the field containing scheduled monument NHLE 1006796 would be undertaken as well as studies of available aerial photographic (AP) images and LiDAR datasets of the area.

6.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

6.7.1 The Proposed Scheme has the potential to adversely affect designated and non-designated heritage assets during construction. At this stage, it appears that one building would be demolished. Buried archaeological deposits, if present, may be damaged or destroyed by construction excavation and other activities.

6.7.2 The placement of bunds, drainage, ponds, landscaping, compounds, haul roads and planting would take consideration of below-ground archaeological deposits, and preserving remains in-situ would be explored during the design process. Best practice measures to limit impacts on heritage assets will be employed during construction through the implementation of a CEMP.

Operation

6.7.3 Below ground archaeological deposits will not be impacted by the operation of the Proposed Scheme. However, the Proposed Scheme has the potential to impact, to a varying degree, on the setting of some designated heritage assets through changes in noise levels and visual impact of the movement of traffic. These would include some of the 85 listed buildings / structures and the five scheduled monuments.

Summary

6.7.4 Table 6.2 provides a summary of the potential construction stage and operational effects upon heritage assets for the Proposed Scheme.

Table 6.2: Summary of Potential Cultural Heritage Effects

Potential Construction Effects	Potential Operation Effects
Potential moderate adverse effect due to potential physical impact on archaeological remains. Potential moderate adverse effect through physical alteration or demolition of a building of local importance.	Potential adverse effects due to impacts on the setting of designated heritage assets.

6.8 Proposed Level and Scope of Assessment

6.8.1 Further assessment of the construction impacts will be necessary for the Proposed Scheme due to the potential for direct effects on archaeological remains. It is probable that this will include geophysical survey and archaeological trial trench evaluation. In addition, due to the presence of sensitive receptors within close proximity of the Proposed Scheme, further assessment of operational impacts is also required. Further assessment will be undertaken to a Detailed level and will be used to inform an archaeological investigation strategy. All investigations will be based on the regional research framework for the East of England (Medlycott 2011).

6.8.2 Further investigations may be undertaken dependant upon results of the detailed assessment.

6.9 Proposed Methodology including Significance

6.9.1 The assessment will consider all heritage assets, both designated and non-designated. These include scheduled monuments, listed buildings, non-designated below-ground archaeological remains, buildings of local importance, historic landscapes and conservation areas. There are no registered parks and gardens, battlefields or World Heritage Sites within the study area.

6.9.2 This assessment will consider both temporary and permanent construction and operational impacts on heritage assets. Temporary impacts will be classed as impacts on setting through construction-related activities; whereas permanent impacts can be either: physical impacts on the integrity of the asset; or impacts on the setting.

Assessment of Value / Sensitivity

6.9.3 The value/sensitivity of historic environment receptors will be based upon Table 6.3. Assessment of value / sensitivity will be based on a combination of designated status and professional judgement. It will consider the Secretary of State's non-statutory criteria for the scheduling of ancient monuments, assessment criteria adopted by Historic England as part of the Monument Protection Programme (MPP), and the Secretary of State's Principles of Selection Criteria for Listed Buildings.

6.9.4 It will also recognise that occasionally some heritage assets have a lower or higher than normal value / sensitivity within a local context. Additionally; this assessment process should consider the component of the heritage asset that is being affected, and the ability of the heritage asset to absorb change without compromising the understanding or appreciation of the resource.

Table 6.3: Criteria for Assessing Value / Sensitivity

Value / Sensitivity	Typical criteria
Very High	World Heritage Sites, assets of acknowledged international importance, assets that can contribute significantly to acknowledged international research objectives.
High	Scheduled monuments, grade I and II* listed buildings, grade I and II* registered parks and gardens, registered battlefields, undesignated assets of schedulable quality, undesignated monuments, sites, or landscapes that can be shown to have specific nationally important qualities, and assets that can contribute significantly to national research objectives.
Medium	Grade II listed buildings, grade II registered parks and gardens, conservation areas, undesignated sites of high importance identified through research or survey, monuments or sites that can be shown to have important qualities in their fabric or historical association.
Low	Undesignated assets – monuments or archaeological sites with a local importance for education or cultural appreciation, and which add to local archaeological and historical research. Very badly damaged assets that are of such poor quality that they cannot be classed as high or medium, parks and gardens of local interest.

Value / Sensitivity	Typical criteria
Negligible	Heritage resources identified as being of no historic, evidential, aesthetic or communal interest; and resources whose importance is compromised by poor preservation or survival, or by contextual associations to justify inclusion into a higher grade.

Source: Based on DMRB (Volume 11, Section 3. Part 2), 2007

Assessment of Magnitude of Impact

6.9.5 The degree of impact to the heritage asset from the introduction of the Proposed Scheme will be assessed in accordance with the criteria presented in Table 6.4.

Table 6.4: Criteria for Assessing the Magnitude of Impact

Magnitude	Criteria
Major	Total loss or fundamental alteration to a heritage asset's significance and/or setting. Addition of new features that substantially alter the setting of a heritage asset.
Moderate	Partial loss or alteration a heritage asset's significance and/or setting. Addition of new features that partially alter setting of a heritage asset to the extent where the significance is impacted.
Minor	Minor loss of an element of a heritage asset and/or its setting. Addition of new features that form largely inconspicuous elements in the setting of a heritage asset to the extent that its significance is slightly impacted.
Negligible	Very minor loss of elements of a heritage asset and/or its setting. Addition of new features that do not alter the setting of a heritage asset.
No Change	No change to the heritage asset.

Source: Based on DMRB (Volume 11, Section 3, Part 2), 2007

Assessment of Significance of Effect

6.9.6 Effects will be evaluated by combining the assessment of both the value / sensitivity (heritage significance) of an asset, with the magnitude of the impact. This allows the prediction of the significance of the effect, as shown in Table 1.2. These effects can be beneficial or adverse; and temporary or permanent, depending on the nature of the development, the mitigation measures, and any enhancement measures proposed. In accordance with DMRB guidance, effects with an assessment of moderate and above are considered to be significant.

6.10 Conclusion

6.10.1 During construction, there is the potential for a direct effect upon the setting of designated assets, one non-designated building, and archaeological remains. Further assessment to a Detailed Level for the construction impacts will therefore be necessary for the Proposed Scheme. In addition, due to the presence of sensitive receptors within 1km of the Proposed Scheme, further assessment of operational impacts is also required.

6.10.2 Assessment to Detailed level will be undertaken and will be presented within the ES.

7 Landscape

7.1 Introduction

7.1.1 The Landscape and Visual Impact Assessment (LVIA) section of this Scoping Report aims to identify the potential for significant effects of the Proposed Scheme upon the surrounding landscape and visual receptors (consistent with the outcome requirements of the DMRB defined Scoping Exercise process). This chapter has been prepared with reference to DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 5, and IAN 135/10 and Landscape Institute and Institute of Environmental Management and Assessment 'Guidelines for Landscape and Visual Impact Assessment, Third Edition'. The potential requirement for further assessment to either a Simple or Detailed Level has been identified.

7.2 Study Area

7.2.1 In recognition of the guidance given in DMRB Volume 11 Section 3 Part 5 Landscape Effects, the study area for the LVIA extends 1km from the Proposed Scheme limits. This has been limited to 1km due to the containing nature of the local topography and the existing vegetation cover, which limits the potential for wider effects. The study area will be extended for any receptors sitting outside of the 1km which have the capacity to experience significant effects as a result of the Proposed Scheme.

7.3 Existing and Baseline Knowledge

Landscape Character

7.3.1 The Proposed Scheme sits on the edge of two National Character Areas (NCA) 89 Northamptonshire Vales and 92 Rockingham Forest.

7.3.2 The Northamptonshire Vales NCA consists of a series of low-lying clay vales and river valleys, including the valleys of the rivers Nene, Welland and their tributaries. The area is 10% urban, and many road networks traverse the area. Despite the predominance of built settlements and low levels of tranquillity, there are contrasts with the distinctly more rural feel and higher tranquillity levels, particularly along river corridors and areas of farmland.

7.3.3 The Rockingham Forest NCA is essentially a broad, low, undulating ridge which falls away from a prominent, steep northern scarp overlooking the Welland Valley. Large areas of woodland remain a significant feature of the landscape and, while not forming continuous belts, the blocks of woodland often coalesce visually with hedgerow trees and smaller copses to increase the perception of extensive woodland cover across the landscape. The area contains many 17th to 19th century country houses, with mature parkland estates adding to the overall wooded character. The Proposed Scheme is located adjacent to the Sutton Heath and Bog SSSI, however, it is not considered that this will be affected by the Proposed Scheme.

7.3.4 The Proposed Scheme falls within the following local landscape character assessments; Huntingdonshire Landscape and Townscape Assessment (2007) and Peterborough City Council (PCC) Landscape Character Assessment (2007).

7.3.5 Within the Huntingdonshire Landscape and Townscape Assessment, the Proposed Scheme falls within Northern Wolds Landscape Character Area (LCA) and Nene Valley LCA.

7.3.6 The Northern Wolds LCA forms a broad north-south strip to the western side of Huntingdonshire, extending from the Nene Valley in the north to the Southern Wolds to the south east. It is characterised by a strong topography of ridges bisected by pronounced valleys that are well-vegetated and intimate in scale. A historic landscape containing many medieval features and a dispersed pattern of historic villages. Distinctive square church towers topped with spires form characteristic landmarks.

7.3.7 The Nene Valley LCA comprises landscape associated with the River Nene. Whilst it is only a small area within Huntingdonshire (the north-west tip), it stretches beyond the district boundaries into Northamptonshire. Land use is formed of the valley floor of the River Nene, with areas of arable and pastoral farmland (some traditional water meadows remain). Distinctive limestone villages reflect the local geology, whilst the A1 is a predominant feature in the area.

7.3.8 In the PCC Landscape Character Assessment, the Proposed Scheme is located within the Nene Valley LCA and Nassaburgh Limestone Plateau LCA. Nene Valley LCA

7.3.9 The Nene Valley LCA runs from Wansford in the west into the heart of Peterborough city centre. The A47 runs close to northern boundary while the River Nene marks the boundary with Huntingdonshire to the south. It is characterised by the broad valley of the River Nene, which meanders through the area. Pasture and flood meadows are located along the banks of the river, with larger arable fields beyond. Villages possess distinctive stone buildings and generally sympathetic infill development.

7.3.10 Nassaburgh Limestone Plateau LCA extends from Wittering in the west up to the boundary with Peterborough City in the east. The A47 approximately follows the southern boundary adjacent with the Nene Valley character areas. It comprises a gently undulating landscape with large blocks of woodland. Arable fields are large and enclosed by low hedgerows or dry stone walls and there are large areas of well-managed parkland within the character area.

7.3.11 The landscape character of this section of A47 is relatively coherent, it is characterised by gently undulating hills sloping down to the River Nene, south west of the Proposed Scheme. Land use is predominantly arable farmland of medium to large fields, with occasional isolated farms to the north of the A47, whilst the small villages of Stibbington and Sutton can be found to the south of the A47. The river corridor is well vegetated, with clumps of trees and shrubs running along much its length in this location. The Nene Way Public Right of

Way (PRoW) runs along the river to the south. The area is generally tranquil, except where the A47 crosses the landscape.

Visual Amenity

7.3.12 The study area comprises wide gently undulating topography ranging between 10 and 50m Above Ordnance Datum allowing the opportunity for extensive views across the landscape. However, the extent of visibility is constrained by ridges locally and the woodland blocks and numerous hedgerows.

7.3.13 There are a number of visual receptors located within the likely Zone of Theoretical Visibility (ZTV) for the Proposed Scheme. Visual receptors with a high sensitivity to change within the study area include people occupying residential properties from locations such as: The Drift and rear of properties on Nene Way, which have views filtered by vegetation; and the rear of properties on Roman Drive, which have partially filtered views.

7.3.14 Other sensitive receptors include users of PRoWs (there are two notable PRoWs locally: Hereward Way, which runs north to south of the Proposed Scheme, and Nene Way to the south of the Proposed Scheme, which links up with Hereward Way at the River Nene) and recreational users at Sacrewell Farm and Country Centre.

7.4 Assumptions and Limitations

7.4.1 The content of the Scoping Report is based on a desk study and information gained from previous stages of design development and assessment.

7.4.2 Reference to landscape designation information and an analysis of the physical features of the local landscape, help to understand the likely sensitivity of the landscape character and visual receptors, and the potential effects upon those assets.

7.5 Guidance and Best Practice

7.5.1 Guidance and best practice will be followed to industry standards, with particular reference to:

- DMRB Volume 11 Section 3 Part 5 Landscape Effects
- Interim Advice Note 135/10 (IAN 135/10) Landscape and Visual Effects Assessment
- Guidelines for Landscape and Visual Impact Assessment, Third Edition (Landscape Institute & IEMA, 2013)
- An Approach to Landscape Character Assessment (Natural England, 2014)

7.6 Consultation

7.6.1 Non-statutory public consultation on the Proposed Scheme ‘option’ was undertaken in March and April 2017. Where relevant, points arising from this

previous consultation stage will be taken into account in the development of mitigation measures for the Proposed Scheme.

7.6.2 Further consultation will be undertaken with statutory and non-statutory consultees as part of the formal application process. In particular, the Local Planning Authority and other relevant stakeholders will be consulted to; identify and agree key viewpoints to inform the assessment; consider the need for specific presentational material (such as photomontage) to assist understanding of the Proposed Scheme; review the methodology to ensure it robustly represents assessment of the potential effects of the Proposed Scheme; and provide comment on the landscape design and mitigation strategy to ensure landscape and visual effects are appropriately addressed within the design of the Proposed Scheme.

7.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

Landscape Effects

7.7.1 For the Proposed Scheme, the presence of construction plant, materials, machinery, construction compounds and the provision of construction lighting (see Appendix C – Lighting Impact Assessment methodology) would potentially have an adverse impact on the local landscape character during the construction period. Along the corridor of the existing A47, the adverse impact would be limited due to the existing highways setting. However, beyond the immediate road corridor the adverse impacts would be significant, as a result of the permanent loss of existing vegetation and arable farmland to construction of the new road and associated infrastructure and temporary loss of land to construction compounds, haul roads etc.

Visual Effects

7.7.2 Clearance of vegetation during construction has the potential to directly alter the visual baseline for visual receptors of the Proposed Scheme. The removal of trees and screening vegetation would result in the opening up of views along the route of the Proposed Scheme. Locations where this would have an impact include; the proposed new access route for Sacrewell Farm and Country Centre; opposite the junction of A47 and Sutton Heath Road (where the Proposed Scheme moves south of the existing A47 and at the existing roundabout joining the A47 and Nene Way. The loss of vegetation, together with the proximity of construction works, compounds etc to nearby receptors, including a number of residential receptors, PRoW users and recreational receptors, would result in significant visual effects during construction. There would also be the potential for significant adverse direct visual effects afforded by road users on the A47 and associated access roads during construction.

Operation

Landscape Effects

7.7.3 In year 1 of operation, due to the rural setting and the influence of the new road and associated highways elements, such as embankments, slip roads and roundabouts within the local context, together with the gently sloping topography locally, there is potential for the local landscape character to be permanently altered. Albeit, the retention of existing mature trees and hedgerows would minimise the impacts upon the character. Therefore, there would be significant effects in year 1 of operation.

7.7.4 By year 15 of operation, the proposed mitigation planting would seek to minimise any long-term effect upon landscape character, helping the Proposed Scheme to settle within the surrounding landscape, reducing the impact of the Proposed Scheme to negligible after approximately 15 years. Therefore, it is unlikely that the Proposed Scheme would have significant adverse effect on the landscape character of the surrounding area in the long-term once mitigation planting has matured.

Visual Effects

7.7.5 During operation, a number of sensitive receptors have the potential for adverse effects in year 1, where views are open towards the new road and its associated infrastructure, such as the proposed new access route for Sacrewell Farm and Country Centre, opposite the junction of A47 and Sutton Heath Road and where the Proposed Scheme moves south of the existing A47 views would be afforded.

7.7.6 By year 15 of operation, mitigation such as screening planting would alleviate potentially adverse visual effects for the Proposed Scheme, with significant effects reducing over time to non-significant, with the maturation of the planting aiding screening of the Proposed Scheme.

7.7.7 There is also potential for adverse night time visual effects as a result of the influence of vehicle headlights on residential properties. Night time lighting effects would potentially result in significant adverse visual effects at year 1 reducing to not significant adverse by year 15 following the establishment of Proposed Scheme mitigation planting.

Summary

7.7.8 Table 7.1 provides a summary of potential construction and operational effects upon the surrounding landscape and visual receptors for the Proposed Scheme.

Table 7.1: Summary of Potential Landscape and Visual Effects

Potential Construction Effects	Potential Operation Effects
Landscape: Potentially significant adverse effects on landscape character, due to removal of vegetation and the presence of construction activity, plant, lighting and material stock pilings, as well as construction compounds and haul routes.	Landscape Year 1: Potentially significant adverse effects during Year 1 due to the removal of vegetation and the opening up of views of sensitive receptors to new road location and associated highways infrastructure. Landscape Year 15: By Year 15, effects would have reduced over time as mitigation planting establishes resulting in not significant adverse

Potential Construction Effects	Potential Operation Effects
	effects. Similarly, impact on the wider landscape character would reduce over time as mitigation planting establishes.
Visual: Detrimental impact on views of the site and construction activity from nearby visual receptors related to removal of vegetation and the presence of construction activity, plant, lighting, material stock piling and construction compounds. However, the Effects would be set in context of neighbouring A47.	Visual Year 1: Operational significant adverse effects associated with visibility of the road/highway infrastructure and vehicles. Potential adverse effects on; residential properties in Sutton, Stibbington and Wansford and individual properties in the wider area; recreational users of the local PRoW network; and road users of the A47 and local roads within the study area. Potential significant adverse night-time visual effects on residential receptors as a result of the influence of vehicle headlights Visual Year 15: Operational significant adverse effects associated with residual change in views following the establishment of Proposed Scheme mitigation planting. Potential adverse effects on; residential properties in Sutton and individual properties in the wider area; recreational users of the local PRoW network, Potential not significant adverse night-time visual effects on residential receptors as a result of the influence of vehicle headlights.

7.8 Proposed Level and Scope of Assessment

7.8.1 Given that significant effects upon both landscape character and visual amenity are likely for the Proposed Scheme during both construction and operation and the scale of the proposed works, the Proposed Scheme meets the criteria set out in IAN 135/10 Landscape and Visual Effects Assessment for a Detailed level of assessment.

7.9 Proposed Methodology including Significance

7.9.1 No single prescribed methodology exists for assessing landscape and visual impact; however, the assessment will follow best practice guidelines as set out above.

7.9.2 A further desktop study and walkover survey will be undertaken to review and update the baseline information gathered in previous assessments. This will clarify both the study area and Zone of Theoretical Visibility (ZTV), and allow the project landscape architect to undertake a local Character Assessment to understand the Landscape Value and associated sensitivity to change of each character area.

7.9.3 The ZTV will be based upon the area from which the development will theoretically be visible to a person with a viewer height of 1.6m above ground

level. Digital Surface Model (DSM) data will be used to create the ZTV model. As outlined above the ZTV will be verified and refined during the site survey.

7.9.4 The significance of effect on the landscape character and its constituent elements will be determined by combining the sensitivity of the affected landscape with the magnitude of change attributable to the Proposed Scheme. The consideration of sensitivity will be determined by a combined judgement of the landscape's susceptibility and value.

7.9.5 The criteria for assessing landscape sensitivity is presented in Table 7.2, and the criteria for assessment magnitude of change is presented in Table 7.3.

Table 7.2: Criteria for Assessing Landscape Sensitivity

Sensitivity	Typical Descriptors
High	Landscapes, which by nature of their character, would be unable to accommodate change of the type proposed. Typically, these would be landscapes: • With either a very simple or a very complex pattern; • With limited presence of existing built features or linear infrastructure, including highways. • Associating with areas of intimacy or tranquillity. • Of high quality with distinctive elements and features making a positive contribution to character and sense of place. • Likely to be designated e.g. National Park and Area of Outstanding Natural Beauty (AONB), but the aspects which underpin such value may also be present outside designated areas, especially at the local scale. • Areas of special recognised value through use, perception or historic and cultural associations. Likely to contain features and elements that are rare and could not be replaced.
Medium	Landscapes, which by nature of their character, would be able to partly accommodate change of the type proposed. Typically, these would be landscapes: • With a distinct, coherent pattern. • With notable presence of existing built features or linear infrastructure, including highways. • Associating with a broad sense of enclosure brought about by landform or vegetation cover. • Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place. • Locally designated, or their value may be expressed through non-statutory local publications. • Containing some features of value through use, perception or historic and cultural associations. Likely to contain some features and elements that could not be replaced.

Sensitivity	Typical Descriptors
Low	Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically, these would be landscapes: • Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place. • Not designated • Containing few, if any, features of value through use, perception or historic and cultural associations. • Likely to contain few, if any, features and elements that could not be replaced.

Source: Derived from IAN 135/10 with amendment

Table 7.3: Criteria for Assessing Magnitude of Landscape Change

Magnitude	Description
Major Adverse	Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.
Moderate Adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Minor Adverse	Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Negligible or No Change	Barely perceptible change or no change to existing character or elements.
Minor Beneficial	Slight improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Moderate Beneficial	Partial or noticeable improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features.
Major Beneficial	Large scale improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features.

Source: Derived from IAN 135/10 with amendment

7.9.6 Key visual receptors will be visited to identify the nature of existing view and the potential magnitude of change associated with the Proposed Scheme.

7.9.7 Visual impact significance will be determined by combining the sensitivity of the visual receptor with the magnitude of change attributable to the Proposed Scheme. The consideration of sensitivity will be determined by a combined

judgement of a receptor's susceptibility and the value attached to a particular view.

7.9.8 The criteria for assessing visual sensitivity is presented in Table 7.4, and the criteria for assessment of the magnitude of change is presented in Table 7.5.

Table 7.4: Criteria for Assessing Visual Sensitivity

Sensitivity	Typical Receptors
High	Residential properties. Users of PRoWs or other recreational trails (e.g. National Trails, footpaths, bridleways etc.). Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.). Views with a value derived from association with a heritage asset or a planning designation or where associated with a literary or artistic point of reference.
Medium	Outdoor workers Users of scenic roads, railways or waterways or users of designated tourist routes. Schools and other institutional buildings, and their outdoor areas.
Low	Indoor workers Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes. Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities).

Source: Derived from IAN 135/10 with amendment

Table 7.5: Criteria for Assessing Magnitude of Visual Change

Magnitude	Description
Major Adverse	The Proposed Scheme, or a part of it, would become a dominant detracting feature or focal point within the view.
Moderate Adverse	The Proposed Scheme, or a part of it, would form a noticeable detracting feature or element within the view which would be readily apparent to the receptor.
Minor Adverse	The Proposed Scheme, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible or No Change	Barely perceptible change or no change to existing views.
Minor Beneficial	The Proposed Scheme would result in a perceptible enhancement of the view but would not alter the overall balance of features and elements that comprise the existing view.
Moderate Beneficial	The Proposed Scheme would result in a noticeable enhancement of the view which would be readily apparent to the receptor.

Magnitude	Description
Major Beneficial	The Proposed Scheme would result in a prominent enhancement of the view and contribute to the defining focus or feature of the view.

Source: Derived from IAN 135/10 with amendment

7.10 Conclusion

7.10.1 Given that significant effects upon both landscape character and visual amenity are likely for the Proposed Scheme during both construction and operation and the scale of the proposed works, the Proposed Scheme meets the criteria set out in IAN 135/10 Landscape and Visual Effects Assessment for a Detailed Level of assessment.

7.10.2 Further assessment will be presented in the form of a detailed Landscape and Visual Impact Assessment as part of the ES.

8 Biodiversity

8.1 Introduction

8.1.1 This chapter presents the key ecological receptors within the footprint and surrounding areas of the Proposed Scheme. It has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 4, and IAN 130/10, to a Scoping Level, and where necessary, the requirement for further assessment to either Simple or Detailed level will be identified. The potential impacts on these receptors as a result of the Proposed Scheme has also been assessed, and this will form the basis of any recommended further survey and assessment requirements, to determine the magnitude of impacts, the requirements for mitigation measures, and overall significance of effects. Where required, the assessment will be presented within the ES.

8.2 Study Area

8.2.1 The following study areas have been used to gather information on ecological receptors that could be affected by the Proposed Scheme:

Table 8.1: Zones of Influence for Ecological Receptors

Ecological Receptor	**Boundary from Proposed Scheme**
Internationally and nationally designated nature conservation sites, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites, National Nature Reserves (NNR) and SSSIs	2km
SACs designated for bat populations	30km
Statutory sites designated for their bird interest	10km
Locally designated nature conservation sites, including Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and RSPB reserves	2km
Habitat Suitability Index (HSI) assessments of waterbodies for Great Crested Newts (GCN)	500m
Water vole, otter and crayfish	250m
Aquatic invertebrates from within wetland habitats	Direct impacts
Other preliminary ecological assessments including Phase 1 habitat survey badger, reptiles, and breeding birds	100m
Ecological Receptor	**Boundary from Proposed Scheme**
Internationally and nationally designated nature conservation sites, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites, National Nature Reserves (NNR) and SSSIs	2km
SACs designated for bat populations	30km
Statutory sites designated for their bird interest	10km
Locally designated nature conservation sites, including Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and RSPB reserves	2km

Ecological Receptor	Boundary from Proposed Scheme
Habitat Suitability Index (HSI) assessments of waterbodies for Great Crested Newts (GCN)	500m
Water vole, otter and crayfish	250m
Aquatic invertebrates from within wetland habitats	Direct impacts

8.3 Existing and Baseline Knowledge

8.3.1 A number of nationally and locally designated sites occur within the study area, which are presented in Table 8.2.

Table 8.2: Summary of Existing Nature Conservation Baseline

Summary of Existing Baseline
• River Wensum SAC/SSSI 1.6km north-east • Sutton Bog and Heath SSSI 50m North • Wansford Pasture SSSI0.4km South • Old Sulehay Forest SSSI 1.08km South-west • West Abbot's and Lound Woods SSSI 1.5km north-east • Castor Hanglands SSSI 1.6km North-east • Sutton Disused Railway CWS 0km • River Nene CWS 50m South • Sutton Meadows CWS 50m South • A47/A1 Interchange Road Verges CWS 0.1km West • Stibbington Pits CWS 0.2km South • Heil Corner and Top Field Spinney CWS 0.6km South • Standens Pasture Local Wildlife Site (LWS) 0.6km South-west • Yarwell Gravel Pit LWS 1.8km South • Andrews Quarry LWS 2.2km South-west • Yarwell Mill Lake LWS 2.4km South

8.3.2 On-line resources (MAGIC) identifies pockets of ancient woodland within the study area, they are all additionally CWSs or SSSI including:

- Sutton Wood
- Moore/Upton Woods
- Castor Hanglands
- Old Sulehay Forest
- Abbot's/Lounds Woods

8.3.3 An Extended Phase 1 Habitat survey was undertaken by two suitably qualified ecologists in May 2016, in order to assess the ecological importance of the site and determine the requirement for Phase 2 Surveys. The full findings of the surveys were reported in the A47 Wansford to Sutton Stage 2 Preliminary Ecological Appraisal.

8.3.4 The survey work and desktop study identified suitable habitat for the following species:

- Bats
- Breeding birds
- Overwintering birds
- Great crested newts
- Other amphibians

- Badgers
- Reptiles
- Otters
- Water voles
- Fish
- Aquatic invertebrates (including white-clawed crayfish)
- Terrestrial invertebrates
- Invasive species, both terrestrial and aquatic

8.3.5 The main habitat types recorded within the study area were Deciduous woodland, lowland fens, floodplain grazing grassland, lowland calcareous grassland, lowland meadows, traditional orchards, arable, mixed broad-leaved woodland, broad-leaved plantation woodland, hedgerows, semi-improved calcareous grassland, improved grassland, wet heath and bog, amenity grassland, running water, standing water and buildings.

8.3.6 Surveys to date have taken place to support previous design and development. Surveys are also being carried out to inform the EIA, ultimately to inform production of the ES. These have taken place in 2016 and 2017, as detailed in Table 8.3.

Table 8.3: Previous and Ongoing Ecological Surveys

Survey	Dates Undertaken	Study Area (including areas not surveyed)	Survey Methodologies (methods, frequencies etc)
Phase 1 Habitat Survey / Preliminary Ecological Appraisal	September 2016 April 2017	Up 100m from outer most route Phase 1 has been updated as required	JNCC's Handbook for Phase 1 habitat survey - a technique for environmental audit. CIEEM's Guidelines for Preliminary Ecological Appraisal.
Phase 2 Botanical Surveys (DAFOR scale rather than NVC level surveys)	July 2016 and July 2017	Focused on SSSI and CWSs which could be directly impacted by the route (within 50m of route)	DAFOR scale-based surveys.
Fungi	Sept and Oct 2017	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Watlin R, Fasham M and Dobson D (2005). Fungi in: Hill D, Fasham M, Tucker P, Shewry M and Shaw P (eds) *Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring*, 271-278. Cambridge University Press, Cambridge.
Hedgerow Surveys	July 2017	All accessible land within the footprint of the Proposed Scheme, plus a 500m buffer	Hedgerow Regulations 1997.
Tree Surveys	July to October 2017	All accessible land within the footprint of	British Standard 5837: British Standard for trees in relation to construction updated in 2012.

Survey	Dates Undertaken	Study Area (including areas not surveyed)	Survey Methodologies (methods, frequencies etc)
		the Proposed Scheme, plus a 50m buffer	
Aquatic Invertebrates	July 2017	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Standard methodologies. Environment Agency (last issue: 2012) Freshwater macroinvertebrate sampling in rivers. Operational instruction 018_08. Environment Agency (last issue: 2014) Freshwater macro-invertebrate analysis of riverine samples. Operational instruction 024_08 Site selection, three-minute kick-samples, preservation of invertebrates, sorting and analysis to EA 2014 guidance. Analysis using BMWP and ASPT scores.
Badgers	January 2017	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Standard methodology Search for all field signs within the Study Area. Field signs include setts and other excavations, latrines, prints and paths, hairs, feeding evidence etc.
Bat Roost Appraisals	January 2017	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	All bat surveys have taken place in accordance with Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd edition, Bat Conservation Trust.
Bat At-Height Tree Roost Inspections	January 2017	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	As above.
Bat Emergence/Re-Entry Surveys	July to September 2017 inclusive	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Emergence/re-Entry surveys for high habitat suitability/risk took place three times, for moderate suitability/risk two times, and for low suitability/risk once, in the period described.
Bat Activity Transect Surveys	July to September inclusive	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Transect surveys took place monthly during the periods identified, based on moderate habitat suitability.
Bat Automated/Static Surveys	July to September inclusive	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Automated surveys used Anabat detectors in representative habitats present on site to

Survey	Dates Undertaken	Study Area (including areas not surveyed)	Survey Methodologies (methods, frequencies etc)
			record bats over a longer period of time.
Birds - Breeding	July 2017	All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer	Birds were recorded by walking, listening and scanning by eye and with binoculars. Birds were considered to be breeding if singing, displaying, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute.
Birds – Autumn Passage	Sept 2017	All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer	As the breeding bird survey above. As above, Birds were recorded by walking, listening and scanning by eye and with binoculars. All birds were recorded, regardless of the activity/behaviour.
Birds - Overwintering	January to March 2017 inclusive Surveys were undertaken on a monthly basis i.e. three surveys were undertaken through the above period	All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer	As the breeding bird survey above. As above, Birds were recorded by walking, listening and scanning by eye and with binoculars. All birds were recorded, regardless of the activity/behaviour.
Great Crested Newt	May – June 2016	Within 500m from outermost route	English Nature Great Crested Newt Mitigation Guidelines (2001). Biggs J et al '*Analytical and methodological development for improved surveillance of the Great Crested Newt*. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA.; ARG UK (2010), ARG UK Advice Note 5: *Great Crested Newt Habitat Suitability Index*,

Survey	Dates Undertaken	Study Area (including areas not surveyed)	Survey Methodologies (methods, frequencies etc)
			Amphibian and Reptile Groups of the United Kingdom.
Reptiles	Sept and Oct 2017 Seven visits took place during this survey period	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer.	Froglife (1999) Advice Sheet 10 and the Herpetofauna Workers' Manual (1998). Use of refugia to attract reptiles on site, manual searches of suitable refugia present on site, checks for signs of reptile activity including sloughed skins, burrows, egg laying sites etc.; and sustained visual observation of banks/other suitable habitat within the site.
Terrestrial Invertebrates	July to October 2017 inclusive	All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer	Sweep netting and pitfall traps, follow by analysis.
Water Vole and Otter	Spring surveys took place in April and September 2017	All accessible, suitable habitat within the footprint of the Proposed Scheme, plus a 250m buffer	Standard water vole survey methodologies of Strachan et al. (2011) and Dean et al. (2016), searching for field signs including latrine sites, feeding stations, lawns, prints and runways. Standard otter survey methodology as identified in New Rivers and Wildlife Handbook, the Environment Agency's Fifth Otter Survey of England 2009-2010, and Monitoring the Otter (Chanin, 2003). Surveys involved searching for spraints, footprints, feeding remains, slides and haul-outs, couches and holts.
Desmoulin's Whorl Snail	July to October 2017 inclusive	Within 500m from outermost route	IJ Killeen and EA Moorkens (2003), *Monitoring Desmoulin's Whorl Snail*, Conserving Natura 2000 Rivers Monitoring Series No. 6, English Nature, Peterborough.
White-clawed Crayfish	April 2017 and July to October 2017 inclusive	Within 500m from outermost route	Peay S (2003). *Monitoring the White-clawed crayfish* Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Series No 1. English Nature, Peterborough.
Invasive Species surveys	No specific survey - invasive species	All accessible, suitable habitat within those areas surveys above	Visual identification.

Survey	Dates Undertaken	Study Area (including areas not surveyed)	Survey Methodologies (methods, frequencies etc)
	have been identified during the PEA and as incidental sightings during other surveys		

8.3.7 UK Biodiversity Action Plan Priority Habitats present within 2km include; rivers, ponds, lowland mixed deciduous woodlands, arable field margins, traditional orchards, hedgerows, lowland calcareous grassland and lowland fens.

8.3.8 Protected species surveys are currently being undertaken for a number of species. Desk based results yielded a total of 278 records for seven different bat species within a 10km radius of the A47 site. Those species include: Daubenton's bat *Myotis daubentonii*, coctule bat *Nyctalus noctule*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, whiskered/Brandt's bat *Myotis mystacinus/brandti* and other, unidentified bat species.

8.3.9 Although much of the land directly surrounding the A47 comprises of arable farmland, holding limited potential for bat use, there are also hedgerows, semi-improved grassland, broad-leaved plantation woodland, dense scrub and areas of tall ruderal located in the wider landscape. These features offer more in terms of foraging and communing potential.

8.3.10 Six buildings were identified within the 50m of the proposed route. Of those, one showed high roost potential, two showed moderate roost potential, one had low roost potential and two were identified as negligible roost potential. 78 trees on the site were identified as having between low and high bat potential. Tree hibernation surveys identified one possible roost, 11 trees with high hibernation potential and a further 49 trees with either low or moderate potential.

8.3.11 All bat surveys undertaken in 2017 were performed by Amey, with some surveys being sub-contracted to Ecus. Bat emergence/ re-entry surveys for trees took place between July and September 2017. No roosts have been identified.

8.3.12 Bat emergence/ re-entry surveys for building took place from July to September 2017. One building (Heath House) has a confirmed soprano pip roost (50 individuals peak count), and Old Station House garage is a confirmed roost as dropping have been found, although access through most of the season has been denied. No other roosts in buildings have been identified.

8.3.13 Activity transects and the associated static/automated surveys have taken place between July and October. Activity has been low level so far, with no significant findings. Analysis of Myotis calls is ongoing.

8.3.14 Desk based studies provided records of 112 invertebrate species. Of these, 46 were noted as being Biodiversity Action Plan (BAP) species. Phase 1 habitat surveys noted Sutton Head and Bog SSSI as being a potential habitat spot for the Annex II species; Desmoulin's whorl snail *Vertigo moulinsiana*.

8.3.15 Analysis currently suggests the majority of species are associated with poor quality grasslands.

8.3.16 There are 66 records of badger *Meles meles* or their setts within a 2km radius of the A47. Of these records, 27 were from the last 10 years. During the Phase 1 habitat survey, site investigators highlighted the presence of active and inactive setts within the wider surroundings of the Proposed Scheme. The site supports a good network of suitable foraging areas and connective features such as hedgerows and woodland.

8.3.17 A detailed badger survey was undertaken in April 2017, with updates and ongoing monitoring as appropriate. A sett has been confirmed located next to the petrol Station. Camera traps have confirmed sett is active. A second sett has been located in the disused railway although access in this location has been difficult, so monitoring effort has been less than the above sett.

8.3.18 Eight records of great crested newt *Triturus cristatus* were reported between 1984 to 1998. As no sightings have been reported in more recent years, it is possible that these records no longer represent current distribution.

8.3.19 A habitat suitability index assessment was undertaken for all waterbodies in the survey area. Out of the 29 ponds assessed, 15 received a score equal to below average or higher. These 15 ponds were then surveyed using environmental DNA (eDNA) survey methodology. The eDNA results returned negative for all 15 ponds.

8.3.20 There are 16 records of European otter *Lutra lutra* within a 2km search radius of site centre (1966-2012). The Phase 1 habitat survey reported the River Nene, which runs adjacent to the site, as having a high potential for supporting otters. Locally the river is known as hosting a stable population, inclusive of potential holts, lying up areas as well as foraging and commuting routes.

8.3.21 Surveys were undertaken in April 2017, finding several otter tracks and signs. Potential holts/ lying up areas were identified, some of which were near potential watercourse crossing points. The September survey has identified a number of spraints, all found along the tributary to the Nene, however high potential holts (cracked willows on banks with hollows) were inspected and no real sign of them being used.

8.3.22 There are 9 records of water vole *Arvicola terrestris* within a 2km search radius of site centre (1970-2001). The Phase 1 habitat survey identified the River Nene to have a high potential to support water voles, and is locally known to support a stable population.

8.3.23 Surveys undertaken for water voles in April 2017 provided no sightings or field signs for the species.

8.3.24 Although there are no previous records of white-clawed crayfish *Austropotamobius pallipes* within 2km of the Proposed Scheme, multiple small watercourses were identified as having low suitability. These watercourses were assessed and surveyed for white-clawed crayfish, producing negative results.

8.3.25 Breeding birds – limited level of activity was recorded during this survey, although it was comparatively late in the season. No notable species were noted.

8.3.26 Autumn passage birds – recent surveys have indicated very limited activity, with no species of note identified.

8.3.27 Wintering birds – Wintering bird surveys recorded a total of six Schedule 1 species birds, ten BoCC Red or NERC S41 species, 14 BoCC Amber species, 14 BoCC Green species and two species from the Birds Directive Annex I /II.

8.4 Assumptions and Limitations

8.4.1 It should be noted that the absence of certain protected or rare species from the Phase 1 Survey does not preclude their presence on a site. There is always the risk of protected or rare species being over-looked, either owing to the timing of the survey or the scarcity of the species at the site.

8.4.2 Ecological surveys are ongoing and where undertaken field surveys were confined to locations where landowner permission has been obtained. Surveys will continue in 2017 and early 2018 with access sought to areas previously unsurveyed.

8.4.3 A number of the detailed surveys were started late in the season (mid July), meaning that only half a season of data is available. To provide robustness to these surveys, it is intended to continue early season surveys in 2018 (as described below) to ensure that the sufficient surveys effort has been undertaken, and that surveys at the sensitive early part of the season are included for assessment.

8.4.4 The current programme is such that the surveys undertaken during the first half of 2018 will be used alongside those surveys already completed in 2016 and 2017, to inform the production of the ES. Surveys will continue through 2018 to inform a robust baseline against with future monitoring can take place, and to inform any EPS licences that would be required.

8.5 Guidance and Best Practice

8.5.1 Further assessment will be undertaken in accordance with the following guidance, and targeted surveys for protected species will be necessary as part of this assessment:

- DMRB Volume 11 Section 3 Part 4 Ecology and Nature Conservation
- HA (2010) IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment

- Chartered Institute of Ecology and Environmental Management (CIEEM) (2016) Guidelines for Ecological Impact Assessment in the UK
- CIEEM Sources of Survey Methods

8.6 Consultation

8.6.1 Detailed consultations have yet to be undertaken with statutory and non-statutory bodies. These bodies will include Natural England, Environment Agency, Cambridgeshire County Council, Peterborough City Council, The Wildlife Trust for Cambridgeshire, and the RSPB. This Scoping report chapter represents the first official consultation with these bodies regarding the Proposed Scheme.

8.6.2 Consultation with other groups may also be required, including:

- Local wildlife organisations and group
- Land owners

8.7 Potential Effects, including Monitoring and Mitigation Measures

Construction Phase

8.7.1 During the construction phase, vegetation clearance is likely to be required for the Proposed Scheme. This habitat loss would directly reduce and fragment the available terrestrial habitat for species, such as badgers, breeding birds and reptiles. Fragmentation may impact on bat flight routes.

8.7.2 The Proposed Scheme will inevitably lead to some loss of habitat, both permanent (to the Proposed Scheme footprint) and temporary (for site compounds, offices, lay-down areas, haul roads etc). Sutton Meadows CWS will be highly affected by the Proposed Scheme with Sutton Disused Railway CWS also being affected by land-take, however on a smaller scale. Appropriate mitigation and compensation will be included in more detail in the ES with the final design. Mitigation is likely to include habitat replacement where priority land is directly impacted by land-take.

8.7.3 Construction impacts may include increased risk of a pollution incident, such as contaminated land run off or spills / leaks of oils and fuels, and increased airborne pollutants into adjacent habitats which support these species.

8.7.4 With construction adjacent to the River Nene, there would be the potential for impacts to the flowing water habitats (i.e. the River Nene and tributary watercourses) which could include pollution (water and vehicle emissions), litter, hydrology changes etc. Alterations to drainage situations could result in adverse effects upon aquatic vegetation, aquatic invertebrates, fish, wildfowl, otters and water voles. Input from environmental specialists into the detailed design will eliminate or minimise these effects. The Construction Environmental Management Plan (CEMP) will also address these issues and management and mitigation will be implemented to avoid and combat any adverse actions.

8.7.5 A small agricultural pond which borders the current A47, will be lost to the Proposed Scheme. The pond is deemed to hold relatively low ecological value. There is no potential for GCNs.

8.7.6 Specific bat mitigation will likely be required to some extent dependant on the final design and impacts, this may include creating, restoring or improving roosts (bat boxes, bat bricks in new or existing structures) or creating, restoring or enhancing habitat to facilitate foraging and/or commuting. Detailed consideration will be given to impacts on existing roosts, and to commuting and foraging routes, with work to avoid impacts, or to reduce impacts as far as possible, undertaken. Any loss of bat roosts will require appropriate mitigation and licensing from Natural England.

8.7.7 Any night-time works required may directly disturb nocturnal species such as bats and badgers due to increased lighting pollution, noise and vibration. This disturbance could potentially contribute to the displacement of this species from the area. During construction, if works are to take place during the night, any lighting required should be managed to avoid spill onto ecological features. The impact can be minimised by using hoods, cowls or shields to prevent back spill. Additional best practice measures would also be included within and implemented through a CEMP to manage and minimise adverse construction stage effects. Measures could include the presence of an ecological clerk of works, toolbox talks, the sensitive timing of works and phased, supervised vegetation clearance.

Operational Phase

8.7.8 Once operational, the works for the Proposed Scheme would result in the permanent loss and potential severance of habitats of biodiversity value such as broad-leaved woodland, mixed woodland, semi-improved neutral grassland, arable, and hedgerows. In the absence of mitigation, the permanent loss of habitat suitable for protected species has the potential to adversely affect individual species and their conservation status. For example, land-take will take place upon Sutton Disused Railway CWS reducing habitat coverage on the site. As a result, it is anticipated that there is the potential for significant adverse effects upon nature conservation features once operational which warrants further assessment and the development of mitigation measures. Such measures to minimise effects and to ensure that there is no net loss of biodiversity would be incorporated within the Proposed Scheme design and reported in the ES as appropriate. This could include the following measures:

- Habitat recreation and enhancement
- An appropriate ecological design
- An appropriate option design to ensure that irreplaceable features are avoided or fully compensated

8.7.9 The new road would be operating in a closer vicinity to the adjacent River Nene. The Proposed Scheme design, and detailed assessment, will include work to address any potential adverse impacts in terms of ecology, and the associated water-based impacts, for example due to altered groundwater flows, inputs from

new drainage systems etc. The impacts on Stibbington Pits will also be considered.

8.8 Proposed Level and Scope of Assessment

8.8.1 It is proposed that a number of protected species surveys will be undertaken, for the following reasons:

- Preparation of the biodiversity chapter of the ES
- To inform any necessary European Protected Species (EPS) licence applications (and preceding ghost EPS license applications to support the DCO application process)
- To inform the production of the HRA
- To inform the inclusion of suitable mitigation measures within the Proposed Scheme design
- To provide up-to-date ecological data on which construction-phase and post-construction monitoring can be based

8.8.2 Building on the information provided in Table 8.3, detailing completed and ongoing ecological surveys to October 2017, it is proposed that the following surveys take place.

Phase 1 Habitat Survey

8.8.3 This will take place to update existing survey data, to the geographical extents used to date. This will include an invasive species survey. This will take place in spring 2018.

Phase 2 Habitat Survey

8.8.4 Phase 2 habitat surveys, using the NVC methodology, will take place in April – May 2018, on those high value areas/habitats identified and surveyed to date i.e. the SSSI and CWSs which could be affected by the Proposed Scheme.

Aquatic Invertebrates

8.8.5 Further aquatic invertebrate surveys will be undertaken in May 2018 to provide early season data. Late season surveys results will be available in November 2017.

Badgers

8.8.6 This will take place to update existing survey data. Badgers are a mobile species, and there would be implications for careful consideration should they be found in the study area. This will take place in spring 2018.

Bats

8.8.7 Further bat surveys will take place in 2018, to build on the existing survey data. It is proposed that emergence/re-entry surveys would be carried out for all high potential trees, and high and medium potential buildings and structures within

the study area. These surveys would take place between May and August 2018, and would be repeated in 2019.

8.8.8 In addition, monthly transects and the associated static monitoring would take place, between May and September 2018.

8.8.9 All surveys will be to the Bat Conservation Trust (BCT) guidelines as detailed below as a minimum, with additional surveys proportional to the factors that the EPS Licence application will consider.

Breeding Birds

8.8.10 Surveys started in July 2017 and are anticipated to be finalised between March and June 2018. The survey methodology (times, durations, survey locations, recording methods, acceptable weather conditions etc) would replicate that used to date. Particular attention will be paid to raptors, as has been the case to date.

Overwintering Birds

8.8.11 Overwintering bird surveys are proposed to take place over winter of 2017/18. They would begin in October 2017, taking place monthly for six months. The survey methodology (times, durations, survey locations, recording methods, acceptable weather conditions etc) would replicate that used to date.

Reptiles

8.8.12 Reptile surveys will be undertaken between April and June 2018, to supplement the surveys that have taken place in autumn 2017.

Water Voles and Otters

8.8.13 The mobile nature of these species (particularly otter), the high levels of protection, and the need for dedicated mitigation and potential licensing means that surveys will be carried out from April to September 2018.

8.8.14 It is not proposed to carry out the following surveys:

- Phase 2 Botanical Surveys – survey data is unlikely to change. Limited flora communities, of low to moderate ecological value only.
- Aquatic invertebrate surveys – It is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES unless the 2017 indicate that additional surveys are required to monitor a protected, rare or endangered species. Communities not likely to change/move in any significant way.
- Hedgerow surveys – It is assumed that the survey data from the 2016 Phase 1 survey will be sufficient to inform the ES.
- Great crested newts – scoped out at Stage 2 as there are no ponds that are used by GCNs.

- Reptiles – It is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES and allow accurate assessment of impacts to be made.
- Terrestrial invertebrate surveys – as with the aquatic invertebrates, it is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES so no further surveys are proposed unless the 2017 results indicate that additional surveys are required to monitor a protected, rare or endangered species. Fish surveys- It is assumed that the Natural England data will be sufficient to inform the ES.

Survey Methodologies

8.8.15 All protected species surveys proposed for October 2017 onwards will be to the standard methodologies as described of those that have already taken place, as described in Table 8.3.

8.8.16 In addition, and where relevant, surveys will draw on the Ecological Impact Assessment methodology set out in the Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater and Coastal, Second Edition (January 2016).

Evaluation of Effects

8.8.17 All potential impacts arising from the Proposed Scheme will be addressed: direct or indirect, temporary, short term or long-term, and the effects of any environmental mitigation measures including alterations to the Proposed Scheme design will also be considered.

8.8.18 Impacts will be assessed for all ecological features (species, habitats and designated sites) identified during the assessment which are considered to be significant.

8.8.19 The significance of any impacts will be based on the consideration of the nature conservation value of the features (Table 8.4) and the magnitude of the impact on them (Table 8.5). These will be combined to give an overall appraisal category in the final assessment (Table 8.6).

Table 8.4 Criteria for Determining Nature Conservation Value of Features

Value	Criteria	Examples
Very High	High importance and rarity, international scale and limited potential for substitution	An internationally designated site or candidate site: A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole. Any regularly occurring population of an internationally important species, which is threatened or rare in the UK i.e. UK BAP, red data book species.

Value	Criteria	Examples
High	High importance and rarity, national scale, or regional scale with limited potential for substitution	A nationally designated site or a discrete area, which meets the published selection criteria for national designation, including Ancient woodland on NE register. A viable area of a priority habitat identified in the UK BAP. Any regularly occurring population of a nationally or regionally important species which is threatened or rare in the county (local BAP).
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution	Any regularly occurring, locally and regionally significant population of a species listed as being nationally scarce. Any County and other sites which the designating authority has determined meet the published ecological selection criteria for designation, including county wildlife sites. A regularly occurring, locally significant number of a County and regional important species.
Low	Low or medium importance and rarity, local scale	A diverse and/or ecologically valuable hedgerow network. Local designated sites including Roadside Nature Reserves.
Negligible	Very low importance and rarity, local scale	Other sites, species or habitats with little or no local biodiversity and earth heritage interest.

Table 8.5 Criteria for Determining Magnitude of Impact

Magnitude	Criteria
Major negative	The proposal (either on its own or with other proposals) may adversely affect the integrity of the site, in terms of the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Intermediate negative	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. However, if, in the light of full information, it cannot be clearly demonstrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as major negative.
Minor negative	Neither of the above apply, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Positive	Impacts which provide a net gain for wildlife overall.

8.8.20 The significance of the impacts will be ascertained using the criteria listed in Table 8.6.

Table 8.6 Description of the Significance of Effect Categories

Significance category	Typical description of effect
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 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 may be important, but are unlikely to be highly important to the decision-making factors. The cumulative effects of such factors may influence the 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 with the margin of forecasting error.

8.8.21 The significance of the impacts will be considered during the following phases of the project:

Construction Phase

8.8.22 This will take account of the operations required to construct the Proposed Scheme including the potential sites for Contractors' compounds, haul routes and borrow and disposal areas.

Operational Phase

8.8.23 This will look at the land take required to construct the project together with any drainage and other ancillary works. It will consider the impact of traffic and other related effects on the designated sites, habitat and species. The ongoing, long term maintenance requirements and actions will also be considered.

8.8.24 Assessments for the operational phase will include one for the opening year of the Proposed Scheme, and one for the design year, 15 years after opening. This will allow any changes in impacts to be identified. For example, this will consider the establishment of any habitat created as part of the Proposed

Scheme, which is unlikely to be functioning at opening year, but by 15 years will be maturing well, and becoming well used by protected and other species.

8.8.25 Similarly, it is likely that traffic flows will change between opening year and design year, with a corresponding potential change in impacts. As with above, the two assessments will draw out any changes in the magnitude of impacts etc.

8.8.26 Table 8.7 provides a summary of potential construction and operational effects for biodiversity for the Proposed Scheme.

Table 8.7 Summary of Potential Biodiversity Effects

Potential Construction Effects	Potential Operation Effects
Potentially significant direct and indirect impacts to protected species, designated sites and sensitive habitats.	Potentially significant direct and indirect impacts to protected species, designated sites and sensitive habitats.

8.8.27 The scope of the works and the potential significance of direct and indirect effects warrants further assessment to a Simple level in the first instance, in accordance with IAN 130/10, as there is potential to cause disruption to protected species, designated sites and sensitive habitats as a result of the Proposed Scheme.

8.9 Proposed Methodology including Significance

8.9.1 The survey and assessment would be undertaken in line with best practice guidelines as recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM), which coincide with the recommended approaches to survey methodologies detailed in the DMRB, Volume 11, Section 3, Chapter 7, parts 7.9-7.19. Exceptions may occur in circumstances where professional judgement is used to select an alternative methodology deemed to be more suitable for this particular site, if approved or suggested by the relevant consultees.

8.9.2 The published CIEEM guidelines (CIEEM, 2016) utilise an approach to valuing ecological features that involves the use of professional judgment, based on available guidance and information, together with advice from experts who know the area in which the study area sits and/or the distribution and status of the features that are being considered. Significance of effects would be assessed in accordance with DMRB guidance, which also relies on professional judgment and the advice and views of appropriate statutory agencies and other consultees on local ecological status, in its approach to assigning value.

8.10 Conclusion

8.10.1 There is potential for significant direct and indirect effects to protected species, designated sites, and sensitive habitats as a result of the Proposed Scheme. Subsequently, this warrants further assessment to a Detailed level in the first instance, in accordance with IAN 130/10.

8.10.2 This assessment will be presented within an ES.

9 Geology and Soils

9.1 Introduction

9.1.1 This chapter provides a description of the soils, geology, ground conditions and hydrogeology for the Proposed Scheme. The chapter characterises the baseline geo-environmental conditions at each site and identifies the sensitivity of the ground conditions and potential constraints posed by the existing baseline conditions on the Proposed Scheme. Materials that may be encountered or generated from the proposed works and any potential constraints that these may place on the Proposed Schemes are also discussed.

9.1.2 The potential requirement for further assessment to either Simple or Detailed level will therefore be identified. This assessment will be presented within an ES.

9.1.3 The effects of the Proposed Scheme upon agricultural land have been assessed in Chapter 12 People and Communities, and are not considered in this chapter.

9.2 Study Area

9.2.1 The study area to identify the baseline geo-environmental conditions is initially within a 100m radium of the Proposed Scheme between Wansford and Sutton, this may be increased depending on the results of scheduled ground investigations.

9.2.2 The assessment considers the impacts and constraints posed by the ground and groundwater conditions for both the construction and operational phases of the Proposed Scheme.

9.3 Existing and Baseline Knowledge

9.3.1 Sources of information used in this Chapter include previous reporting, historical and geological mapping and online data sources. Key sources used include:

- Mott MacDonald Sweco JV, Addendum Preliminary Sources Study Report, A47 Improvements Programme – Wansford to Sutton. HAGDMS No: TBC, September 2017.
- Amey, Geotechnical Preliminary Sources Study Report, A47 Wansford to Sutton, HAGDMS No: 29538, April 2017.

9.3.2 Baseline data for the Proposed Scheme can be found in Table 9.1. Note chainages (ch.) are taken from the preferred route announcement design, also used in the PSSR.

Table 9.1: Baseline Data for Wansford

Aspect	Details	
Freeflow Slip Road - ch0 - 750		
Geology	0 – 4m	Head Deposits (Present at approximate ch75 – 125) likely to consist clayey sandy silt with occasional gravel and roots.
	0 – 8m	Bedrock deposits of the Upper Lincolnshire Limestone, likely to consist of moderately weak light brown oolitic limestone with traces of brown sandy clay.
Main Road ch0 – 600		
Geology	0 – 3m	Bedrock deposits of the Upper Lincolnshire Limestone, likely to consist of moderately weak light brown oolitic limestone with traces of brown sandy clay.
	0 – 7m	Bedrock deposits of the Lower Lincolnshire Limestone, likely to consist of moderately weak light brown oolitic limestone with traces of brown sandy clay.
	1 – 4m	Bedrock deposits of the Grantham Formation. The materials are likely to comprise stiff brown sandy clay with chert/ limestone gravel.
	4 – 18m	Bedrock deposits of the Whitby Mudstone Formation, likely to consist of stiff blue-grey clay.
Main Road ch600 – 1250		
Geology	0 – 4m	Superficial deposits of River Terrace Deposits, likely to consist of slightly silty fine to medium sand over fine to medium sands and sub-rounded gravels.
	0 – 3m	Bedrock deposits of the Grantham Formation. The materials are likely to comprise stiff brown sandy clay with chert/ limestone gravel.
	4 – 18m	Bedrock deposits of the Whitby Mudstone Formation, likely to consist of stiff blue-grey clay.
Main Road ch1250 – 1300		
Geology	0 – 5m	Superficial deposits of Alluvium, likely to consist of very clayey sands.
	3 – 10m	Bedrock deposits of the Grantham Formation. The materials are likely to comprise stiff brown sandy clay with chert /limestone gravel.

Aspect	Details	
Main Road ch1300 – 2550		
Geology	0 – 4m	Made Ground (ch1325 – 1375) associated with the old railway, likely to be a variable material and feature old railway sidings, ash and granular and cohesive materials with poor engineering properties.
	0 – 5m	Superficial deposits of River Terrace Deposits (ch1400 – 2550), likely to consist of slightly silty fine to medium sand over fine to medium sands and sub-rounded gravels.
	1 – 3m	Bedrock deposits of the Rutland Formation, likely to consist of hard brown silty clay with occasional gravel/cobbles.
	6 – 8m	Bedrock deposits of the Upper and Lower Lincolnshire Limestone (ch.1300 – 1600), likely to consist of moderately weak light brown oolitic limestone with traces of brown sandy clay.
Sites of Geological Interest	Historic Quarrying	According to the Envirocheck Report there are several records of historic mining quarrying activity within 100m of the site boundary. These include quarrying of River Terrace Deposits, Lincolnshire Limestone and the Rutland Formation. For further information, please refer to the AMEY and Mott MacDonald Sweco JV Preliminary Source Study Report (PSSR).
	Local geological Sites	There are no local geological sites within 100m of the site.
	BGS Recorded Mineral Sites	The Mott MacDonald Sweco JV PSSR indicates the presence of one BGS Recorded Mineral Sites within 100m of the site boundary. • Sutton Gravel Pit, (B11SW) 8m E, (NGR 509981,299251), River Terrace deposits, Ceased. In addition, one further site of General Quarrying or Sand, Clay or Gravel pits are noted as past land uses: • Quarrying of Sand and Clay, Operation of Sand and Gravel pits, (B11SW) 19m E, NGR 509985, 299239.
Hydrology and Hydrogeology	• The River Nene is located immediately to the south of the Proposed Scheme and flows from west to east. • Whitewater Brook is located at approximate Ch. 1200, crossing the route in a north to south direction with several small streams approaching this from the north. At this location, culverts have been proposed. • Several small drains are also located towards the eastern end of the Proposed Scheme, one located at the location of a proposed culvert • Groundwater is likely to be present in the River Terrace Deposits and within the Alluvium. Groundwater may also be encountered within the Head deposits, which have the potential to be variable in composition. Groundwater is likely to be encountered close to the existing ground level of the site in the vicinity of the River Nene in the central section of the route. • Rapid groundwater flow was reported in the Lincolnshire Limestone (see HAGDMS No: 29538), however some historic boreholes in this stratum were also recorded as dry. Groundwater flow in this unit was indicated to be eastwards. • The superficial deposits of Alluvium and River Terrace Deposits are classified as Secondary A aquifers, with Head deposits classified as a Secondary	

Aspect	Details
	Undifferentiated aquifer. Further detail on the designations can be found in the HAGDMS No: 29538. • The bedrock deposits of the Lincolnshire Limestone are classified as Principal aquifer. The Rutland Formation is designated as a Secondary B aquifer, the Grantham Formation as a Secondary Undifferentiated aquifer and the Whitby Mudstone Formation is designated as Unproductive strata. Further detail on the designations can be found in the AMEY PSSR. • Groundwater flow is likely to be primarily towards the south and the River Nene, together with other surface water bodies.
Soil Survey	The BGS UK Soil Observatory (UKSO) viewer was reviewed in the Mott MacDonald Sweco JV PSSR for soilscape information. It identifies the following types of soil across the site: • Shallow lime-rich soils over chalk or limestone (associated with bedrock exposure). • Freely draining slightly acidic but base-rich soils (associated with the River Terrace Deposits). Loamy and clayey floodplain soils with naturally high groundwater (associated with Alluvium deposits).
Landfill Records	There are no Registered Landfill Sites within 1km of the site.
Current Land Use and Man Made Features	• The principal land use throughout the area is largely associated with agriculture (undeveloped land). • Lowland calcareous grassland, coastal/ floodplain grazing grassland, deciduous woodland and traditional orchards are present to the south and in the vicinity of the River Nene. • Lowland Fens and ponds/ accumulation areas are noted to the south of the River Nene. • The site is positioned immediately north of a meander of the River Nene, with some sections sitting above an erosional slope associated with the river, this appears to be associated with the historical landslip area identified on the BGS maps. • The Proposed Scheme crosses Whitewater Brook valley approximately halfway across the Proposed Scheme s length. • The town of Wansford is present west of the proposed Scheme. • The village of Sutton is located south of the eastern area of the Proposed Scheme. • The existing A47 runs approximately east to west across the site. • A dismantled railway crosses the proposed route at Ch. 1350. • The north to south trending A1 motorway forms a junction with the A47 at the far western end of the Proposed Scheme. • A Site of Special Scientific Interest named Sutton Heath and Bog is situated approximately 50m north of the site, covering an area north of the site where the Proposed Scheme crosses Whitewater Brook, adjacent to Sutton Heath Road.
Route History	The historical development of the area has been summarised from historical mapping and the AMEY / MMS JV Reports: • By 1885 the Stamford and Wansford Railway crosses the proposed route close to its midpoint. Wansford Road Station is shown as present 50m north of the site. A small area of mixed woodland is noted immediately east of the railway crossing. A weir and stanchion is shown on the River Nene approximately 100m south of the site. • Multiple small roads and tracks cross the proposed route and local area throughout the site history. • In 1900 an old gravel pit is noted immediately adjacent to the far eastern extent of the site at Ch 2350. • The A1 road is constructed in approximately 1952. • In 1958 a site of “Roman Buildings” is noted immediately south of the site in the vicinity of the planned underpass. The route of the A47 is also shown as the course of a Roman Road.

Aspect	Details
	• 1964-1965 mapping indicates a new road under construction in the current footprint of the A47, with a junction to the A1. Further changes are shown to the A1/A47 junction in 1969 mapping. • 1970 mapping indicates an overhead power line supported by pylons crossing the site at Ch 2550, two ponds are also shown in an area of woodland to the west of the former Wansford Rail Station, together with two drains crossing under the A47, feeding a pond to the south. • By 1970-1978, new structures are shown as present adjacent to the south boundary and comprise a filling station (Ch 500) and Filter tank (Ch 300). • The railway crossing the route close to its mid-point is noted as having been dismantled by 1980. • In 1980 – 1983, a pumping station is noted approximately 25m to the south of the site, with large embankments shown in the vicinity of it. A mast is also noted in the vicinity of the pumping station. Workings are noted 25m to the south of the site, no area is denoted for these. • In 1992, a new road alignment for the A47 with this shown as joining the roundabout at the eastern end of the route. • A sluice is shown adjacent to the pumping station, on the north bank of the River Nene in 1994. • 1996 mapping indicates the presence of a pond to the west of the A1, approximately 25m from the planned slip road. • In 1999, a new pond is shown to the west of the A1 and is indicated to be partially filled. • Over time, the surrounding settlements have grown.
Potential Contamination Risks	On site • Large areas of the site and surroundings are currently designated as agricultural fields. Fertilisers, pesticides or sewage sludge may have been applied to the ground within the site footprint. • Agricultural machinery and associated fuel spillages within the site footprint may result in contaminations. • The current A47 carriageway and associated side roads are likely to result in contamination associated with vehicle fuel, chemicals, brake and exhaust by products. • The disused railway line that crosses the site is a potential source of contaminates including hydrocarbons and heavy metals. • The potential Made Ground anticipated being present within the carriageway foundations may also be a potential source of contamination. Off site • The fuel station located south of the Proposed Scheme at approximate Ch 600 could be a potential source of hydrocarbons (e.g. via fuel and/or oil leaks), airborne particulates and the possibility of fuel spillage. • Potential Made Ground anticipated to be present within the foundations of existing buildings and pylons alongside the proposed route could be a potential source of contamination. • The Wansford Pumping Station and associated tunnels located at approximate Ch. 400, could be a potential source of chemicals associated with water purification. There is also likely to be Made Ground associated with previous construction activities on this site. • Traffic using the A1 west of the site could be a potential source of hydrocarbons and airborne particulates. • The disused rail line and associated structures and infrastructure could be a source of hydrocarbons. • An electricity substation and mast are located approximately 80m south of the proposed carriageway. A further mast is located approximately 80m north of the site. Both are at approximate Ch. 300. These could be possible sources of heavy metals and PCB's. • Historical sand and gravel pits surrounding the site boundary at varying distances. These may have been filled with uncontrolled material or targeted by fly tipping, both of which could be contaminated.

Aspect	Details
	• A sewage pumping station is located on the west side of the A1 at Ch. 100 of the freeflow slip road.

9.4 Assumptions and Limitations

9.4.1 The baseline information on the Proposed Scheme has been based on a preliminary sources study report of currently available information at the time of writing.

9.4.2 To the extent that this Chapter is based on information supplied by other parties, it has been assumed that this information is complete and correct. All sources used have been listed within section 9.3.

9.4.3 Reported baseline conditions from site walkovers have been assumed to be accurate, however owing to the dynamic nature of the environment, conditions may change during the construction and operational phases. No site walkover was conducted due to access restrictions.

9.4.4 To the extent that this chapter uses information obtained from a ground investigation, persons using or relying on it should recognise that any such investigation can examine only a fraction of the subsurface conditions.

9.4.5 In relation to contaminated land, mapping and site walkovers may not always identify small areas of historic/hidden contamination and there is the potential for previously unidentified contamination to be encountered during the construction process.

9.4.6 A ground investigation will need to be undertaken to confirm the ground conditions in the vicinity of the Proposed Scheme and establish whether any contamination is present in near surface soils.

9.4.7 The main limitation to the assessment is the absence of site-specific information on the ground and groundwater conditions along the proposed route. Accordingly, it has only been possible to undertake a broad desk based study using publicly available information.

9.4.8 Based on the historical land use in the area, it is considered that there is a possible risk of encountering contaminated ground in excavations. Currently, the presence of contaminated ground has not been confirmed. It is possible that significant excavation may be required for the culvert and underpass areas, it is likely that potentially contaminated ground may be encountered should this be required. For the purpose of the assessment, it has been assumed that the Proposed Schemes will not disturb any areas of significantly contaminated ground.

9.5 Guidance and Best Practice

9.5.1 The assessment will be undertaken in accordance with the published standards and guidance, with particular reference to:

- DMRB Volume 11 Section 3 Part 11 Geology and Soils.

- Environmental Protection Act 1990 (as amended by the Environment Act 1995).
- Environmental Protection (Duty of Care) Regulations 1991 (as amended 2003).

9.6 Consultation

9.6.1 Specific consultation with the Environment Agency will be necessary to discuss the impact of the Proposed Scheme on the landfill sites identified and vice versa. This will be undertaken to inform the ES.

9.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

9.7.1 Excavation works associated with the Proposed Scheme have the potential to directly damage any underlying geological features for the Proposed Scheme. However, since the Proposed Scheme is not located within a geologically protected site, and there are no important geological deposits present on site, it is anticipated that there would be no significant direct impacts upon geology during construction.

Operation

9.7.2 It is anticipated that there would be no significant effects upon geology as a result of the Proposed Scheme.

Summary

9.7.3 Table 9.2 provides a summary of potential construction and operational effects for geology and soils for the Proposed Scheme.

Table 9.2: Summary of Potential Geology and Soils Effects

Potential Construction Effects	Potential Operation Effects
No significant construction effects anticipated.	No significant adverse effects anticipated.

9.8 Proposed Level and Scope of Assessment

9.8.1 **T**he scope of the construction works and the potential significance of direct effects warrant further assessment to a Simple Level only.

9.8.2 The completed and operational Proposed Scheme is not expected to result in any significant direct adverse impacts upon Geology and Soils. As a result, it is considered that no further assessment of operational stage effects is required for the Proposed Scheme.

9.9 Proposed Methodology including Significance

9.9.1 The assessment method for Geology and Soils will take into consideration the guidance provided in the DMRB Volume 11, Section 3, Part 11.

9.9.2 The sensitivity of geological receptors will be determined according to Table 9.3.

Table 9.3: Scale for Evaluation of the Sensitivity of Geological/Soil Receptors

Sensitivity	Criteria	Typical Examples
Very High	International Scale: Very high importance and rarity and very limited potential for substitution	Important on a European or global level: • Geology: World Heritage Sites. • Soils: Agricultural soils of Grade 1 quality. • Minerals: Energy minerals – minerals used to generate energy such as coal oil and gas. • Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing a regionally important resource or supporting site protected under wildlife legislation; or SPZ I. • Future site users: Very sensitive land uses proposed such as residential housing with gardens, allotments. • Built Environment: Sites of international Importance, World Heritage Sites.
High	National Scale: High importance and rarity, limited potential for substitution	Important in the UK: • Geology: Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site). • Soils: Agricultural soils of Grade 2 quality. • Minerals: Poor quality energy minerals or silica (industrial) sand for use in glass making. • Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing locally important resource or supporting river ecosystem; SPZ II. • Future site users: Sensitive land uses proposed such as schools, residential housing without gardens, open spaces. • Built Environment: Listed buildings, Scheduled Monuments.
Medium	Regional Scale: Medium quality and rarity	Important in the context of the South West: • Geology: Regionally Important Geological Sites (RIGS). • Soils: Agricultural soils of Grade 3 quality. • Minerals: Construction aggregates – minerals used in building and engineering or to manufacture building and engineering products such as concrete. • Controlled Water: Moderate classification of groundwater vulnerability; Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ III. • Future site users: Moderately sensitive land uses such as commercial developments and open spaces. • Built Environment: Sites with local interest for education or cultural appreciation.
Low	District Scale: Low quality and rarity	Important in the context of South Somerset: • Geology: Rock exposures. • Soils: Agricultural soils of Grade 4-5 quality. • Minerals: Poor quality materials suitable for us as general fill only.

Sensitivity	Criteria	Typical Examples
		• Controlled Water: Deep Secondary aquifer with poor water quality not providing baseflow to rivers; Aquifer not used for water supplies (public or private). • Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail. • Built Environment: Infrastructure (e.g. Roads, railways, tramways).
Negligible	Local Scale: Very low importance and rarity	Important within and adjacent to site (~2 km of site): • Geology: No rock exposures. • Soils: Urban classified soils. • Minerals: No minerals. • Controlled Water: Non-aquifer. • Future Site Users: No sensitive land use proposed.

9.9.3 Magnitude of effect will be determined by the predicted deviation from the baseline conditions and the scale of impact. The methodology for determining the magnitude of an impact is shown in Table 9.4.

Table 9.4: Scale of Magnitude of Impact for Geological/Soil Receptors

Magnitude of Effect	Geological Changes	Soils Including Waste	Human Health	Groundwater	Surface Water
Major	Disturbance or loss of geological features of interest e.g. change in condition status of geological SSSI or RIGS. Permanent impact on geological conditions. Sterilisation of 50% or more of mineral asset.	Generation of large volume of hazardous material for disposal off-site or treatment. Physical removal or degradation of a large area of soil. Remediation/ improvement of a large area of soil.	Site investigation data indicating severe contamination. Quantitative or qualitative risk assessment data estimating a significant likelihood of adverse/ beneficial impacts from exposure/ reduction in exposure to pollutants in the environment.	Significant change in groundwater quality with respect to Drinking Water Standards (DWS). Pollution/ treatment of potable source. Any pollution inside Zone 1 or a groundwater protection zone of special interest.	Significant change in water quality, impacting quality with respect to Environmental Quality Standards (EQS). Loss of attribute and/ or quality or function e.g. loss or extensive change to a fishery.

Magnitude of Effect	Geological Changes	Soils Including Waste	Human Health	Groundwater	Surface Water
Moderate	Some disturbance or loss of geological feature. Temporary impact on geological conditions. Sterilisation of 15-50% of mineral asset.	Generation of hazardous/ non-hazardous material for disposal off-site or treatment. Physical removal or degradation of a moderate area of soil. Remediation/ improvement of a moderate area of soil.	Site investigation data indicating moderate contamination. Quantitative or qualitative risk assessment data estimating medium risk of adverse/ beneficial impacts from exposure/ reduction in exposure to pollutants.	Moderate changes insufficient to change water quality with respect to DWS.	Moderate changes insufficient to change water quality with respect to EQS. Moderate decline in the attribute quality or function.
Minor	No disturbance or loss of geological feature. No permanent impact on geological conditions. Sterilisation of <15% of mineral asset.	Generation of inert/ non-hazardous waste materials which may be suitable for re-use on site. Physical removal or degradation of a minor area of soil. Remediation/ improvement of a minor area of soil.	Site investigation data indicating significant contamination is unlikely. Quantitative and qualitative risk assessment data estimating low likelihood of adverse/ beneficial impacts from exposure/ reduction in exposure.	Minor impact insufficient to impact on characteristics of water resource.	Measurable change in water quality but no change with respect to EQS or minor. Negligible decline in attribute quality or function.
Negligible	Physical removal, degradation (including loss of structure and contamination) or improvement of a very minor area of soil. Minimal impact on geological conditions and minerals assets.				
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.				

9.9.4 The likely severity of effects on geology and soils due to the construction and operation phases of the Proposed Scheme will be assessed using the matrix presented in Table 1.2.

9.9.5 A descriptive meaning for each of the five significance categories relevant to Geology and Soils is detailed in Table 9.5.

Table 9.5: Explanation of Significance of Effect for Geological/Soil Receptors

Significance Category	Description and Examples		Significance
Neutral	**-**	• Minimal effect on geological condition. • Minor loss of urban soils. • No discernible negative effect to buildings/ infrastructure.	**Not Significant**
Slight	**Adverse**	• Changes to Made Ground deposits only. • Moderate/major loss/degradation of Grade 4 or 5 soils. • Minor/moderate loss/degradation of Grade 3 soils. • Easily preventable, non-permanent health effects on humans. • Minor low-level and localised contamination of on-site soils. • Easily reparable damage to buildings/ infrastructure.	
	Beneficial	• Remediation of localised low levels of contamination. • Remediation of non-sensitive water resource • contamination. • Minimal improvements to overall soil and water quality.	
Moderate	**Adverse**	• Superficial disturbance to near surface deposits. • Changes in geomorphology, large loss/degradation of Grade 3 soils. • Minor loss/ degradation of Grade 1 or 2 soils. • Sterilisation of low quality mineral resources. • Easily preventable, permanent health effects on humans. • Pollution of non-sensitive water resource or Low long term risk of pollution to sensitive water resource. • Localised damage to buildings/infrastructure (on or off site).	**Significant**
	Beneficial	• Remediation of localised moderate levels of contamination. • Remediation of moderate, localised sensitive water resource contamination.	
Large	**Adverse**	• Moderate/ large loss/ Degradation of Grade 2 soils. • Moderate loss/degradation of Grade 1 soils. • Sterilisation of high quality mineral resource. • Medium/ long-term (chronic) risk to human health. • Medium long-term risk of pollution of sensitive water resources. • Contamination of off-site soils.	
	Beneficial	• Remediation of localised high levels of contamination. • Remediation of significant localised sensitive water resource contamination.	

Significance Category	Description and Examples		Significance
Very Large	**Adverse**	• Loss of exposed designated geological feature or large loss/degradation of Grade 1 soils. • Short-term (acute) risk to human health. • Short-term risk of pollution of sensitive water resources. • Catastrophic damage to buildings / infrastructure.	
	Beneficial	• Remediation of significant, widespread elevated levels of soil contamination/sensitive water resource contamination.	

9.10 Conclusion

9.10.1 The scope of the construction works and the potential significance of direct effects warrant further construction stage assessment for the Proposed Scheme. This would include the undertaking of a ground investigation to further establish the baseline information of the Proposed Scheme area and to investigate the areas identified to establish the potential contaminants present and identify the method of treatment if necessary. The ground investigation would be undertaken in accordance with DMRB Volume 4, Section 1, Part 7 Site Investigation for Highway Works on Contaminated Land.

9.10.2 Further construction stage assessment to a Simple level in the first instance will be undertaken, and will be presented within an ES.

9.10.3 The completed and operational Proposed Scheme is not expected to result in any significant direct adverse impacts upon Geology and Soils. As a result, it is considered that no further assessment of operational stage effects is required for the Proposed Scheme.

9.10.4 Overall for geology, soils and materials, construction of this Proposed Scheme has the potential to have a Moderate/ Large impact, due to the sensitivity of groundwater (Principal Aquifers present) and surface water (River Nene) and the Sutton Heath and Bog SSSI situated approximately 50m north of the site.

9.10.5 Providing proper consideration is paid to potentially sensitive receptors during the construction phase, it is considered that the operation of the Proposed Scheme will not pose any significant risk to the ground and groundwater conditions. Any effects will be of a negligible magnitude posing a neutral impact.

9.10.6 There is an absence of site-specific information on the geological, geotechnical and hydrogeological conditions. It is understood that a programme of ground investigation is to be carried out in the near future to provide detailed information on the ground and groundwater conditions. If the ground investigations show that areas of contaminated land will be disturbed to construct the Proposed Schemes, it is likely that the potential effect of the construction impacts will become of greater significance.

10 Materials

10.1 Introduction

10.1.1 This chapter assesses the potential impact on material assets as a result of the Proposed Scheme, and has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, to a Scoping Level. For the purposes of this Scoping Report, materials are defined as comprising:

- The use of material resources
- The generation and management of waste

10.1.2 The potential requirement for further assessment to either Simple or Detailed level will be identified. Where required, this will be presented within an ES.

10.2 Study Area

10.2.1 Currently there is no guidance available for defining the study area to be used for materials assessments. As a result, the study, which will be adopted in the ES, has been determined through professional judgement by the influence of the Proposed Scheme, rather than through a set geographical location.

10.2.2 During construction, the majority of waste will be generated within the immediate environment of the construction site and any re-use, recycling or treatment will, wherever practicable, take place on-site. However, where reuse or recycling is not practicable on-site, wastes will need to be removed to external facilities elsewhere. There is potential that disposal to landfill of some waste materials may be required, either locally or further afield, depending on the nature of the waste. The assessment will, therefore, take into account the closest appropriate waste facilities to the Proposed Scheme.

10.3 Existing and Baseline Knowledge

10.3.1 There are no current estimates on material resource use and waste generation during the site remediation/preparation, demolition and construction phases. These shall be developed as the design is progressed.

10.3.2 Information on historic land uses and potential sources of land contamination is addressed in Chapter 9: Geology & Soils. Potential sources of contamination that are greater than 1km away from the Proposed Scheme have not been considered since these are unlikely to impact upon the Proposed Scheme given the distance and nature of the proposed construction.

10.3.3 Commercial construction and demolition (C&D) waste is identified as by far the most significant source of inert waste in Norfolk and there is the need for additional inert waste recycling infrastructure within the region. Capacity of regionally appropriate waste management facilities is an important consideration in the assessment and will be considered in the environmental assessment.

10.3.4 Further available information from the Defra, Environment Agency and the Local Planning Authorities on current waste generation and operational waste management facilities in Norfolk will be collated to provide the baseline for this assessment.

10.4 Assumptions and Limitations

10.4.1 The potential impacts associated with material use and the production, movement, transport, processing and disposal of waste will be assessed once the type and quantity of materials and wastes have been estimated.

10.5 Guidance and Best Practice

10.5.1 The following legislation, standards and best practice guidelines are considered to be relevant to the Proposed Scheme which regulate the management of materials and waste:

- EU Waste Framework Directive 2008/98/EC
- Waste (England and Wales) Regulations 2011 (as amended 2012)
- Environmental Protection Act 1990, Part II, Section 34
- Hazardous Waste (England and Wales) Regulations 2005 (as amended, 2009)
- Environment Permitting (England and Wales) Regulations 2010 (as amended 2011 and 2012)
- Environment Agency (EA) (Standard Rules SR2015 No39: use of waste in a deposit for recovery operation
- CL:AIRE Definition of Waste: Development Industry Code of Practice Version 2, 2011
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009

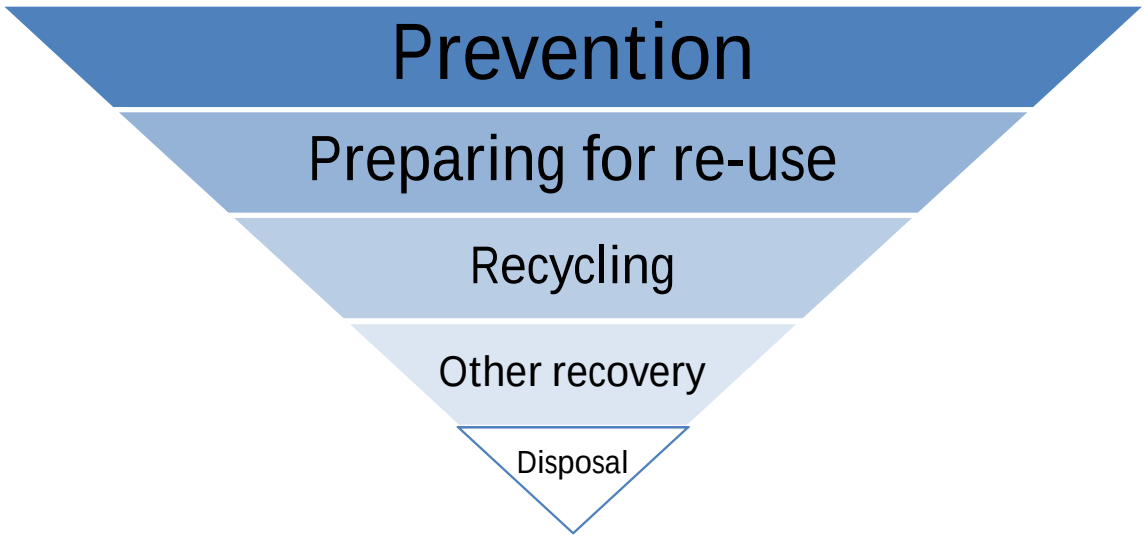
10.5.2 A Site Waste Management Plan (SWMP) is also an important tool for improving environmental performance, managing potential environmental impacts, meeting regulatory commitments and helping to reduce waste and therefore overall project costs. The SWMP aims to determine the waste types and amounts to be produced during design and construction and to identify appropriate waste management controls.

10.5.3 A Materials Management Plan (MMP) may also form part of the SWMP, where there is a need to demonstrate that any material re-use strategy does not pose any risk to human health or the environment and in accordance with 'The Definition of Waste: Development Code of Practice' Version 2 CLAIRE March 2011, is not a waste disposal activity.

10.5.4 The MMP documents how materials anticipated in the ground as part of the works are to be dealt with, including details on potential use, relative volumes, storage areas, intended final destination of the materials, protocols to track movements of these materials and any contingency arrangements (e.g. with regard to treatment of contaminated soils).

10.5.5 The waste hierarchy is a fundamental guidance to reduce waste generation at source and reduce the volume of waste to be sent to landfill (see Figure 10.1).

Figure 10.1 Waste Hierarchy



Source: Guidance on applying the Waste Hierarchy, Defra 2011

10.6 Consultation

10.6.1 No consultation regarding the materials assessment is required with statutory environmental bodies to support the ES. Consultation and liaison with the Environment Agency will be ongoing, where relevant during the EIA process.

10.7 Potential Effects, including Monitoring and Mitigation Measures

10.7.1 Since the estimated cost of the Proposed Scheme is greater than £300,000, it is considered that there is the potential for adverse effects on material assets, through the use of materials and the generation of waste.

10.7.2 **Table 10.1: Summary of Materials and Waste that have the Potential to Generate Significant Environmental Effects**

Project Activity	Material use and potential to generate significant effects	Potential waste arisings and potential to generate significant effects
Site remediation/ preparation/ earthworks	Potential direct effects associated with the import and use of primary aggregates and/or fill material, which may result in the depletion of natural resources.	Potential direct effects associated with the off-site disposal of waste, which may result from: • The production of waste from site clearance, e.g. green waste, inert waste, and contaminated soils. • Surplus excavated materials.

Project Activity	Material use and potential to generate significant effects	Potential waste arisings and potential to generate significant effects
		• Clearance of any existing highways infrastructure such as fencing, barriers, signage, lighting, traffic signals.
Demolition	Demolition would not require the use of any materials.	Demolition of 1 property would be required, which may produce inert waste, such as bricks and concrete, hazardous waste, such as asbestos, and other waste, such as wood.
Site construction	The environmental effects of the use of material resources on construction sites are associated with the carbon emissions released from the initial extraction, processing, and transport. However, if significant quantities of materials are required for the Proposed Scheme, this may ultimately lead to the depletion of non-renewable resources. Although quantities and types of materials are not known at present, the type of materials that are likely to be required may include (but not limited to): • Safety barriers (concrete and steel barriers) • Concrete and plastic drainage • Manholes • Fill material • Kerbs and gullies • Pavement (subbase, road base, base course, binder course, surface course) • Concrete and steel for structures • Box culverts • Sheet piling • Topsoil • Road lighting columns • Communications infrastructure • Road signs and markings	During construction, waste arisings may result from (but not limited to): • Redundant pavement. • Metals from existing highways signage. • Communications cables. • Materials brought to site that are not used for their intended purpose, e.g. damage items, cut offs, and surplus materials. • Soil. • Plastics from existing drainage infrastructure.
Operation and maintenance of asset	Materials associated with the annual maintenance regime are expected to be minimal.	Waste arisings during operation and maintenance are expected to be minimal.

Construction

10.7.3 Specific quantities of materials and waste have not been quantified at this stage, including estimations of the cut and fill balance.

10.7.4 Materials that are likely to be required for the construction of the Proposed Scheme are outlined in Table 10.1. Mitigation measures to reduce the effects of material resource use involve the reduction in the use of virgin materials and aggregates, which may be achieved through reducing the material requirements of the design itself, the use of site-won or recycled materials, and use of materials with a high proportion of recycled content.

10.7.5 Considering the works required, which encompasses the construction of new dual carriageway, junctions, and associated structures there is potential that a significant quantity of materials would be required. It is assumed that any significant effects due to the quantity of materials required, can be appropriately mitigated through the implementation of mitigation measures outlined above. However, without accurate material quantification at this stage, this assumption cannot be confirmed. Therefore, further assessment will be necessary, with accurate material quantification and detailed design information, to confirm the likelihood of significant effects.

10.7.6 In addition, there is also potential for direct adverse effects due to the generation of waste, which may require off-site disposal. In accordance with the waste hierarchy, consideration would be given to the re-use of waste on-site before waste is transported off-site for disposal. Where waste cannot be re-used on-site, recycled, or recovered, direct effects may result from the contribution to landfill and therefore utilising the remaining landfill capacity, and the subsequent indirect risk of damage to local hydrological systems and emissions associated with necessary transport. However, given the scale of the works identified, and minimal demolition required, significant effects, as a result of waste generation from the Proposed Scheme, are unlikely. It is recommended that further assessment, with accurate material quantification and detailed design information, is undertaken to confirm this conclusion.

10.7.7 The preparation of a Site Waste Management Plan (SWMP) and a CEMP would ensure that any adverse effects associated with materials use, waste generation and required transport are appropriately managed. Mitigation measures to be included in the SWMP and CEMP, may include (but not limited to):

- Waste management to be moved as far up the waste hierarchy as practicable, which may include specifying the use of site-won or recycled materials as opposed to sourcing new materials.
- Identify where waste minimisation measures have been considered in the design.
- Surplus waste materials, that cannot be re-used on-site, should be sent for recycling, and opportunities for re-use on other large nearby Proposed Schemes should be sought.
- Encourage resource efficiency by minimal ordering of materials.
- Waste to be appropriately segregated and stored/stockpiled on-site by waste type, to ensure waste remains in a suitable condition to be re-used.

- Where waste must be removed from site for treatment or disposal, ensure these sites are located as close to the works as possible and hold the appropriate permits.
- Local suppliers should be used, where possible, for the supply of materials for use on-site, in order to reduce fuel requirements and cost of delivery and to reduce greenhouse gas emissions resulting from transportation.
- Specify for the use of recycled materials as opposed to sourced new virgin materials.

Operation

10.7.8 It is anticipated that materials use and waste generation e.g. for maintenance, would be minimal as a result of the operation of the Proposed Scheme and, therefore, have no significant effects.

10.8 Proposed Level and Scope of Assessment

10.8.1 There is potential for significant adverse effects on materials resources during construction due to the potential quantity of materials required to construct the Proposed Scheme. It is assumed that any significant effects can be appropriately mitigated. However, in the absence of accurate material quantification this assumption cannot be confirmed. Therefore, further assessment will be required for the use of material resources during construction.

10.8.2 It is unlikely that significant quantities of waste requiring off-site treatment or disposal would be generated from the construction of the Proposed Scheme. However, further assessment, with further detailed design information and any waste quantification, is necessary to confirm this conclusion. Therefore, simple assessment is recommended to be undertaken for the effects on material assets from waste generation.

10.8.3 No assessment is required for material resource use and waste generation during operation, as no significant direct or indirect effects are anticipated.

10.9 Proposed Methodology including Significance

10.9.1 The ES will set out the methodology recognising the requirements of the NNNPS, including how significance of effects are to be determined.

10.9.2 The Simple Level assessment will consider the following:

- The materials required for the project and where information is available, the quantities.
- The anticipated waste arisings from the project and where information is available, the quantities and type (e.g. hazardous).
- The impacts that will arise from the issues identified in the Scoping exercise in relation to materials and waste.
- The results of any consultation.

- A conclusion about whether this level of assessment is sufficient to understand the effects of the project or whether Detailed Assessment is necessary.

10.9.3 Professional judgement will be used to provide an assessment of effects based on several factors, including:

- The availability / scarcity of the material resources.
- The type of materials required and their associated embodied carbon, e.g. primary/virgin materials, manufactured materials, recycled materials.
- The type of waste generated, e.g. inert, non-hazardous, hazardous.
- The capacity and availability of suitable facilities within close proximity to the Proposed Scheme to manage, treat or dispose of waste generated.
- Implementation of the waste hierarchy, i.e. where the generation of the waste is avoided through design in the first instance, then minimised, recycled, recovered or disposed of.

10.10 Conclusion

10.10.1 There is a potential for significant adverse effects from the use of materials and generation of waste. An initial Simple Assessment is proposed, followed by a Detailed Assessment if the environment impacts cannot be clearly identified by the Simple Assessment. The requirement for a Detailed Assessment shall be considered following completion of the Simple Assessment.

10.10.2 The results of the assessment will inform development of a SWMP, MMP/ Materials Logistics Plan (MLP) which shall be prepared for the Proposed Scheme by the appointed Contractor. The SWMP and MMP/MLP shall consider the sourcing, procurement, transport, delivery, storage, handling, use and disposal of materials in a sustainable manner, in accordance with the waste hierarchy.

10.10.3 With implementation of a SWMP, MMP/MLP and other appropriate mitigation measures during construction as detailed in the CEMP, the use of materials and generation of waste is unlikely to result in significant direct or indirect effects, although an assessment to a Simple Level will be undertaken to confirm this conclusion.

10.10.4 No further assessment is required for the effects of the Proposed Scheme on material resources during operation, as significant direct or indirect effects are unlikely as there would be minimal requirements for materials and generation of waste.

11 Noise and Vibration

11.1 Introduction

11.1.1 This Chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 7, to a Scoping Level. The construction and operation of the Proposed Scheme would have the potential to give rise to both temporary and permanent noise and vibration impacts at sensitive receptors in the area, which in turn could generate adverse or beneficial effects. This section identifies the key noise and vibration impacts, describes the study area and key receptors. The potential requirement for further assessment to either Simple or Detailed level will also be identified. This will then be presented within an ES.

11.2 Study Area

11.2.1 The DMRB Volume 11 Section 3 Part 7 HD213/11 Noise and Vibration (2011) provides the methodology for assessment of road projects within the UK.

11.2.2 For operational noise, the methodology requires that the study area is identified as an area within 1km of the physical works associated with the Proposed Scheme. Within this study area, road traffic noise predictions are performed at any sensitive receptor within 600m of a road where this is the possibility of a change of 1dB $L_{A10, 18hr}$ upon Proposed Scheme opening, or 3 dB $L_{A10, 18hr}$ in the long-term.

11.2.3 For potential effects due to road traffic noise outside of the 1km area, the methodology requires that sensitive receptors are identified adjacent to roads where the change in received road traffic noise level would, as a result of the Proposed Scheme, increase or decrease by at least 1 dB $L_{A10, 18hr}$ on opening or 3dB in the long term. Consequently, the spatial extents of the assessment may extend beyond the physical works associated with the Proposed Scheme.

11.2.4 For construction noise, the study area is the same as that defined for assessment of operational noise impacts, although this may be extended to assess the impacts from construction traffic on the existing road network and from potential diversion routes. Within the study area the extent of the assessment will be limited to areas where total noise (calculated construction noise plus baseline noise) exceeds baseline noise levels.

11.3 Existing and Baseline Knowledge

11.3.1 The Proposed Scheme will provide a new dual carriageway between Wansford and Sutton adjacent to the existing A47 single carriageway (See Section 2.4 for the scheme description).

11.3.2 A review of noise-sensitive receptors and an initial noise survey was undertaken as part of the noise assessment reported in previous assessments.

11.3.3 The area is predominantly rural, the majority of noise sensitive receptors being located in Wansford, Stibbington, Thornhaulgh, Stibbington Sutton and Ailsworth. There are relatively few receptors directly adjacent to the Proposed Scheme, less than ten being reported, although a much greater number (approximately 350) within the provisional study area. There are also other noise sensitive receptors such as churches, community halls and amenity areas within the study area.

11.3.4 The previous assessment reported that noise from the A1 and A47 dominated the noise environment. Noise measurements taken in the vicinity of the A1 were high, as might be expected, whereas noise readings taken in Sutton were relatively low, the measurement location being approximately 450m from the A47. Measured noise levels showed little difference between night-time and daytime, which was considered to be due to HGV traffic during the night.

11.3.5 Two Noise Sensitive Areas have been identified within the study area, one located on the A1 south of the junction with the A47 towards the River Nene (IA_ID:5303, asset owner Highways England) and one on the A47 at Sutton Heath Road (IA_ID:5304, asset owner Highways England).

11.3.6 Table 11.1 identifies sensitive receptors, which includes typical examples identified in DMRB.

Table 11.1: Noise and Vibration Resources and Receptors

Resource/Receptor	Description
Dwellings	Houses and any other building in residential use such as public houses, hotels etc.
Commercial premises	Shops, offices etc.
Community facilities	Libraries, public halls, sports centres, theatres, concert halls, places of worship etc.
Recreational facilities	Amenity areas, footpaths, sports grounds etc.
Educational establishments	Schools, university campus.
Designated sites	If relevant, environmentally sensitive areas and buildings sensitive to noise and vibration.
Other	Any other premises highly sensitive to noise and vibration such as laboratories etc.

11.3.7 Further surveys will be necessary and the following sources will be consulted prior to deciding locations:

- Noise mapping undertaken as part of the requirements of The Environmental Noise (England) Regulations 2006
- OS mapping
- Consultation with the Local Authority
- Traffic flows

- Review of previous surveys and assessments

11.3.8 Surveys will comprise both long-term and short-term monitoring broadly in accordance with The Calculation of Road Traffic Noise (CRTN) methodology (HMSO, 1988).

11.4 Assumptions and Limitations

11.4.1 There is currently no information on construction traffic movements, which is required to undertake an assessment of construction noise. Forecast traffic flows, speeds and percentage heavy goods data are currently unavailable. Discussion on potential impacts and effects within this Scoping Report have therefore been undertaken in the absence of this information. As the design progresses and this information becomes available it will be incorporated into the assessment.

11.5 Guidance and Best Practice

11.5.1 The following legislation, standards, and best practice guidelines are relevant to the Proposed Scheme:

- The National Planning Policy Framework 2012
- The Noise Policy Statement for England 2010
- The National Policy Statement for National Networks 2014
- The Land Compensation Act 1973 Part 1
- The Noise Insulation Regulations 1975 (amended 1988)
- Sections 60 and 61 of The Control of Pollution Act 1974
- The Environmental Protection Act 1990
- British Standard (BS) 5228-1:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’
- BS5228-2:2009+A1:2014 'Code of construction practice for noise and vibration control on construction and open sites - Part 2: Vibration'
- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 ‘Noise and Vibration’ (HD213/11 – Revision 1) 2011
- Interim Advice Note 185/15 ‘Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into ‘speed bands’ for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality’ and Volume 11, Section 3, Part 7 ‘Noise’
- Calculation of Road Traffic Noise (CRTN) 1988
- Guidelines for Noise Impact Assessment, Institute of Environmental Management & Assessment (IEMA) 2014

11.5.2 The above list is not exhaustive and further guidance will be referred to where necessary.

11.6 Consultation

11.6.1 Consultation with Environmental Health Officers (EHO) of Huntingdonshire District Council and Peterborough City Council will be progressed following the consultations undertaken to date during the course of the EIA process. Discussion on methodology for the ES chapter and proposed survey locations will form a key element of the consultation.

11.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

11.7.1 During construction, the Proposed Scheme has the potential to directly alter the noise and vibration baseline for sensitive receptors for a temporary period. Impacts are likely to be restricted to areas where the existing baseline noise levels are exceeded. This would principally be in the vicinity of the Proposed Scheme envelope, although could extend along elements of the existing road network, depending on haul routes and the quantity of construction-related traffic. With strict adherence to mitigation including the shielding of noisy items of plant, the use of enclosures and the use of appropriate screening, to be included within the CEMP, construction noise would be managed to appropriate levels and is therefore not anticipated to have significant direct effects. However, at this stage with insufficient information on construction activities further assessment will be needed to confirm this and to inform the mitigation strategy. This will be undertaken based upon the requirements of BS5228 Parts 1 and 2 during the EIA process.

Operation

11.7.2 During operation, there is the potential for changes to traffic flows and road alignment to result in noise changes at noise sensitive receptors, including Noise Impact Areas (NIAs). However, with the implementation of appropriate mitigation, such as the provision of noise barriers/bunds and low noise road surfacing, potential adverse effects may be minimised. Nonetheless, it is considered that there is the potential for significant residual adverse effects to noise sensitive receptors which warrants further assessment.

11.8 Proposed Level and Scope of Assessment

11.8.1 The Proposed Scheme has the potential to directly alter the noise and vibration baseline for numerous sensitive receptors both temporarily (during construction) and permanently (during operation). Therefore, a quantitative assessment of both construction and operational noise and vibration is required in order to establish significant effects and to inform the mitigation strategy. The assessment will therefore be undertaken to a Detailed Level, in accordance with DMRB.

11.9 Proposed Methodology including Significance

11.9.1 The National Policy Statement for National Networks (DfT, 2014) requires that *'due regard'* must be given to relevant sections of the NPPF, the Noise Policy

Statement for England (Defra, 2010) and the associated National Planning Policy Guidance on noise (CLG, 2014a). In order to comply with these documents, it will be necessary to determine Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) for noise impacts. The mitigation strategy will depend upon the magnitude of any impacts at sensitive receptors between LOAEL and SOAEL, in addition to exceedances of SOAEL, which will indicate the occurrence of significant adverse effects.

Construction noise

11.9.2 BS5228–1:2009+A1:2014 (BSI, 2014) does not define strict criteria to determine the significance of noise impacts, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are provided. 'Example Method 2 – 5dB(A) change' (Annex E 'Significance of Noise Effects' Section E.3.3) will be adopted for the assessment of effects at sensitive receptors.

11.9.3 This approach considers the potential changes in ambient noise levels and more appropriately reflects conventional EIA methodologies compared with the use of fixed/absolute noise limits.

Construction vibration

11.9.4 BS5228 'Code of construction practice for noise and vibration control on construction and open sites – Part 2: Vibration' (BSI, 2014) provides guidance on the effect of vibration and the likelihood they will cause complaint and cosmetic damage to buildings. BS 5228 does not indicate whether particular vibrations are significant. However, it does state that: *"It is likely that vibration of... [1.0mm/s]...in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents".*

11.9.5 Generally, vibration from construction activities would be temporary and intermittent in nature. On this basis, in the assessment a PPV of 1.0 mm/s or more would be considered to have the potential to result in a significant adverse impact.

11.9.6 BS 7385 provides guidance on the levels of vibration that would be necessary to cause structural damage to different types of buildings. The Standard indicates that continuous PPVs of more than about 7 mm/s would be required to cause structural damage to residential buildings. Potentially vulnerable buildings and appropriate mitigation will be identified. For residential buildings, limits will be placed based upon levels at which there is a likelihood of complaint, these being considerably lower than those at which building damage may occur.

Operational noise

11.9.7 DMRB HD213/11 describes the impacts of road traffic noise in terms of the noise descriptors conventionally used for assessing the impact of road traffic in the UK, i.e. the statistical noise level $L_{A10,18h}$ over an 18-hour period between 06:00 and 24:00 (the traffic noise index). The Calculation of Road Traffic Noise (CRTN) methodology (HMSO, 1988) will be followed in the calculation of road

traffic noise, which will provide input to assessment of impact using the DMRB methodology.

11.9.8 The level of road traffic noise from the road network will be predicted using traffic data provided in terms of 18-hour annual average weekday traffic (AAWT) flow between the hours of 06:00 to 24:00, along with average vehicle speed and percentage heavy vehicles.

11.9.9 Calculations of the road traffic noise level will be undertaken for four scenarios:

- Do Minimum option in the baseline year.
- Do Minimum option in the future assessment year.
- Do Something option in the baseline year.
- Do Something option in the future assessment year.

11.9.10 In the above scenarios, 'Do Minimum' means traffic growth with committed development only. 'Do Something' means committed growth with the Proposed Scheme.

11.9.11 In accordance with DMRB HD213/11, for a Detailed Level of assessment, the assessment of road traffic noise impacts requires the following comparisons:

- The short-term change in road traffic noise upon Proposed Scheme opening (Do Minimum option in the baseline year vs. Do Something option in the baseline year);
- The long-term change in road traffic noise assuming the Proposed Scheme is built (Do Minimum option in the baseline year vs. Do Something option in the future assessment year).
- The long-term change in road traffic noise assuming the Proposed Scheme is not built (Do Minimum option in the baseline year vs. Do Minimum option in the future assessment year).

Operational Vibration

11.9.12 Low frequency noise from vehicle exhausts may induce vibration (rattle) in light building elements such as windows i.e. airborne vibration. DMRB HD 213/11, para. A5.28 advises that vibration disturbance most closely parallels exposure to traffic noise levels, and that subject to professional judgement relating to conditions under which the research was undertaken, disturbance from vibration may be quantified along similar lines to nuisance from noise (the original research was restricted to properties within 40m of the carriageways where there were no noise barriers or other screening).

11.9.13 DMRB notes that traffic induced vibration is expected to affect a very small percentage of people at noise exposure levels below 58dB L_{A10}.

Summary of Proposed Significance Criteria

11.9.14 Environmental assessment regulations and the NPPF require that the assessment considers the significance of any impacts. These will be considered

on the basis of magnitude and change. NPPF requirements regarding single objective noise-based measures will be based upon those adopted for other recent infrastructure Proposed Schemes.

11.9.15 Table 11.2 summarises proposed LOAEL and SOAEL values. Where values already exceed SOAEL criteria, small increases of 1dB will be regarded as significant whether they occur in the long-term or short-term.

Table 11.2: Summary of Potential Noise and Vibration Effects

ATime Period	Source	Adverse Effect Level	Noise Level
Day	Operational Noise	LOAEL	Free-field 50dB $L_{Aeq,16hr}$
Day		SOAEL	Façade 67.5dB $L_{A10\ 18hr}$
Night		LOAEL	Free-field 45dB $L_{Aeq,\ 8hr}$
Night		SOAEL	Free-field 55dB $L_{night,\ outside}$
Day	Construction noise	LOAEL	Facade 50dB $L_{Aeq,16hr}$
Day		SOAEL	Façade 75dB $L_{Aeq,12hr}$
Night		SOAEL	Facade 55dB $L_{Aeq,\ 8hr}$
Night		LOAEL	Façade 45dB, $L_{Aeq,\ 8hr}$
	Construction Vibration	LOAEL	PPV 0.14mm/s
		SOAEL	PPV 1.0 mm/s

11.10 Conclusion

11.10.1 During construction, the Proposed Scheme has the potential to directly alter the noise and vibration baseline for numerous sensitive receptors for a temporary period. Impacts are likely to be restricted to the vicinity of the Proposed Scheme option envelope, although could extend along elements of the existing road network. Mitigation will be key to minimising adverse impacts. Significant effects are unlikely with an appropriate CEMP and mitigation in place. Nonetheless, A further assessment to a Detailed Level in the form of a quantitative construction noise and vibration assessment is required to inform the mitigation strategy.

11.10.2 For operational noise and vibration effects, whilst there is the potential for beneficial effects for existing NIAs, adverse effects from the introduction of a new noise source and changes to traffic flows would also be likely. As a result, further assessment in the form of road traffic noise predictions is required for sensitive receptors, once traffic data is available. Appropriate mitigation and enhancement would ensure that direct impacts are minimised.

12 People and Communities

12.1 Introduction

12.1.1 This chapter assesses the impacts of the Proposed Scheme on people and communities. The DMRB topic 'People and Communities' is identified within Highways England's Interim Advice Note (IAN) 125/15. This new guidance replaces both the 'Effects on all Travellers' and 'Community and Private Assets' topics from IAN 125/09 and covers effects associated with:

- Non-Motorised Users (NMUs) (pedestrians, cyclists and equestrians)
- Amenity
- Motorised Travellers (MTs) Views from the Road
- Motorised Travellers Driver Stress
- Community Severance
- Local Economy
- Community Land and Community Facilities
- Agricultural Land
- Individual Farm Business
- Development Land
- Demolition of Private Property and Associated Land Take.

12.1.2 The potential requirement for further assessment to either Simple or Detailed level will be identified, and where required, this will be presented within the ES.

12.2 Study Area

12.2.1 No study areas for people and communities are specified in DMRB Volume 11 Section 2 Part 4, and DMRB Volume 11 Section 3 Parts 6, 8 and 9, and therefore the study areas used for this chapter have been defined through professional judgement, based on the type and scale of the Proposed Scheme and the context of the surrounding area. These study areas are considered more than sufficient in terms of identifying the significance of effects in full.

12.2.2 The area within 250m of the Proposed Scheme boundary will be referred to as the Local Impact Area (LIA) and will be the primary study area for this topic. This LIA will be used to assess:

- **NMUs:** The study area will comprise all NMU facilities including Public Rights of Ways (PRoWs), footways, long distance walks and cycle routes within 250m of the Proposed Scheme.
- **Amenity:** The study area will comprise all NMU facilities within 250m of the Proposed Scheme.
- **MTs Driver Stress:** The study area will comprise all roads and connecting roads within 250m of the Proposed Scheme.
- **Community Severance:** The study area will include community facilities and connecting NMU routes within 250m of the Proposed Scheme.

- **Community Land and Community Facilities:** The study area will comprise community facilities and community land within 250m of the Proposed Scheme. Community facilities include schools, healthcare facilities and other community focussed resources. Community Land includes formal facilities such as parks, sports and recreation grounds, children's play areas, outdoor sports facilities, amenity spaces, allotments, cemeteries, and more informal facilities such as natural green spaces.
- **Demolition of Private Property and Associated Land Take:** The study area will consider impacts on private property within 250m of the Proposed Scheme. For this assessment, private property includes residential, industrial, and commercial properties including businesses such as independent shops.
- **Development Land:** The study area will consider unimplemented planning permissions and development allocations within 250m of the Proposed Scheme.
- **Agricultural Land and Individual Farm Business:** The study area will encompass land within 250m of the Proposed Scheme potentially required to accommodate infrastructure.

12.2.3 The study area for MTs View from the Road considers views from the Proposed Scheme in operation only.

12.2.4 The study area for the local economy will be the Unitary Authority of Peterborough. However, because the Proposed Scheme is one of several along the A47, the cumulative impacts of the Proposed Scheme may be felt more widely and as such, the County of Norfolk will also be included. This area is referred to as the Wider Impact Area (WIA).

12.3 Existing and Baseline Knowledge

12.3.1 The Proposed Scheme is located on the outskirts of Peterborough, close to the small towns of Wansford, Stibbington and Sutton.

12.3.2 Table 12.1 summarises the existing baseline, for all people and community topics except for local economy for the Proposed Scheme

Table 12.1: Summary of Existing People and Communities Baseline

Topic	Summary
MTs: Driver Stress	• The A47 is an extremely busy single carriageway road with a speed limit of 60mph. • The section of A47 between Wansford and Sutton is currently a single carriageway. This acts as a bottleneck, resulting in congestion, leading to longer journey times and a poor safety record, which leads to driver stress. • Given the surrounding land use, and the fact that the road is a key link between major conurbations, Heavy Duty Vehicles (HDVs) and large agricultural vehicles are common.

Topic	Summary
	• Fast moving traffic, in significant volumes along the A47 makes emerging from junctions very difficult, leading to driver frustration and stress. Relatively frequent interactions with NMUs exacerbate the perceived danger of using side roads, adding to driver stress. • Driver stress is therefore considered to be high along this stretch of road.
MTs: View from the Road	• The view from the A47 is mostly obscured due to mature verge vegetation. • Where gaps in the vegetation do allow motorised travellers to see beyond the highway boundary, which is mostly to the east of Wansford, views extend further to the north than the south due to the gently sloping topography of the area. These views are predominantly of the surrounding arable agricultural land, interspersed with frequent wooded areas.
NMUs	• There are eight designated PROWs within the study area, all of which are footpaths: o Wansford Nene Way Permissive 1 Section 1 Nene Way (ID: 574) o Wansford Hereward Way Permissive 2 Section 1 Hereward Way (ID: 786) o Wansford Annual Maintenance 113 Section 1 Annual Maintenance (ID: 460) o Wansford Annual Maintenance 113 Section 2 Annual Maintenance (ID: 785) o Wansford Nene Way Permissive 4 Section 1 Nene Way (ID: 784) o Wansford Hereward Way Permissive 3 Section 1 Hereward Way (ID: 787) o Wansford 4 Section 1 (ID: 459) o Sutton Section 1 (ID: 392) • There are undesignated cyclepaths on the roundabouts of the dumbbell junction of the A1/A47 interchange. • NMUs surveys undertaken during February 2017 revealed low usage of the PROWs in the study area.
Amenity	• There are at-grade undesignated crossing facilities for the cyclepaths on the roundabouts of the dumbbell junction of the A1/A47 interchange. • Amenity varies per NMUs facility depending on the barriers between people and traffic and at points where NMUs cross existing roads.
Demolition of Private Property and Associated Land Take	• There are three businesses located in the LIA; a BP petrol station, a Ducati motorcycle salesroom and a Rontec service station with shop. More businesses are located in the villages of Wansford and Sutton. • Residential properties are concentrated primarily in the villages of Wansford and Sutton, with a small number of residential properties located along the route. Two of these residential properties are accessed directly from the A47 and are located within 15 meters of the road.
Community Land and	• There is a picnic area and the Wansford Cricket Green located within the LIA.

Topic	Summary
Community Facilities	• There are no other community facilities located in the LIA, but numerous community facilities are found in Wansford and Sutton, between 500m and 1km from the Proposed Scheme. These include churches (St. Michael and All Angel's Church, Sutton, Parish Church of Saint Mary the Virgin Church, Wansford) community halls (Christie Village Hall and Wansford Community Hall, both in Wansford), medical facilities (Wansford Surgery) and recreational facilities (Wansford cricket green and Sacrewell agricultural education farm).
Community Severance	• No specific baseline information was available for community severance.
Development Land	• The Peterborough Core Development Strategy does not identity any development sites within the LIA. • A list of development sites in the wider area is in the Interim Environmental Assessment Report. These will be reviewed and updated with the latest developments. • Currently there are proposals for the creation of up to four villages in the vicinity of the Proposed Scheme. These plans include the construction of between 1,000 and 1,200 homes and industrial units at a site north of the A47 (between Sutton Heath Road and Lower Lodge Farm), and the construction of 800 to 1,600 homes each on three separate sites (east of Nene Way). As part of the assessment this will be reviewed and updated throughout the EIA process.
Agricultural Land	The following information has been taken from previous assessments and confirmed through the Multi-Agency Geographic Information Service for the Countryside (MAGIC) and the Natural England land capability for agriculture maps: • The above documents state that the quality of the agricultural land for the footprint and 250m buffer zone of the Wansford to Sutton Proposed Scheme varies between grade 4 (poor quality) to grade 2 (very good quality) within the study area. • The occurrences and broad locations of the different grades of agricultural land as defined by Ministry of Agriculture, Fisheries and Food (MAFF) are summarised below. • Grade 4 land is found in the immediate vicinity of the River Nene and the low-lying land immediately either side of the river channel. • Grade 3 located north of the A47. • Grade 2 land is located north and west of Wansford and south of the A47. It should be noted that the maps provided by MAGIC and Natural England are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five grades, as their preparation preceded the subdivision of Grade 3. Further assessment will be required as part of the next phase of works to properly assess the grade of the agricultural land.

Topic	Summary
Individual Farm Business	No information is available on individual farm businesses.

Local Economy Baseline

12.3.3 The English Indices of Deprivation 2015 are commonly used for the measurement and comparison of deprivation between neighbourhoods in England. In terms of deprivation, the neighbourhood that includes Wansford is ranked 23,406 out of 32,844 Lower Super Output Areas (LSOA) in England, with 1 being the most deprived LSOA. Sutton is located in the neighbourhood ranked 22,325. This indicates that Wansford is within the 30% least deprived neighbourhoods in England, and Sutton is within the 40% least deprived neighbourhoods.

12.4 Assumptions and Limitations

12.4.1 This assessment relies on secondary and desk based evidence, using publicly available data and information where available. This information includes strategic documents, Geographical Information Science (GIS) software, and previous design and development.

12.4.2 Data used to define the baseline social and community conditions has been compiled from existing published sources. Assessments are based on the most recent data available for the study areas. The currency of data varies from dataset to dataset depending on how frequently information is collected. Dates for each dataset are noted in the baseline section where available.

12.4.3 To prevent double-counting of significant effects, effects relating to other environmental topics (such as noise and air quality) are not considered in detail as part of this scoping assessment.

12.4.4 Similarly, potential effects on human health are considered as part of those topics which are themselves determinants of health – namely noise, air quality, and, where relevant, within the people and communities chapter. Any potential effects arising for human health are set out in the potential effects section below.

12.4.5 The LIA for property, land and severance effects is based on a 250m boundary from the outer limits of the Proposed Scheme, and not on distances via particular modes (such as walk times), by particular routes, or taking into account man-made and natural barriers (such as major roads, railway lines, or water courses).

12.4.6 The construction strategy, including the construction footprint (Red Line Boundary) and the location of the construction compound for the Proposed Scheme, are currently unknown. Assumptions have been made as it its proposed or recommended content. The full extent of land take (permanent and temporary) during construction is therefore unknown at this stage. A definite figure will be available as the design progresses through detailed design.

12.5 Guidance and Best Practice

12.5.1 People and Communities is identified as a DMRB topic within IAN 125/15 and the assessment will use this to guide the sub-topics considered and the approach to identifying the significance of potential effects.

12.5.2 A further IAN specific to the People and Communities is in development, and the assessment is cognizant of this, even where it is not directly used to inform the assessment approach itself. As a result, and pending new guidance, further assessment required for People and Communities will be assessed using guidance contained within DMRB Volume 11, Section 3 as follows:

- Part 6 – Land Use
- Part 8 – Pedestrians, Cyclists, Equestrians and Community Effects
- Part 9 – Vehicle Travellers

12.5.3 No specific published guidance currently exists for assessing the effects on social and community resources. The assessment approach will be conducted using previous professional experience of undertaking similar reviews on large scale transportation infrastructure.

12.6 Consultation

12.6.1 Further assessment will be informed by the responses to the statutory public consultation that will be undertaken for the Proposed Scheme. In addition, consultation will be required with landowners who have land within the RLB for further assessment on agricultural and individual farm business.

12.7 Potential Effects, Including Monitoring and Mitigation Measures

Construction

NMUs

12.7.1 The Proposed Scheme would have a direct impact on all of the footpaths outlined in Table 12.1, as well as the undesignated cycle paths on the east roundabout of the dumbbell junction with the A1/A47. It would be necessary to temporarily close these amenities to facilitate construction works. This may result in temporary increases in journey times and lengths for NMUs. At this early stage in design, it is considered that appropriate mitigation could be applied, such as the provision of adequate diversions and signage, to ensure these temporary effects would not be significant, especially as the NMUs surveys have revealed a low usage of these PROWs. However, further assessment is required to confirm this.

Amenity

12.7.2 Amenity is likely to be temporarily impacted for users of NMUs facilities during construction through the presence of construction plant, machinery, materials, construction compounds and construction lighting, and diversion routes, whilst there is also potential for barriers and traffic flows to change.

12.7.3 In addition, construction activities may cause indirect effects for NUMs, due to noise, dust and the presence of construction plant, materials, compounds sites and machinery for a temporary period. The effects of such activities are discussed further in Chapter 4 Air Quality, Chapter 6 Landscape and Visual Effects and Chapter 10 Noise and Vibration.

MTs: Driver Stress

12.7.4 During construction, traffic management would be likely to result in temporary reduced speeds and lane closures, which would increase congestion and therefore journey times and driver frustration. This could temporarily increase driver stress for MTs. However, this would be managed through the implementation of a traffic management plan (TMP) and therefore effects are unlikely to be significant. However, further assessment is required to confirm this.

Community Severance

12.7.5 There is the potential that there will be some minor temporary effects to access for Sacrewell Farm during the construction of the overhead structure and associated embankment, which may impact on visitor access to the farm. Alternative access will always be provided. Access to the BP petrol station is also likely to be modified during construction, particularly the construction of a site road, any effects will be assessed, mitigated for and reported in the ES. Following construction, the BP petrol station may be required to alter its access arrangements to link up with the new road layout. This may involve a left in left out arrangement from the westbound A47. There is likely to be temporary closure of the existing southbound A1 layby.

12.7.6 Most of the construction works will occur off line and are not anticipated to impact existing traffic flows.

Community Land and Community Facilities, and Development Land

12.7.7 There are not anticipated to be any effects on community land, community facilities and development land.

Demolition of Private Property and Associated Land Take

12.7.8 It is likely that one residential property will be demolished for the Proposed Scheme. The property is located to the east of the disused railway. This is likely to result in a significant adverse effect on residents.

Local Economy

12.7.9 The Proposed Scheme will require new construction workforce to deliver it. At present, however, no construction strategy for the Proposed Scheme is available. There is currently, therefore, no information on whether the workers required will be new or existing employees of the designated contractor (who is yet to be appointed), the skill levels likely to be required for delivery, and whether those workers can and will be drawn from the LIA or WIA. If the Proposed Scheme results in new employment in the area, then this could have

a slight beneficial impact on employment rates. However, because of the size of the Proposed Scheme, this effect is unlikely to be significant.

12.7.10 For the duration of the construction phase, approximately 16 months, there will be construction workers on-site. It is anticipated that there would be a slight and indirect temporary beneficial impact on the local economy as a result of these workers using local hospitality and catering establishments, for example around mealtimes. This effect is also unlikely to be significant as any uplift would be minor for a scheme of this size.

Agricultural Land and Individual Farm Business

12.7.11 Temporary land-take can be defined as the land within the Proposed Scheme footprint required during the construction phase only (e.g. for access and construction compounds). Temporary land should be re-instated and restored to the baseline conditions and returned to the landowner before the Proposed Scheme becomes operational.

12.7.12 Permanent land-take can be defined as the land within the Proposed Scheme footprint required for the construction phase and retained for the operational phase of the proposed Scheme.

12.7.13 The Proposed Scheme is likely to require both temporary and permanent land-take of some grade 2 (very good quality), a small proportion of grade 3 (good to moderate quality) and some grade 4 (poor quality) agricultural land. Grade 2 agricultural land is categorised as the Best Most Versatile (BMV) agricultural land, therefore the permanent and temporary land-take of this land required for the construction of the Proposed Scheme, as well as the land-take of grade 3 and grade 4 agricultural land, has the potential to have significant adverse effects during construction.

12.7.14 The overall land-take, both temporary and permanent is currently unknown. For temporary land-take, the mitigation measures for agricultural land would require the re-instatement of the area to the same quality as measured pre-construction phase, before it is returned to the landowner. For permanent land-take, the mitigation measures for agricultural land would require the provision of alternative land or financial compensation. It is assumed that alternative means of access will be provided where existing access points are disrupted by the Proposed Scheme. It is also assumed that hedgerows, field boundaries, water supplies and existing field drainage infrastructure will be re-instated where effects are sustained as a result of operation.

12.7.15 The Proposed Scheme would also require land-take (temporary and permanent) of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. For temporary land-take, this would result in the potential for significant adverse impacts for landowners for a temporary period during the construction phase. For permanent land-take, this would result in the potential for permanent significant adverse effects for landowners. For individual farm businesses affected by permanent land-take (e.g. alterations in farm husbandry, field severance and changes in farm access etc.), where possible, mitigation

measures would include the provision of new agricultural land of the same classification with an alternative means of access, or financial compensation.

12.7.16 The construction footprint (RLB) and the locations of the construction compounds are currently undefined, therefore the full extent of land-take (permanent or temporary) during construction is unknown at this stage. A definite figure will be available as the detailed design of the Proposed Scheme

Operation

NMUs

12.7.17 Numerous NMUs facilities may be permanently affected, however, this opens up the potential for the Proposed Scheme to deliver NMU enhancement opportunities through the provision of new or improved facilities. New routes have the potential to reduce or increase journey times for walkers, cyclists and horseriders. Further assessment informed by further detailed design information and an appropriate NMUs strategy is required to confirm this.

Amenity

12.7.18 The changes to the NMUs facilities may result in a change in amenity for walkers, cyclists and horseriders, through a change in barriers or traffic flows along roads which NMUs travel alongside.

MTs: Driver Stress

12.7.19 It is anticipated that driver stress on the A47 would be reduced as a result of the Proposed Scheme. The A47 between Wansford and Sutton would become a dual carriageway which would relieve congestion allowing for a more free-flow network, reduce journey times and allow for safe overtaking of slower vehicles. This would all contribute towards reducing driver stress.

MTs: View from the Road

12.7.20 Views from the road are likely to change slightly as the new carriageway would be a dual carriageway and would be constructed slightly off-line to the north and south of the existing A47 carriageway. Landscape mitigation measures, such as tree planting is likely to shield views from the road for MTs, however in the absence of a landscape design at this stage, it is not possible to confirm this conclusion. Further assessment will be required to assess the change in the view from the road for MTs.

Community Severance

12.7.21 Once the Proposed Scheme is operational there may be some severance to pedestrians crossing the new road. The effects of this will be reduced by the under bridge that would be constructed.

Community Land and Community Facilities, Development Land, and Demolition of Private Property and Associated Land Take

12.7.22 There will be permanent land take as a result of the Proposed Scheme. This is discussed in the construction stage impacts (Section 12.7). This will affect private residential property, and agricultural land (which is discussed in Section 12.8.7-12.8.9).

Local Economy

12.7.23 Direct operational employment is not expected to be created as a result of the Proposed Scheme. However, there are likely to be increased indirect employment opportunities related to reduced congestion and improved journey times. Alone these are likely to be minor, but may be significant when viewed cumulatively alongside other schemes being undertaken on the A47. These are likely to be felt throughout Norfolk.

Agricultural Land and Individual Farm Business

12.7.24 During the operational phase, the Proposed Scheme would require permanent land-take of some grade 2 (very good quality), a small proportion of grade 3 (good to moderate quality) and some grade 4 (poor quality) agricultural land. Grade 2 agricultural land is categorised as the Best Most Versatile (BMV) agricultural land, therefore permanent land-take of this as well as the land-take of grade 3 and grade 4 agricultural land, has the potential to have significant adverse effects during operation.

12.7.25 The effects and impacts to landowners caused by temporary land-take are alleviated during the operational phase of the Proposed Scheme, as the land is re-instated and returned to the land owner. The overall amount of permanent land-take required is currently unknown. For permanent land-take, the mitigation measures for agricultural land would require the provision of alternative land, or financial compensation. It is assumed that alternative means of access will be provided where existing access points are disrupted by the Proposed Scheme.

12.7.26 The Proposed Scheme would also require permanent land-take of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. The effects and impacts to landowners caused by temporary land-take are alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner. For individual farm businesses affected by permanent land-take (e.g. alterations in farm husbandry, field severance and changes in farm access etc.), where possible, mitigation measures would include the provision of new agricultural land of the same classification with an alternative means of access, or financial compensation.

Summary

12.7.27 Table 12.2 provides a summary of potential construction and operational stage effects on people and communities for the Proposed Scheme.

Table 12.2: Summary of Potential People and Communities Effects

Topic	Summary
NMUs	Construction: NMUs facilities are likely to be temporarily affected. However, with appropriate mitigation measures, effects are unlikely to be significant. Operation: NMUs facilities would be permanently affected. An appropriate NMUs strategy will be developed during the EIA process to ensure no significant effects to NMUs.
Amenity	Construction: Temporary direct effects upon amenity due to changes in exposure to traffic and presence of construction activity for walkers, cyclists and horseriders. With appropriate mitigation, these effects are unlikely to be significant. Operation: NMUs facilities would be directly affected through changes to barriers and traffic flows.
MTs: Driver Stress	Construction: Driver stress for MTs would increase with changes in traffic flows and speeds, however these effects are unlikely to be significant with the implementation of a TMP. Operation: Relief from congestion and improvements in journey times would reduce driver stress. Benefits are therefore predicted.
MTs: View from the Road	Operation: Views are likely to change slightly due to the alignment of the new dual carriageway and new landscape planting.
Community Severance	Construction: Temporary access alterations to Sacrewell Farm during the construction of the overhead structure and associated embankment, which may impact on visitor access to the farm. Operation: Following construction, the BP petrol station may be required to alter its access arrangements to link up with the new road layout. This may involve a left in - left out arrangement from the westbound A47.
Community Land and Community Facilities	Construction and operation: Community facilities are not likely to be directly affected by the Proposed Scheme.
Development Land	Construction and Operation: There are not likely to be any direct effects on development land.
Demolition of Private Property and Associated Land Take	Construction and operation: It is likely that one residential property will be demolished for the Proposed Scheme. There will be permanent land take in order to construct the new dual carriageway to the south of the A47. This will affect private residential property.

Topic	Summary
Local Economy	Construction: The Proposed Scheme will require new construction workforce to deliver it. At present, no construction strategy for the Proposed Scheme is available. There is currently, therefore, no information on whether the workers required will be new or existing employees of the designated contractor. Operation: Direct operational employment is not expected to be created as a result of the Proposed Scheme. However, there are likely to be increased indirect employment opportunities.
Agricultural Land	Construction: Both temporary and permanent land-take (grade 2- very good, grade 3- good to moderate and grade 4- poor quality agricultural land) are required for the Proposed Scheme. Operation: Permanent agricultural land-take would be required to accommodate the new road layout, and therefore the Proposed Scheme has the potential to have significant effects on agricultural land.
Individual Farm Business	Construction and operation: Individual farm businesses would experience the permanent and temporary land-take of agricultural land of grade 2 (very good quality), grade 3 (good to moderate quality) and grade 4 (poor quality). Temporary land-take is required to accommodate construction compounds and access during the construction phase. Permanent land-take is required for the new road layout during the construction and operational phases. This land-take has the potential to have significant effects.

12.8 Proposed Level and Scope of Assessment

12.8.1 Further assessment is required for NMUs, amenity, and MTs driver stress during both construction and operation, and for MTs view from the road during operation to a Simple Level.

12.8.2 Due to the potential for significant effects, assessment is required for agricultural land and individual farm businesses to a Simple Level during construction and operation.

12.8.3 In addition, due to the potential for significant effects, further Detailed Level assessment is required to explore the impacts of the Proposed Scheme on community land and community facilities, development land, private property and associated land take, community severance, and local economy.

12.9 Proposed Methodology including Significance

NMUs

12.9.1 The assessment of effects of the Proposed Scheme on non-motorised users NMUs will be undertaken using the guidance contained within the DMRB Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and by applying professional judgement. The assessment will examine the likely detriment or improvement to NMUs journeys, including changes to journey length and quality of a journey.

Amenity

12.9.2 Amenity is described as the “relative attractiveness or pleasantness of a route or place” in DMRB 11.3.8 and as such, the assessment will consider all relevant NMU routes within the study area. Changes to the degree and duration of people’s exposure to traffic, fear or safety for people or existing barriers between pedestrians and vehicle traffic, footpath width, distance from traffic and any crossing facilities within the study area will also be considered. Exposure to noise, dirt and air quality and impacts relating to visual intrusion are also relevant to amenity but will not be included in the assessment, as these impacts are appropriately covered in Chapter 10 Noise and Vibration, Chapter 3 Air Quality, and Chapter 6 Landscape.

MTs: View from the Road

12.9.3 DMRB 11.3.9 considers that the existence of a new road may enable more people to see the surrounding landscape than before or require people to pass through visually unattractive areas. Route selection has potential to allow travellers to appreciate the wider area and their location in relation to distinctive landscape features through new appropriate views, although characteristics of the new road that may also intrude on views. The view from the road assessment will provide a qualitative overview of the views afforded by the Proposed Scheme however, consideration will not be given to the existing conditions experienced by motorised travellers or construction stage effects, as DMRB considers only impacts for the new road. A description will also be

provided for traveller's exposure to different types of scenery through which the routes pass, using the four categories below:

- No view – road in deep cutting or contained by earth bunds, environmental barriers or adjacent structures.
- Restricted view – frequent cuttings or structures blocking the view.
- Intermittent view – road generally at ground level but with shallow cuttings or barriers at intervals
- Open view – view extending over many miles, or only restricted by existing landscape features

MTs: Driver Stress

12.9.4 The assessment of effects of the Proposed Scheme on driver stress will be undertaken using the guidance contained within DMRB Volume 11.3.9. DMRB considers that Driver Stress has three components: frustration, fear of potential accidents and route uncertainty. A qualitative overview will be provided for construction and operation periods applying the three-point descriptive scale (Low, Moderate or High) in line with DMRB 11.3.9.4. The construction driver stress assessment will consider the likely scope of works and will consider potential changes to traffic flows, speeds and congestion for roads within the study area, when compared with the baseline. The operational driver stress assessment will use the traffic model and consider changes in traffic flows and speeds with or without the Proposed Scheme scenarios in the first 15 years after opening.

Community Severance, Community Land and Community Facilities, Development Land, Demolition of Private Properties and Associated Land Take, and Local Economy

12.9.5 Further assessment will be undertaken in accordance with DMRB Volume 11.3.6 and 11.3.9, and will consider both direct and indirect effects arising as a result of the construction and operation of the Proposed Scheme. This involves identifying social and community resources in the study area, as well as receptors relevant to the topic, and then identifying the activities relating to the Proposed Scheme that could have an effect on those receptors and resources.

12.9.6 Social and community receptors include:

- Residents in the immediate area of the Proposed Scheme
- Landowners in the immediate area of the Proposed Scheme
- Local employers and businesses in the area
- Employees and job-seekers, particularly those who live locally
- Users of community facilities in nearby villages, such as educational establishments, health facilities, recreational facilities, places of worship and public transport

12.9.7 Social and community resources include existing and potential:

- Residential, business, community and development land affected by the Proposed Scheme, construction works, and compounds.,
- Community facilities and services including, for example, public transport, hospitals and community health facilities, primary and secondary schools, nurseries, places of worship and leisure and recreation services.

Agricultural Land and Individual Farm Businesses

12.9.8 Further assessment will need to be undertaken in accordance with DMRB Volume 11, Section 3, Part 6 (Amendment No 1): 'Land Use', and will consider both direct and indirect effects arising as a result of the construction and operation of the Proposed Scheme. As outlined in the DMRB, the Ministry of Agriculture Fisheries and Food (MAFF), has classified agricultural land in England and Wales by grade according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use for food production.

12.9.9 The quality of the agricultural land, within the study area varies between Grade 4 (poor quality) to Grade 2 (very good quality). The occurrences and broad locations of the different grades of agricultural land as defined by MAFF are summarised as follows: grade 4 land is found in the immediate vicinity of the River Nene and the low-lying land immediately either side of the river channel; Grade 3 located north of the A47; and, grade 2 land is located north and west of Wansford and south of the A47. This information has been taken from the previous assessment and confirmed through the MAGIC and the Natural England Land Capability for Agriculture maps and shall be refined as part of our assessment work.

12.9.10 It should be noted that the maps provided by MAGIC and Natural England are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five grades, as their preparation preceded the subdivision of Grade 3.

12.9.11 Based on the information above, it will be required to undertake an Agricultural Land Classification Survey and Soil Resource Survey. The methodology required to be followed for both are set out below.

12.9.12 The purpose of the Agricultural Land Classification survey is to categorise the agricultural land at the site in accordance with the Agricultural Land Classification for England and Wales (MAFF, 1988). This will determine whether it qualifies as the "best and most versatile" (BMV) land as defined in the National Planning Policy Framework (NPPF). The MAFF ALC system classifies land into five grades numbers one to five, with Grade 3 divided into sub-grades; 3a and 3b. BMV agricultural land falls into Grades 1, 2 and Sub-grade 3a. This land ranges from Excellent (Grade 1) to Good quality (Sub-grade 3a) and is the most flexible, productive and efficient in response to inputs. Land in sub-grade 3b is of Moderate quality with lower yields, and/or a more restrictive cropping range. Grades 4 and 5 are Poor and Very Poor quality respectively, with severe or very severe limitations. The survey work required for an ALC shall be

conducted in accordance with DEFRA (2009) and British Standards BS3882:2015 and BS8601:2013. The survey requires an examination of the local topography, surface conditions and climatic data in addition to intrusive soil inspections, using a combination of hand augers and trial pits.

12.9.13 The purpose of the Soil Resource Survey and Suitability Assessment (SRS) is to further classify the soils of the site and to identify potential topsoil and subsoil resources present within the red line boundary and assess their suitability for off-site sale, on-site re-use in landscaping and on-site re-use in the restoration of temporary areas of agricultural land required for the construction phase of the Proposed Scheme. The SRS component of this work shall be conducted in accordance with DEFRA (2009) Section 2.1 Paragraph 18 and Section 4.1 and British Standards BS3882:2015 and BS8601:2013. This shall be based on existing field boundaries and differences in land-use and vegetation cover likely to influence soil properties.

12.9.14 The fieldwork required for an ALC and SRS survey shall be conducted at the same time, with a minimum density of one observation per hectare based on a rectilinear grid needed. A 70mm diameter (Edleman) hand auger shall be used to log and sample these locations to a depth of 1.2m (or until an impenetrable layer is encountered after three attempts in a location). Soil material shall be brought to the surface in 200mm auger segments for inspection and logging. Each excavated auger profile shall be photographed and horizon depths recorded to 100mm accuracy.

12.9.15 Soil inspection pits allow the soil horizons identified by hand auger to be examined in greater detail and photographed. The frequency of the soil inspection pits would be related to the number of different soil types encountered in the auger profiles within the order of one pit per soil type being excavated. Where required, soil pits should be dug to a depth of 1.2m (or until an impenetrable layer is encountered).

12.9.16 Soil profile observations shall be supplemented by observation of field conditions (e.g. relief, vegetation cover etc.) and desk study data. Soil properties shall be recorded in the field according to the Soil Survey Field Handbook (Hodgson, 1997) which provides the standard criteria for soil description. Soil matrix colour, mottles, organic matter, texture, stoniness, water state, structure, consistence and plant root characteristics shall be logged on-site for each horizon observed.

12.9.17 All auger holes and observation pits will be in-filled and re-instated immediately. Access shall be agreed with landowners in advance of any survey work.

12.9.18 Samples shall be collected in the field at each observation location for every soil profile in accordance with BS3882:2015 (topsoil) and BS8601:2013 (subsoil). These samples shall be submitted to a UKAS accredited laboratory for analysis according to BS3882:2015 and BS8601:2013. The analyses shall include:

- Soil texture
- Organic matter content
- Soil pH

- Plant nutrient content
- Electrical conductivity
- Potentially phytotoxic elements
- Visible contaminants
- Sharp contents

12.9.19 The combination of the field observations, soil profiles, climatic data and sample testing to BS3882:2015 and BS8601:2013 results allow for the land to be Graded to ALC Classifications and for the soil resources on-site to be identified. A report shall be produced identifying the ALC Classification and soil resources of the site.

12.9.20 The results of the SRS shall inform the Soil Management Plan (SMP). DEFRA (2009) state:

12.9.21 “A Soil Resource Plan (SRP) (or SMP) should be produced on all construction sites where re-usable reserves of topsoil and/or subsoil have been identified.”

12.9.22 The purpose of a SMP is to set out how soils are to be managed on-site, ensure the quality of the soil resources on-site are maintained during construction and ensure temporary land-take of agricultural land is restored satisfactorily upon return to the landowner. The SMP shall require site inspections throughout the construction phase to allow for observations of the soil management on-site.

12.9.23 The DMRB also outlines the assessment of effects on individual farm businesses. It considers land-take, changes in land quality, alterations in farm husbandry, field severance and changes in farm access likely to be imposed on individual farm businesses as a result of the Proposed Scheme. These are aspects which would be undertaken during the EIA process through an agricultural land questionnaire to specific identified farms. The assessment of effects on individual farm businesses will therefore be limited to the size and ALC grade of severed or potentially affected farms.

12.9.24 The assessment will be carried out by working directly with affected landowners, and their agents where appropriate. Questionnaires will be distributed to land users whose land is identified within the area of influence of the Proposed Scheme. These will be followed with direct communications, to discuss farm-specific operations, husbandry requirements and mitigation options. An ALC survey will also be conducted pre-construction to determine the quality and Grade of the effected agricultural land from the Proposed Scheme.

12.9.25 This information will be combined with local land registry data on the location and size of land holdings to construct a profile of baseline agricultural conditions on each farm. The area of land-take (both temporary and permanent) will then be calculated for each farm business, both in absolute terms and as percentage of the total area of land utilised by the farm business.

Significance of Effects

NMUs*, Amenity, and MTs*

12.9.26 Criteria defining significance of effects are not outlined within DMRB Volume 11 Section 3 Part 8 or Part 9. However, DMRB Volume 11 Section 2 Part 5 provides an approach to determining significance of effects as outlined in Table 12.3. The significance of effects for each effect category have been assigned interpreting the guidance from DMRB and using professional judgement.

Table 12.3: Descriptors of the Significance of Effect Categories

Significance Category	Typical Descriptors of Effect
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 features 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 may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effects 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.

Source: DMRB Volume 11 Section 2 Part 5

12.9.27 Interpreting the guidance from DMRB, the effect categories have been allocated the following significance (Table 12.4). All NMUs are highly sensitive to change and are considered to be highly valued. Therefore, the descriptors included in the magnitude of change table also correspond to the overall significance of effects for both NMUs (refer to Table 12.5) and amenity (refer Table 12.6).

12.9.28 Views from the road assesses only views from the new road in operation, and therefore value, magnitude and significance of effects are not taken into account. A Low, Moderate and High descriptive scale is used to provide a description on driver stress changes from the baseline for motorised travellers in line with DMRB 11.3.9.4 (refer to Table 12.7 and Table 12.8).

Table 12.4: Value, Magnitude and Significance Assigned to the Effect Categories

Effect Category	Value	Magnitude	Significance
NMUs	High	Negligible, Minor, Moderate or Major (depending on the scale of severance).	Slight, Moderate, Large or Very Large (depending on value and magnitude).
Amenity	High	Dependant on changes to traffic flows and facilities.	Slight, Moderate, Large or Very Large (depending on value and magnitude).

Effect Category	Value	Magnitude	Significance
MTs: Views from the Road	N/A	N/A	N/A – only considers views from the new road in operation.
MTs: Driver Stress	Low	Low, Moderate or high (considers change in stress on individual roads from the baseline).	Neutral, Slight or Moderate or Large (depending on overall change from baseline in study area).

Table 12.5: Impacts and Magnitude of Change on NMUs

Description of impacts on non-motorised users	Magnitude
Substantially improve NMUs network through the provision of new amenities for NMUs where none existed previously. Length of journeys decreased by over 500m.	Major Beneficial
Improve existing NMUs network through the provision of new amenities for pedestrians and cyclists where few or none existed previously. Length of journeys decreased by 250-500m.	Moderate Beneficial
Improve existing NMUs network through the upgrading of existing amenities or provision of new amenities for NMUs where some already exist. Length of journeys decreased by up to 250m.	Minor Beneficial
Length of journeys not materially changed.	Negligible Beneficial
No change to journey length.	No Change
Length of journeys not materially changed.	Negligible Adverse
Improvements to existing NMUs amenities are not provided. Length of journeys increased by up to 250m.	Minor Adverse
Existing NMUs facilities are degraded. Length of journeys increased by 250-500m.	Moderate Adverse
Closure/ removal of NMUs amenities where they previously existed. Length of journey journeys increased by over 500m.	Major Adverse

Source: Derived by professional judgement and based on DMRB 11.3.8 Chapter 6

Table 12.6: Impacts and Magnitude of Change on Amenity

Description of impacts on amenity	Magnitude
Substantial improvement to NMUs network through the provision of new amenities for pedestrians and cyclists where none existed previously.	Major Beneficial
Improvement to a greater degree than Slight (determined through professional judgement) for the existing NMUs network through the provision of new amenities for pedestrians and cyclists where few or none existed previously.	Moderate Beneficial
Improve existing NMUs network through the provision of new amenities for pedestrians and cyclists where few or none existed previously.	Minor Beneficial
No change in facilities.	No Change
Pedestrian at grade crossing of a new road carrying below 8,000 vehicles per day (AADT). A new bridge would need to be climbed or a subway traversed.	Minor Adverse
Pedestrian at grade crossing of a new road carrying between 8,000-16000 vehicles per day (AADT) in the opening year.	Moderate Adverse

Description of impacts on amenity	Magnitude
Pedestrian at grade crossing of a new road more than 16,000 vehicles per day (AADT) in the opening year.	Major Adverse
Description of impacts on amenity.	Magnitude
Substantial improvement to NMUs network through the provision of new amenities for pedestrians and cyclists where none existed previously.	Major Beneficial

Source: Derived by professional judgement and based on DMRB 11.3.8 Chapter 6

Table 12.7: Driver Stress from Traffic Flow for Dual carriageway Roads

Average peak hourly flow per lane, in flow Units/1 hour	Average Journey Speed Km/hr		
	Under 60	60-80	Over 80
Under 1200	Moderate (urban area)	Moderate	Low
1200 – 1600	High	Moderate	Moderate
Over 1600	High	High	High

Source: DMRB 11.3.9, Table 2

Table 12.8: Driver Stress from Traffic Flow for Single carriageway Roads

Average peak hourly flow per lane, in flow Units/1 hour	Average Journey Speed Km/hr		
	Under 50	50-70	Over 70
Under 600	Moderate (urban area)	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High

Source: DMRB 11.3.9, Table 3

Demolition of Private Properties and Associated Land Take, Community Severance, Community Land and Community Facilities, Development Land, and Local Economy

12.9.29 The sensitivity of these receptors and resources is governed by their capacity to absorb proposed changes arising from the Proposed Scheme. It ultimately reflects their vulnerability to the impacts of the proposed activities and their access to additional or alternative resources of a similar nature. If a resource is frequently used, if few alternatives exist, or if receptors have limited capacity to absorb the changes arising from the Proposed Scheme, that receptor is considered to be sensitive to the changes. Criteria describing the sensitivity of receptors are identified in Table 12.9.

Table 12.9: Socio-Economic Sensitivity Criteria

Sensitivity	
High	• An already vulnerable receptor with very little capacity and means to absorb changes. • No alternative facilities, access arrangements or opportunities are available within an easily accessible distance. • A highly or frequently accessed resource.
Medium	• A non-vulnerable receptor with limited capacity and means to absorb changes. • A limited range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance. • A moderately, or-semi-frequently accessed resource.
Low	• A non-vulnerable receptor with sufficient capacity and means to absorb changes. • A wide range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance. • An infrequently accessed resource.

12.9.30 To assess the magnitude of an impact on these receptors and resources, each impact arising is assessed in terms of the following indicators:

- Spatial scope – whether impacts are likely to be felt within the Proposed Scheme boundary, within the LIA or WIA (Cambridgeshire), or more widely
- Extent – how many social and community resources and receptors are likely to be impacted
- Duration – whether the impacts would be short or long-term
- Reversibility – whether the impact is permanent or temporary

12.9.31 Taking these indicators into consideration, and also any mitigation measures that can be applied; the criteria are used as guidelines to assess the magnitude of each impact. This is described in more detail in Table 12.10.

Table 12.10: Socio-Economic and Community Impact Magnitude Criteria

Magnitude	Criteria guidelines
Major	• Affects receptors within the WIA and beyond. • Affects the well-being of many receptors (or the well-being of a few receptors in an acute way for an extended period). • Affects receptors for an extended period (e.g. the majority of the construction period or is permanent). • Requires considerable intervention to return to the baseline.
Moderate	• Affects either the well-being of receptors beyond the site boundary into the LIA. • Affects the well-being of a moderate number of receptors. • Continues over a number of years, but the baseline is re-established quickly. • May require some intervention to return to the baseline conditions.
Minor	• Affects the well-being of a small number of receptors. • Occurs exceptionally, mostly within the site boundary. • Does not extend beyond the life of the Proposed Scheme (the end of the construction period or first year of operation). • Baseline returns naturally or with limited intervention within a short timescale.
Negligible	• Localised to a specific location within the site. • Temporary or unlikely to result in detectable impact on the well-being of people or a socio-economic resource. • Considered to be a risk that is manageable with intervention. • Baseline remains consistent.

12.9.32 The significance of any potential effects is evaluated by combining the assessment of magnitude of each impact and the sensitivity of the receptor or resource; effects can be beneficial or adverse. Each type of effect is then determined to be either significant or not significant, as shown in Table 12.11.

Table 12.11: Evaluation of significance of effects

		Sensitivity of receptor		
		Low	Medium	High
Magnitude of impact	Negligible	Not significant	Not significant	Not significant
	Minor	Not significant	Not significant	Significant
	Moderate	Not significant	Significant	Significant
	Major	Significant	Significant	Significant

Agricultural Land and Individual Farm Businesses

12.9.33 Criteria defining significance of effects are not outlined within DMRB Volume 11 Section 3 Part 6 (amendment number one): 'Land Use'. The significance of effect for agricultural land and individual farm businesses have been assigned interpreting the guidance from DMRB and using professional judgement.

12.9.34 The significance of effects on agricultural land and individual farm businesses will be determined in accordance with Table 12.12.

Table 12.12: Significance of effects table: value, magnitude and significance assigned to the effect categories.

Effect Category	Value	Magnitude	Significance
Agricultural Land	Dependent on Agricultural Land Classification (refer to Table 12.13).	Dependent on the area of land lost (refer to Table 12.14).	Slight, Moderate or Large (depending on value and magnitude) (refer to Table 12.15).
Individual Farm Businesses	Dependent on area of land-take (refer to Table 12.16).	Dependent on the proportion of land lost to the business (refer to Table 12.17)	Slight, Moderate or Large (depending on value and magnitude) (refer to Table 12.18).

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

Table 12.13: Value assigned to the assessment of agricultural land based on the ALC grading criteria.

Value	Grade
High	1, 2 and 3a
Medium	3b
Low	4 and 5

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

Table 12.14: Magnitude of impact assigned to the assessment of agricultural land based on the ALC grading criteria and area of land take.

	Land Take		
Grade	**>20ha**	**<20ha**	**Indirect**
1, 2 and 3a	Major	Moderate	Minor
3b	Moderate	Minor	Minor
4 and 5	Minor	Minor	Minor

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

Table 12.15: Overall effect assigned to the assessment of agricultural land based on the ALC grading criteria and area of land take.

	Magnitude		
Value	**Major**	**Moderate**	**Minor**
High	Large Adverse	Moderate Adverse	Slight Adverse
Medium	Moderate Adverse	Slight Adverse	Slight Adverse
Low	Slight Adverse	Slight Adverse	Slight Adverse

Source: Derived by professional judgement and based on DMRB 11.3.6. Chapters 6-10.

Table 12.16: Value assigned to the assessment of individual farm businesses, which is based on the area of land take.

Value	Receptor
High	Total area <20ha AND / OR limited or highly specific range of high-value crops / livestock and low operational flexibility
Medium	Total area 20-50ha AND / OR some diversification or range of crop / livestock types
Low	Total area >50ha AND /OR highly diversified income and flexible management

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

Table 12.17: Magnitude of impact assigned to the assessment of individual farm businesses, which is based on proportion of land lost.

Receptor	Magnitude		
	25% permanent land lost and / or access severely severed	**10-24% permanent land lost and / or access partially severed**	**Indirect 1-9% permanent land lost and / or minor access severed**
Total area <20ha AND / OR limited or highly specific range of high-value crops / livestock and low operational flexibility	Major	Moderate or Major	Minor or Moderate
Total area 20-50ha AND / OR some diversification or range of crop / livestock types	Moderate or Major	Moderate	Slight
Total area >50ha AND / OR highly diversified income and flexibility management	Minor or Moderate	Minor	Neutral or Mino

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

Table 12.18: Significance of effect from the value and magnitude assigned to the assessment of individual farm businesses, which is based on the area of land take and proportion of land lost.

Value	Magnitude		
	Major	**Moderate**	**Minor**
High	Large Adverse	Moderate or Large Adverse	Slight or Moderate Adverse
Medium	Moderate or Large Adverse	Moderate Adverse	Slight Adverse
Low	Slight or Moderate Adverse	Slight Adverse	Neutral or Slight Adverse

Source: Derived by professional judgement and based on DMRB 11.3.6 Chapters 6-10.

12.10 Conclusion

NMUs, Amenity, and MTs

12.10.1 NMUs are likely to be directly affected through changes to NMUs amenities, resulting in changes to journey lengths and times and the amenity of journeys. It is assumed that appropriate diversions and signage would be implemented during construction, and an appropriate NMUs strategy would be developed incorporating new/upgraded facilities into the detailed design, to ensure that effects are not significant.

12.10.2 Driver stress is likely to increase for MTs during construction due to an increase in congestion and reduced speeds, however, it is assumed that this can be

appropriately managed through the implementation of a TMP to ensure effects are not significant. Driver stress would reduce during operation due to the relief from congestion and improvement in journey times.

12.10.3 Further assessment is therefore required for NMUs, amenity, and MTs driver stress, both construction and operation, and for MTs view from the road during operation to a DMRB Detailed Level.

Community Severance, Community Land and Community Facilities, Development Land, Demolition of Private Property and Associated Land Take, and Local Economy

12.10.4 The Proposed Scheme is likely to result in a number of effects on social and community receptors during construction and operation. In particular the demolition of a residential property may give rise to potentially significant effects.

12.10.5 There may be both temporary and permanent access alterations to Sacrewell Farm and the BP petrol station.

12.10.6 There are also likely to be a number of beneficial effects during construction and operation including the creation of temporary construction employment and the potential for a contribution to significant economic benefits arising from the overall programme of work scheduled for the A47 of which the Proposed Scheme is a part.

12.10.7 There are unlikely to be any significant effects on community land and community facilities, and development land, however further assessment is required to confirm this conclusion.

12.10.8 Further assessment is therefore required for property demolition and associated land take, community severance, community land and community facilities, development land, and local economy during both construction and operation.

Agricultural Land and Individual Farm Businesses

12.10.9 During the construction and operation phase of the Proposed Scheme, permanent and temporary land-take will be required from the BMV (Grade 2) and Grades 3 and 4 agricultural land which shall also impact on the individual farm businesses.

12.10.10 Further assessment is therefore required for agricultural land, including individual farm businesses during construction and operation as there is potential for significant effects to result from the Proposed Scheme.

Summary of Further Assessment Requirements

12.10.11 Table 12.19 below outlines the level of further assessment required for each sub-topic of People and Communities scoped into further assessment.

Table 12.19 Level of Further Assessment Required

People and Communities Sub-Topic	Level of Assessment Required
NMUs	Simple
Amenity	Simple
MTs Driver Stress	Simple
MTs View from the Road (Operation only)	Simple
Community Severance	Detailed
Community Land and Community Facilities	Simple
Development Land	Simple
Demolition of Private Property and Associated Land Take	Detailed
Local Economy	Detailed
Agricultural Land and Individual Farm Business	Detailed

13 Road Drainage and the Water Environment

13.1 Introduction

13.1.1 This chapter considers existing environmental baseline information for Road Drainage and the Water Environment alongside the proposed scope of assessment and assessment methodologies. This chapter also addresses the potential effects as a result of the construction and operation of the Proposed Scheme on the Road Drainage and the Water Environment topic. It has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 10, to a Scoping Level. The topic incorporates surface water and groundwater, water resources and flood risk. This chapter identifies the key impacts, describes the study area and key receptors. The potential requirement for further assessment to either Simple or Detailed level will be identified. Where required, this will be presented within the ES.

13.2 Study Area

13.2.1 The study area encompasses a number of water features within a 1km area around the Proposed Scheme. This is extended where there are features that may be affected by pollutants transported downstream of the Proposed Scheme, and therefore these features would be included in the assessment as appropriate.

13.3 Existing and Baseline Knowledge

13.3.1 Baseline information for the study area, including hydrology, water features and WFD waterbodies and water dependent designated conservation sites, is summarised in Table 13.1.

Table 13.1: Summary of Existing Road Drainage and the Water Environment Baseline

	Summary of Existing Baseline
Surface water	• The Proposed Scheme lies within the Anglian River Basin District, adjacent to a meander in the River Nene. • There are various water features located within the vicinity of the Proposed Scheme, including 29 small lakes and ponds in the neighbouring fields and ten drainage channels. • The River Nene is present immediately to the south of the Proposed Scheme and flows in an easterly direction. Several large off-line lakes and drainage ditches are present to the south of the main channel. • Under the Water Framework Directive (WFD) the River Nene (Islip to tidal) is a heavily modified watercourse, currently with good chemical water quality, good overall biological quality, with good fish and good macro-invertebrates and a current overall status of moderate ecological potential.

	Summary of Existing Baseline
	• The Wittering Brook flows in a southerly direction through the Sutton and Heath Bog SSSI and under the A47 before converging with the River Nene. There are approximately five drainage channels and 12 ponds located adjacent to this watercourse. • The Wittering Brook currently has (under WFD) good chemical water quality, moderate ecological quality and a moderate overall ecological status. • There are three southward flowing drainage channels located to the north of the A47, east of The Drift. Two of these are culverted beneath the A47 and the easternmost flows into a pond, which lies within the footprint of the Proposed Scheme. • The Mill stream flows in an easterly direction, approximately 330m north of the A47. It passes beneath the A1 within the Proposed Scheme boundary and flows through a large mill pond before joining the Wittering Brook 500m north of the Proposed Scheme, at the upstream end of Sutton and Heath Bog SSSI. • The Proposed Scheme is situated wholly within a Surface Water Nitrate Vulnerable Zone (NVZ) and a Drinking Water Protected Area (DWPA) and, partially (at the western end) within a Drinking Water Safeguard Zone (DWSZ). • There are two surface water abstractions located on the Mill Stream, north of the A47, and a third located on the River Nene at Warnford Pumping Station (operated by Anglian Water). • The pumping station pumps river water to Rutland Water (located approximately 20km to the north-west) through pipes set in a concrete duct below the A47. Rutland Water is a public water supply reservoir, DWPA, SSSI, SPA and Ramsar site.
Groundwater	• The limestone bedrock beneath Proposed Scheme footprint is classified as a Principal Aquifer (Blisworth Limestone, Lower Lincolnshire Limestone and the Upper Lincolnshire Limestone). This is overlain by superficial deposits (Alluvium, Head and River Terrace Deposits) that are classified as Secondary A, Secondary B and Secondary Undifferentiated Aquifers. • Secondary A and Undifferentiated Aquifers are present along the Nene valley to the south of the A47, in association with the Grantham Formation and the superficial deposits. • A Groundwater Source Protection Zone (SPZ) 3 (Outer Zone) is present approximately 1.4km north of the A47, cutting across the Sutton Heath Road. • There are no licensed groundwater abstractions within approximately 600m of the Proposed Scheme however; low volume private potable abstractions may be present. • British Geological Survey (BGS) records indicate several historical wells may have been present within approximately 600m of the Proposed Scheme.

	Summary of Existing Baseline
	• There is a residential property named 'Deep springs' located to the east of the dismantled railway and south of the A47, suggesting that springs may be present nearby. • Soils in the area have a high leaching potential, meaning that they are able to transmit a wide range of pollutants to the underlying groundwater table. • The western half of the Proposed Scheme lies within a Groundwater NVZ. The current status of WFD groundwater bodies is as follows: • Welland Limestone Unit A (located within the western, eastern and southern extents of the study area) - poor. • Northampton Sands (located within the eastern extents of the study area) - good. • Nene Mid Lower Jurassic Unit (located in the eastern extents of the study area) - good.
Flood Risk	• The land immediately surrounding the River Nene and Wittering Brook watercourses is located within Flood Zones 2 and 3 for fluvial flooding – predicted flood levels and historical incidents are recorded on the HADDMS database. • The risk of surface water flooding is medium to high within the immediate vicinity of the River Nene and Wittering Brook (and their tributaries) and notably, upstream of the Wittering Brook A47 culvert. • The existing A47 route is largely unaffected by surface water with the exception of the crossing of Wittering Brook which is expected to experience flooding during a 1 in 30 year flood, a 1 in 100 year flood and a 1 in 1000 year flood • The study area is potentially at risk from groundwater flooding. • An Environment Agency river level monitoring station is present between the Proposed Scheme and River Nene, adjacent to Wansford Pumping Station.
Drainage	It is assumed that drainage currently discharges to the Wittering Brook and River Nene, although soakaways may be present.
Aquatic Ecology	Otter, water vole and white clawed crayfish have been identified within the vicinity of the scheme. Refer to Chapter 8 Biodiversity for further details.
Conservation Sites	Water dependent designated conservation sites within the vicinity of the Proposed Scheme include (note that all distances are approximate from Proposed Scheme boundary): • The Sutton Heath and Bog Site of Special Scientific Interest (SSSI) lies immediately upstream (to the north), on the eastern bank of the Wittering Brook. The site is partially designated for base-poor marshland species that are dependent on springs emanating from the limestone bedrock. • Castor Flood Meadows SSSI is present on both sides of the River Nene downstream, 2.2km to the south east. Designated species are dependent on the soil water content and the River Nene.

	Summary of Existing Baseline
	• The River Nene flows into the Nene Washes (SSSI / SAC / SPA / Ramsar), located 9.5km east, which is a washland habitat (where water levels are controlled to manage floodwater) that supports water fowl and wetland plants. • Wansford Pasture (SSSI) is located upstream, 450m to the south-west, and fed by springs flowing from the limestone bedrock.

13.4 Assumptions and Limitations

13.4.1 This scoping exercise has been prepared with reference to previous assessments that were undertaken and used available data and Proposed Scheme design at the time of writing in November 2016. Where possible, baseline information has been checked and updated using information available on the internet. Further Detailed assessments will be required (as detailed below) to inform the ES.

13.4.2 Limited design information is currently available therefore it has been assumed that the design will progress in accordance with best practice and, that it will be possible to programme environmental assessments so that they can feed into the design process.

13.4.3 Information on the existing drainage scheme, including the locations of outfalls and soakaways, is currently limited and will be verified as part of a drainage survey to be undertaken during preliminary design.

13.4.4 Whilst the Proposed Scheme design is being developed, it is assumed that drainage from the Proposed Scheme will drain to the existing locations (where the existing road is to be used) and at the same rate and volume of run-off with necessary attenuation, where required. For the new road sections, it is assumed any surface water run-off from the drainage system will be attenuated.

13.5 Guidance and Best Practice

13.5.1 The methodologies listed in Sections 13.5 to 13.8 represent the approach required to meet the following statutory and non-statutory requirements:

- National Planning Policy Framework (CLG, 2012) and its associated Technical Guidance (CLG, 2014, updated 15/04/15).
- Highways (Environmental Impact Assessment) Regulations 2007 (EIA Highways Regulations 2007).
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (EU, 2000).
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

- Planning Inspectorate Advice Note 18: The Water Framework Directive (PINS, 2017).
- Groundwater protection guides covering: requirements, permissions, risk assessments and controls (EA, 2017), previously covered by: Groundwater protection: principles and practice (GP3) (EA, 2013a).
- Land Drainage Act 1991 and 1994.
- Flood and Water Management Act (2010).
- The Environment Act (1995).
- The Water Act (2014).

13.5.2 The Road Drainage and Water Environment assessment will be undertaken in accordance with Highways England's technical guidance provided in DMRB Volume 11, Section 3, Part 10 (HD 45/09).

13.5.3 The requirements of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the '2017 Regulations') will be implemented in the assessment as follows:

- 'population and health' will be considered through the assessment of effects on water quality and secondary effects on surface water and groundwater abstractions or the amenity use of surface waters.
- 'vulnerability to climate change' will be considered within the flood risk assessment and drainage strategy.
- 'vulnerability to major accidents or disasters' will be considered in the assessment of flood risk and contaminant spillage risk (if necessary).
- 'monitoring', if required, will be addressed though the CEMP during construction and specified as a mitigation measure for the operational phase.

13.6 Consultation

13.6.1 Consultation with the Environment Agency will be undertaken during the scoping and EIA process to confirm the requirements for monitoring and further assessment (such as a WFD Compliance Assessment and updated Flood Risk Assessment), to agree the findings of these studies and, to develop and agree a robust mitigation strategy. The Environment Agency and Anglian Water will also be consulted in relation access to the riverside monitoring site and pumping station, and associated infrastructure. Peterborough City Council will be consulted in their capacity as Lead Local Flood Authority (LLFA) and relevant internal drainage boards (IDBs) will be contacted to identify any particular concerns about the Proposed Scheme.

13.7 Potential Effects, including Monitoring and Mitigation Measures

Construction and Demolition

13.7.1 The Sacrewell Farm overbridge will require demolition of the existing structure and significant embankment construction to provide ramps up to the structure. Access to the flood gauging station, pumping station, telecoms mast and other

infrastructure situated at this location may be impacted by construction access requirements and the permanent works embankment. This will be mitigated in the design of the construction works and final Proposed Scheme based on discussions with the Environment Agency and Anglian Water, to ensure that all sites remain accessible.

13.7.2 Works undertaken within the flood plain may impact temporarily on flood risk by reducing floodplain storage. This will be mitigated through best practice, (including the storage of materials and equipment outside of the floodplain) and compliance with relevant Environmental Permits.

13.7.3 Due to the proximity of surface water resources, there is the potential for direct effects on surface water quality and flow characteristics during the construction of the Proposed Scheme.

13.7.4 The culverting of the drainage channels in particular, has the potential to adversely affect surface water quality and flow. This could impact on surface water abstractions, river flora and fauna and designated conservation sites.

13.7.5 The A1 off-slip and the dualling of the A47 are likely to require the widening of the existing (A1) culverts located on Mill stream and, the construction of a new (A47) culvert on Wittering Brook. This work has the potential to temporarily effect surface water flow and fish/eel passage (if present) within these watercourse, as well as channel morphology and the identified crawfish. A culvert extension and new settlement pond will also be needed on the drain passing through the Proposed Scheme footprint west of Nene Way however this ditch is likely to be of low sensitivity therefore impacts would be limited. The EIA process will confirm the sensitivity of these watercourses through site inspections and ecological surveys as appropriate (refer to Section 8 Biodiversity) and the CEMP will include procedures to ensure that the impact on the surface water drains is minimised, and would not result in an interruption of the flow conditions.

13.7.6 There is the potential for mobilisation of sediment and contaminants from road runoff to the watercourses as a consequence of construction works, particularly at site access points and the locations of major earthworks associated with the proposed embankments and bridges. This would be managed by best practice construction measures to be included within the CEMP in accordance with CIRA Guidelines.

13.7.7 Construction activities for the Proposed Scheme could temporarily increase the risk of a pollution incident at the site of works, associated with contaminated land or spills/leaks of chemicals. This could adversely impact on water quality at the nearby conservation sites. However, with appropriate mitigation measures and best practice (such as EA PPG) in place, the risk is considered to be minimal. Any construction activities on or near a Main River would require an Environmental Permit from the Environment Agency. Any works on or to a public sewer would require consent from the sewerage undertaker.

13.7.8 Any piling or excavation could adversely affect water quality in the superficial and bedrock aquifers with potential impacts on spring flow, groundwater quality

and surface water quality. Piling is not proposed currently but cannot be excluded as a possible requirement as the design progresses. The potential risk would be assessed through a land quality risk assessment (undertaken as part of the Simple level assessment referred to in Chapter 9 Geology and Soils) and the works themselves would be subject to a foundation works risk assessment to determine to most appropriate methods of construction and mitigation. Mitigation measures would be set out in the CEMP.

13.7.9 No licenced groundwater abstractions are known to be present within the study area but private abstractions may be in use. The presence of unlicensed potable abstractions will be queried with the local authority.

13.7.10 Surface water quality monitoring would be undertaken prior to and during construction at locations upstream and downstream of the works to ensure that any potential pollution is identified and mitigated. Groundwater samples will be collected during ground investigations to be undertaken prior to construction, to inform the groundwater risk assessment and design of any monitoring programme that may be needed. Sampling requirements would be agreed in advance of construction with the EA

13.7.11 The CEMP would incorporate any further requirements identified by the Updated Flood Risk Assessment or during consultation with the Environment Agency.

13.7.12 Permanent impacts on surface water and groundwater that would affect WFD water body status or impact adversely on any water dependent designated conservation sites are unlikely. Nevertheless, this will be confirmed through a WFD Compliance Assessment that will be undertaken in general accordance with PINS Advice Note 18 and submitted to the Environment Agency as a consultation activity.

13.7.13 With the above mitigation measures in place there would be no deterioration in the status of any identified WFD water body or impact on any water dependent conservation sites.

13.7.14 The requirements for demolition are yet to be confirmed as part of the preliminary design.

Operation

13.7.15 There is the potential for direct effects during the operation of the Proposed Scheme on surface water quality, and flow characteristics, (groundwater flows, surface water runoff flows and flood risk.

13.7.16 There is potential for an increase in routine pollutant inputs to surface water and groundwater from road drainage or spillage risk, should the overall volume of traffic movements increase. Traffic modelling will be undertaken during the assessment and will be used to inform a Highways Agency Water Risk Assessment Tool (HAWRAT).

13.7.17 DMRB HD 45/09 states that if there is a predicted increase in traffic of more than 20%, a HAWRAT assessment should be undertaken to confirm what effect this would have on water quality in the receiving watercourse / aquifer. Should there be a predicted increase in traffic or change in the drainage discharge flows to surface water or groundwater, a HAWRAT assessment will be undertaken to confirm what effect this would have on the receiving watercourses and groundwater (if soakaways are proposed), so that mitigation can be incorporated into the Proposed Scheme design.

13.7.18 The River Nene is a sensitive watercourse due to the presence of the raw water transfer abstraction to Rutland Water and downstream national and international conservation sites. There is also a SSSI located immediately upstream of the Proposed Scheme on the Wittering Brook and sensitive aquatic ecology has been identified locally. It may therefore be advisable to incorporate spillage containment into the Proposed Scheme design. The level of risk and (if required) containment volume will be assessed using the HAWRAT spillage risk assessment tool.

13.7.19 The increase in impermeable surface area as a result of the Proposed Scheme will increase the volume of surface runoff and therefore impact upon fluvial and surface water flood risk. The Proposed Scheme footprint will encroach into Flood Zones 2 and 3, reducing flood plain storage and increasing upstream flood risk. These impacts will be mitigated through the provision of attenuation and compensation storage elsewhere within the Proposed Scheme. This mitigation may take the form of SUDS, where appropriate and subject to suitable ground conditions. Permanent SUDS features should be designed in accordance relevant DMRB Standards (Highways England, 2016a; 2016b) and the SUDS Manual (CIRIA, 2007).

13.7.20 The Mill Stream and Wittering Brook culverts would be designed to allow for current flood flows plus climate change, so would not impact on flood risk. A flood risk assessment (FRA) will be undertaken to evaluate the impacts of these effects, determine the necessary storage volumes and appropriate SuDS components, so that these can be allowed for in the Proposed Scheme design. Climate change allowances will be based on the latest published guidance and agreed in consultation with the Environment Agency and Lead Local Flood Authority, who will be consulted regarding both the scope and findings of the FRA.

13.7.21 The ecological sensitivity of watercourses directly affected by culvert modification will be confirmed by a site inspection (see Chapter 8 Biodiversity), to ensure that any necessary mitigation can be incorporated into the design.

13.7.22 Permanent impacts on surface water and groundwater that would affect WFD water body status or impact adversely on any water dependent designated conservation sites are unlikely. Nevertheless, this will be confirmed through a WFD Compliance Assessment that will be undertaken in general accordance with PINS Advice Note 18 and submitted to the Environment Agency as a consultation activity.

13.7.23 With the above mitigation measures in place there would be no deterioration in the status of any identified WFD water body or impact on any water dependent conservation sites.

Summary

13.7.24 Table 13.2 provides a summary of potential construction and operational effects for Road Drainage and the Water Environment for the Proposed Scheme.

Table 13.2: Summary of Potential Road Drainage and the Water Environment Effects

Potential Construction Effects	Potential Operation Effects
Potential significant effects on water quality due to spillages or ground disturbance; and on flow, runoff and flood risk due to construction activities. All potential impacts would be mitigated by best practice set out in the CEMP, resulting in impacts of neutral significance.	Potentially significant effects on water quality due to spillage and routine runoff, should traffic flows increase (to be confirmed by quantitative assessment). Potential increase in flood risk due to reduced floodplain storage and increased runoff will be mitigated by provision of adequate storage within the design. Residual impacts are predicted to be of neutral significance.

13.8 Proposed Level and Scope of Assessment

13.8.1 The Assessment will be undertaken initially to a Simple Level, to identify potentially significant impacts. Detailed assessment will then be undertaken to refine the understanding of potentially significant effects and inform the design of mitigation measures. All findings will be fed-back to the design team to ensure that any necessary mitigation is incorporated and beneficial opportunities are developed.

Surface Water

13.8.2 The surface water assessment will consider impacts on flow, morphology and water quality, including consented discharges, licenced abstractions and private water supplies. Potential impacts on water dependent conservation sites and aquatic ecology will also be considered

13.8.3 If traffic volumes are predicted to increase significantly HAWRAT (Highways Agency, 2011) runoff and spillage assessments (based on traffic forecast data) will be undertaken to determine impacts on receiving waters, to be supported with surface water sampling if data are not available from the Environment Agency.

Groundwater

13.8.4 Potential effects on groundwater level, flow and quality will be considered, plus indirect effects on dependent receptors including licenced and private abstractions, groundwater dependent habitats and hydraulically connected surface waters.

13.8.5 The risks to groundwater from existing ground contamination will be established through the Simple level risk assessment (undertaken in accordance with

current guidance) and reported in Chapter 9 Geology and Soils. If necessary this would be progressed to a Detailed Assessment.

13.8.6 The potential for impacts on groundwater level, flow and secondary receptors such as water supplies and the River Nene will be assessed in the Road Drainage and Water chapter. The presence of unlicensed potable abstractions will be queried with the local authority as part of this work.

Water Framework Directive

13.8.7 Effects on WFD water bodies will be considered in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 10 (HD 45/09), as well as HAWRAT (Highways Agency, 2011). However, the proposals are not expected to affect WFD water body status or to impact on protected conservation sites.

13.8.8 A WFD Compliance Assessment will be undertaken in general accordance with PINS Advice Note 18 and submitted to the Environment Agency as a consultation activity.

13.8.9 The findings of the WFD compliance assessment will be discussed and agreed with the Environment Agency and if required, a further detailed WFD assessment will be undertaken in accordance with Environment Agency internal guidance.

Flood Risk

13.8.10 A FRA will be undertaken to assess the risk of all forms of flooding and the potential impacts, determine attenuation and floodplain storage compensation volumes and preliminary drainage design. The FRA will be undertaken in accordance with the requirements of the NPPF (CLG, 2012) and its associated Planning Practice Guidance (CLG, 2016). This will incorporate the findings of the drainage strategy.

13.8.11 Climate change allowances will be based on the Environment Agency's 'Climate change allowances for planners' NPPF supporting guidance (EA, 2017). The findings will be discussed with the Environment Agency and LLFA used to inform the preliminary drainage design. The FRA will be reviewed and updated based on feedback from stakeholders and the design team. If necessary, hydraulic modelling to calculate the upstream and downstream impacts and the effect of culvert modifications will be undertaken at this stage. The findings will gain be discussed and agreed with the Environment Agency and LLFA.

13.8.12 The FRA will be prepared in tandem with a drainage strategy for the Proposed Scheme, which will include an assessment of the impact of the proposed drainage on discharge rates and volumes entering receiving surface water bodies or groundwater using a detailed drainage model.

13.9 Proposed Methodology including Significance

13.9.1 The methodology will follow the updated methodology and guidance provided in DMRB Volume 11, Section 3, Part 10 (HA45/09) (HA, 2009b) for assessing the Significance of Effects of Road Proposed Schemes on Road Drainage and the

Water Environment. The procedures and the appropriate methods that must be used when assessing the potential impacts from the road projects on the water environment are described in Section 5.3 and Annex I of the DMRB document.

13.9.2 The following proposed methods will be adopted:

- Method A - Simple assessment of pollution impacts from routine run-off to surface waters using HAWRAT (HA, 2011). The HAWRAT assessment will use updated drainage information and Annual Average Daily Traffic (AADT) data to establish potential impacts of pollutants in routine highway run-off from the Proposed Scheme upon the watercourses within the study area and the requirement for mitigation measures to adequately reduce the risk;
- If required, and dependent on the results of the HAWRAT assessment, Method B - Detailed assessment of pollution impacts from routine run-off will be undertaken.
- The Proposed Scheme may include discharges to groundwater, although this has not been confirmed at this stage. If this is the case, a groundwater assessment will be undertaken using Method C – Groundwater Assessment contained within Annex I of the DMRB Volume 11, Section 3, Part 10 (HD 45/09) (HA, 2009);
- Method D - Assessment of pollution impacts from spillages will be undertaken.
- A hydrological assessment of design floods for the River Nene will be undertaken in line with Method E detailed within Annex I of the DMRB HD 45/09 (Highways Agency, 2009);
- A hydraulic assessment of the Wittering Brook and its tributaries including existing and proposed hydraulic structures (i.e. culverts and bridges) will be undertaken in line with Method F detailed within Annex I of the DMRB HD 45/09 (Highways Agency, 2009).

13.9.3 A drainage strategy will be prepared for the Proposed Scheme which will detail outfall locations, any attenuation requirements and the inclusion of SuDS features, where appropriate. The drainage strategy will be developed based on the findings of the FRA and will inform the impact assessment and the FRA reports.

13.9.4 The Flood Risk Assessment (FRA) will be undertaken in accordance with the requirements of the NPPF (DCLG, 2012; 2016), and the EA's climate change allowances (EA, 2017).

13.9.5 The HAWRAT assessment will use Annual Average Daily Traffic (AADT) data to establish potential water quality impacts of the Proposed Scheme upon the watercourses within the study area and the requirement for mitigation measures to adequately reduce the risk.

13.9.6 Compliance with the WFD will be assessed alongside the EIA in a separate document, based on the guidance provided in PINS, 2017. The documents will cross reference each other and the WFD assessment will form and appendix to the ES.

13.9.7 If a detailed assessment is needed this will be undertaken in accordance with internal Environment Agency documents 'Water Framework Directive compliance of physical works in rivers Screening step 1.3: WFD deterioration & risk to water body status objectives', 'Assessing new modifications for compliance with WFD' and its accompanying Detailed Supplementary Guidance note (EA, 2011a).

13.9.8 Although these are both internal Environment Agency documents, in the absence of more formal external advice, they provide the best guidance currently available.

Assessment of Magnitude of Impacts and Significance of Effects

13.9.9 A definition for the value and importance of a feature is set out in Table 13.3. Definitions for the magnitude of impact are given in Table 13.4. The overall significance of effect is determined using Table 1.2 and the definitions provided in Table 13.5. Effects can be beneficial or adverse. Effects that are moderate, large or very large are considered significant effects. Effects that are slight or neutral are not significant. The potential ecological impacts of routine runoff on surface waters will be assessed using the HAWRAT, as advised in section 5.6 of the DMRB document (HA, 2009b).

13.9.10 These tables are based on the guidance given in HD45/09, although additional criteria have been added to Table 13.5 to meet the requirements of WFD, for which guidance on the assessment of compliance became available after the publication of HD45/09 and therefore is not taken into account by HD45/09.

Table 13.3: Criteria for Estimating the Importance of Water Environment Attributes

Value	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on a regional or national scale.	**Surface Water**: Site protected under EU wildlife legislation (SAC, SPA, or Ramsar site); WFD high status waterbodies. **Groundwater**: Principal aquifer providing a regionally important resource or supporting site protected under EU wildlife legislation; Source Protection Zone 1 (SPZ1); international scale and very limited potential for substitution, or more than 100 residential, commercial or industrial properties, which may be affected by changes to the groundwater regime. **Flood Risk**: Receptor is at high risk from flooding (FZ3b); or floodplain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on a local scale.	**Surface Water**: Site protected under UK wildlife legislation (SSSI); WFD status (or potential) is currently 'good' or has a target of good. **Groundwater**: Principal or Secondary aquifer providing locally important resource or supporting site protected under UK wildlife legislation; SPZ2; national scale, and limited potential for substitution, or between 10 and 100 residential, commercial or

Value	Criteria	Typical Examples
		industrial properties, which may be affected by changes to the groundwater regime. **Flood Risk**: Receptor is at high risk from flooding (FZ3a); floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on a local scale.	**Surface Water**: Site protected under Local wildlife legislation (SNCI), Local Natural Reserve (LNR), WFD status (or potential) is moderate. **Groundwater**: Secondary aquifer which is of limited value because the water quality does not allow potable or other quality sensitive uses, exploitation may be for agricultural or industrial use but is not extensive; limited connection to surface water and may provide some support to local site of nature conservation interest; SPZ3; regional scale, limited potential for substitution, or 10 or fewer residential, commercial or industrial properties, which may be affected by changes to the groundwater regime. **Flood Risk**: Receptor is at moderate risk from flooding (FZ2); floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on a local scale.	**Surface Water**: WFD status (or potential) is poor, or waterbody is not classified under the WFD. **Groundwater**: Unproductive strata, with no known past or existing exploitation and not providing baseflow to rivers or supporting a site of nature conservation interest; and no residential, commercial or industrial properties that may be affected by changes to the groundwater regime. **Flood Risk**: Receptor is at low risk from flooding (FZ1); floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Table 13.4: Estimating the Magnitude of an Impact on an Attribute

Magnitude	Criteria	Example
Major adverse	Results in loss of attribute and/or quality and integrity of attribute.	Failure of soluble and sediment bound pollutants in HAWRAT (Method A, Annex A) and compliance failure with EQS values (Method B). Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex 1). Loss of, or extensive change to, a designated site or aquifer. Potential high risk of groundwater pollution from routine runoff – risk score >250 (Groundwater Assessment, Method C, Annex 1). Increase in peak flood level (1% annual probability) of >100mm.

Magnitude	Criteria	Example
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Failure of soluble and sediment bound pollutants in HAWRAT (Method A, Annex A) but compliance with EQS values (Method B). Calculated risk of pollution from a spillage >1 and <2% annually (Spillage Risk Assessment, Method D, Annex 1). Partial loss of, or change to, a designated site or aquifer. Potential medium risk of groundwater pollution from routine runoff – risk score 150-250 (Groundwater Assessment, Method C, Annex 1). Increase in peak flood level (1% annual probability) of >50mm.
Minor adverse	Results in some measurable change in attribute's quality or vulnerability.	Failure of either soluble or sediment bound pollutants in HAWRAT (Method A, Annex A). Partial change to an aquifer. Calculated risk of pollution from a spillage >0.5 and <1% .annually (Spillage Risk Assessment, Method D, Annex 1). Potential medium risk of groundwater pollution from routine runoff – risk score <150 (Groundwater Assessment, Method C, Annex 1). Increase in peak flood level (1% annual probability) of >10mm.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	No risk identified by HAWRAT. Risk of pollution from spillages <0.5%. No impact on aquifer and risk of groundwater pollution from spillages <0.5%. Negligible change in peak flood level.
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	HAWRAT assessment of either soluble or sediment bound pollutants becomes Pass from baseline of Fail. Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is <1% or more). Reduction in peak flood level (1% annual probability) of >10mm.
Moderate beneficial	Results in moderate improvement of attribute quality.	HAWRAT assessment of both soluble and sediment bound pollutants becomes Pass from baseline of Fail. Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is >1% or more). Reduction in peak flood level (1% annual probability) of >50mm.
Major beneficial	Results in major improvement of attribute quality.	Removal of existing polluting discharge to a watercourse or an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Reduction in peak flood level (1% annual probability) of >100mm.

Table 13.5: Definitions of Overall Significance of Effect

Significance	Examples
Very large adverse	**Surface water:** Potential failure of both soluble and sediment bound pollutants in a High or Good watercourse. **Groundwater:** Potential high risk (score >250) of pollution in the Groundwater Assessment (Method C, Annex 1) to a principal aquifer providing a regionally important resources or supporting a site protected under habitat legislation. **Flood risk**: An increase in peak flood levels (1% annual probability) >100mm increasing the risk to >100 properties.
Large adverse	**Surface water:** Potential failure of both soluble and sediment bound pollutants in a High or Good watercourse. **Groundwater:** Potential high risk (score >250) of pollution in to a secondary aquifer providing water for a small number of dwellings agricultural/industrial use or supporting a LNR. **Flood risk:** An increase in peak flood levels (1% annual probability) >50mm increasing the risk to >100 properties or an increase in peak flood levels (1% annual probability) >100mm increasing the risk to 1-100 properties.
Moderate adverse	**Surface water:** Potential failure of either soluble or sediment bound pollutants in a High or Good watercourse. **Groundwater:** Potential medium risk (score 150-250) to a secondary aquifer providing water for a small number of dwellings agricultural/industrial and/or supporting a LNR. **Flood risk:** An increase in peak flood levels (1% annual probability) >10mm increasing the risk to >100 properties or an increase in peak flood levels (1% annual probability) >500mm increasing the risk to 1-100 properties.
Slight adverse	**Surface water:** Potential failure of either soluble or sediment bound pollutants in a Moderate or Poor watercourse. **Groundwater:** Potential low risk of pollution (score <150) to a secondary aquifer with limited agricultural use and connectivity to surface waters and local ecology. **Flood risk:** An increase in peak flood levels (1% annual probability) >10mm increasing the risk to <10 industrial properties.
Neutral	**Surface water**: No risk identified by Method A or method B assessment (soluble and sediment bound). Calculated risk of spillage <0.5% annually. **Groundwater:** No predicted change in quality of any type of aquifer and/or its use as a resource. **Flood risk:** Negligible change in peak flood (1% annual event) <+/- 10mm.
Slight beneficial	**Surface water:** Method A assessment of either soluble or sediment bound pollutants becomes Pass from previous Fail condition for existing discharges. **Groundwater:** Reduction by 50% or more in existing pollution risk from spillages into an aquifer (when existing spillage risk is <1%). **Flood risk:** A reduction in peak flood levels (1% annual probability) >10mm resulting in reduced flood risk to 1-100 residential properties.
Moderate beneficial	**Surface water**: Method A assessment of both soluble and sediment bound pollutants becomes Pass from previous Refer or Fail condition for existing discharges. **Groundwater:** Recharge of aquifer through provision of treated discharges to ground resulting in measurable improvements to a connected site/habitat (LNR). **Flood risk:** A reduction in peak flood levels (1% annual probability) >10mm resulting in reduced flood risk to >100 residential properties.
Large beneficial	**Surface water:** Removal of an existing polluting discharge through provision of pollution prevention measures, or any other measure, affecting a site/habitat protected under EC or UK legislation. **Groundwater:** Removal of an existing polluting discharge within SPZ 1 or 2 and/or a principal aquifer.

Significance	Examples
	Flood risk: A reduction in peak flood levels (1% annual probability) >50mm resulting in reduced flood risk to >100 residential properties.

13.10 Conclusion

13.10.1 The scoping assessment is based on the findings of the previous assessments, which has identified potentially significant impacts on water resources receptors and flood risk.

13.10.2 Sensitive receptors include the River Nene, and associated surface water abstractions, including a transfer to Rutland Water (reservoir, SSSI, SPA and Ramsar site), groundwater resources (bedrock and superficial aquifers), nearby conservation sites (Sutton Heath and Bog SSSI / Wansford Pasture SSSI) and downstream conservation sites (Castor Flood Meadows SSSI / Nene Washes SAC, SSSI and Ramsar site). The Proposed Scheme footprint encroaches on Flood Zones 2 and 3, defined due to the risk of fluvial flooding.

13.10.3 During construction, there may be effects on water quality due to spillages or ground disturbance; and on flow, runoff and flood risk due to construction activities. All potential impacts would be mitigated by best practice set out in the CEMP, resulting in impacts of neutral significance.

13.10.4 During operation, there may be effects on water quality in the event of an accidental spillage and/or routine runoff, should traffic flows increase. This will need to be confirmed by quantitative assessment during the ES process. The potential increase in flood risk due to reduced floodplain storage and increased runoff will be mitigated by provision of adequate storage within the design, to be confirmed by a FRA. Residual impacts are predicted to be of neutral significance.

13.10.5 Key assessments that will be undertaken to inform the ES are as follows:

- FRA to determine attenuation and floodplain storage compensation volumes and preliminary drainage design.
- HAWRAT runoff and spillage assessment (based on traffic forecast data) to determine impacts on receiving waters / aquifers, to be supported with surface water sampling if data are not available from the Environment Agency.
- A WFD compliance assessment (undertaken in general accordance with PINS Advice Note 18).

13.10.6 All findings will be incorporated into the design during the EIA process to ensure that any necessary mitigation is incorporated and beneficial opportunities are developed. Mitigation will be designed in accordance with relevant DMRB guidance (Highways England, 2016a; 2016b) and the SuDS Manual (CIRIA, 2007).

13.10.7 Permanent impacts on surface water and groundwater that would affect WFD waterbody status or impact adversely on any water dependent designated

conservation sites are unlikely. Nevertheless, this will be confirmed through a WFD Compliance Assessment that will be undertaken in general accordance with PINS Advice Note 18 and submitted to the Environment Agency as a consultation activity. In addition, the requirements for construction monitoring and the suitability of mitigation measures will be agreed.

14 Climate

14.1 Introduction

14.1.1 It has been established that as a result of rising concentrations of carbon dioxide (CO_2) and other greenhouse gases in the atmosphere, climate change is expected to have significant implications for infrastructure assets, particularly those with long operational lifetimes. This requires them to be resilient not only to the climate at the time of their construction, but also to climate variations over the decades of their use.

14.1.2 The Climate Change Act was passed in November 2008 which sets ambitious, legally binding targets for reducing the UK's CO_2 emissions by 34% by 2020 and 80% by 2050, relative to the 1990 baseline. The EIA Directive (2014/52/EU) and subsequent updates to UK EIA regulations (of which the Infrastructure Planning (EIA) Regulations 2017 are of relevance to Nationally Significant Infrastructure Schemes (NSIPs)) also now outline the requirement to assess the impact of projects on climate and their vulnerability to climate change, as presented within this chapter.

14.1.3 This chapter has been prepared following guidance provided in Highways England Major Projects' Instructions 'Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)' (MPI). This section presents the outcomes of the scoping assessment for the climate change related topics. To align with the requirements of the IP EIA Regulations 2017 and the National Policy Statement for National Networks (NNNPS) 2014, it has been divided into two separate aspects:

a) Greenhouse gas (GHG) impact assessment – effects on climate change of GHG emissions arising from the Proposed Scheme, including how the project will affect the ability of Government to meet its carbon reduction plan targets (in accordance with NNNPS paragraph 5.17);

b) Climate change resilience assessment – the resilience of the Proposed Scheme to climate change impacts, including how the proposal will take account of the projected impacts of climate change (in accordance with NNNPS paragraph 4.40 and the IP EIA Regulations 2017).

14.1.4 The potential requirement for further assessment will be identified. Where required, this will be presented within the ES.

14.2 Study Area

Effects on Climate

14.2.1 The effects on climate assessment will consider the greenhouse gas emission potential throughout the lifecycle of the Proposed Scheme for both construction and operation (the latter for the design-life of the Proposed Scheme).

Vulnerability of the Proposed Scheme to Climate Change

Spatial scope

14.2.2 Climate change impacts on the proposed design elements of the Proposed Scheme such as structures, technology, mitigation and compensation areas and the environmental receptors will be considered.

1.1.1 There may be interrelationships between the assessment of potential effects on climate and other disciplines. Therefore, please refer to the following Chapters:

- Chapter 5: Air Quality
- Chapter 6: Cultural Heritage
- Chapter 7: Landscape
- Chapter 8: Biodiversity
- Chapter 9: Geology and Soils
- Chapter 10: Materials
- Chapter 12: People and Communities
- Chapter 13: Road Drainage and the Water Environment

Technical scope

14.2.3 The assessment will identify the key climate impacts on Proposed Scheme design elements such as structures or technological assets, as well as environmental receptors identified within this Scoping Report that may be affected by the Proposed Scheme, in the context of climate change.

Temporal scope

14.2.4 The assessment of climate change effects will consider construction and operational impacts on the Proposed Scheme as a result of climate change. Climate change impacts on construction have the potential to be scoped out depending on the construction duration. The operation assessment will be informed by the design-life of key elements of the Proposed Scheme and availability of UK climate Pprojections.

14.3 Existing and Baseline Knowledge

Effects on Climate

14.3.1 In this context, we are considering existing carbon emissions from a variety of sources in area, including those from transport infrastructure. Peterborough County Council greenhouse gas emissions in 2015 were 1,048.4kt of CO_2[2].

14.3.2 In 2015, UK net CO2 emissions were estimated at 403.8 million tonnes, a decrease of 3.8% in comparison to 2014 levels (Department for Business, Energy and Industrial Strategy, 2017a). Furthermore, 24% of UK greenhouse gas emissions in 2015 originated from the transport sector with emissions of 120 MtCO2e.

14.3.3 The transport sector emissions specifically in Peterborough in 2015 were 436.8kt CO_2 which is a 4.6% reduction since 2005. Specifically, for A-roads in 2015, 253.8kt CO_2 were emitted in Peterborough, which is a 5.9% reduction since 2005.

Vulnerability of the Proposed Scheme to Climate Change

14.3.4 The Met Office contains regional climate information for which Peterborough is included in the Eastern England region. High-level climate observations for Eastern England (The Met Office, 2017) over a 30-year averaging period of 1981-2010 are presented in Table 14.1 below.

14.3.5 It should be noted that climate projection data corresponding to the 2080s (2070-2099) under a high emissions scenario has been selected in line with NPS paragraph 4.41 which states that *"Where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK climate projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood against the 2080 projections at the 50% probability level".*

Table 14.1: Historic Climate Baseline for Eastern England 1981 – 2010

Climatic Conditions	Climate Observations
Temperature	Mean daily minimum temperatures can range from 0°C to 2°C in winter, whilst summer daily maximum temperatures are in the region of 22°C.
Rainfall	Atlantic depressions or convection are the source of the majority of the rain in Eastern England, particularly in Autumn and Winter when Atlantic lows are more vigorous. Annual rainfall in Peterborough averages 609mm. Monthly rainfall is variable, but is highest in the winter months. The number of days with rainfall totals greater than 1mm are 10 days in winter, dropping to less than 9 days in summer.
Wind	Eastern England is one of the more sheltered parts of the UK. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter half of the year when mean speeds are strongest at approximately 10 knots.

Climatic Conditions	Climate Observations
Sunshine	Average annual sunshine totals 1596 hours in Peterborough. Low cloud from the North Sea can affect the coast especially in spring and summer.
Air Frost	The average number of days with air frost varies from 30 to 55 days per year for the region and 46 for Peterborough.

Source: Met Office Regional Climate Data

Future Projections

Effects on Climate

14.3.6 The transport sector is a key driver in projected UK emissions and increases due to road transport emissions are projected to rise by 28 $MtCO_2e$ over 2023-2027 (the fourth carbon budget) (Department for Business, Energy and Industrial Strategy, 2017).

Vulnerability of the Proposed Scheme to Climate Change

14.3.7 The UK Climate Projections contains regional climate information for which Peterborough is included in the eastern England region. Eastern England is predicted to experience changes in temperature, rainfall, and frequency of extreme weather events, particularly flooding as a consequence of climate change. These changes are predicted to occur under all three emissions scenarios (i.e. low, medium, and high greenhouse gas emissions), which are incorporated into the climate change models produced by the Met Office Hadley Centre. The general trend for the region is warmer and drier summers and warmer and wetter winters.

14.3.8 Under the high emissions scenario for the 2080s, estimated changes in climatic conditions are outlined in Table 14.2 below.

Table 14.2: Future Climate Scenarios for the 2080s

Climatic Conditions	Climate Observations
Temperature	The average summer temperature is estimated to increase by 4.5°C under the central estimate, which represents 'as likely as not' probability of change (50th percentile), and average winter temperature is estimated to increase by 3.7°C (50th percentile).
Rainfall	The average summer rainfall rate is estimated to decrease by 27%, whereas the average winter rainfall rate is estimated to increase by 26% (in the 50^{th} percentile or central estimate for both).
Wind	Climate projections for wind are more uncertain than those for temperature and precipitation, due to inherent difficulty in modelling future wind conditions. However, overall an increase in extreme weather including wind is projected (Committee on Climate Change, 2017).

Source: UKCP09 Climate Projections

14.4 Assumptions and Limitations

14.4.1 Information on the climate baseline and future projections are based on freely available information from third parties, including the historical meteorological variables recorded by the Met Office and the UKCP09 developed by the Met Office. In addition, the assessment has been informed by a selected range of existing climate change research and literature, available at the time of writing this assessment.

14.4.2 Climate projections are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The results, therefore, from running the climate models cannot be treated as exact or factual, but projection options. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios and their reliability varies between climate variables. Scenarios exclude outlying "surprise" or "disaster" scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations. Generally global projections are more certain than regional, and temperature projections more certain than those for precipitation. Further, the degree of uncertainty associated with all climate change projections increases for projections further into the future.

14.4.3 The climate projections have previously been independently verified and will not be independently reviewed for this report.

14.4.4 It should also be noted that at present, there is no single accepted methodology for the assessment of climate change within EIA. A qualitative methodology for assessing the vulnerability of the Proposed Scheme to climate change will be produced in line with DMRB Volume 11 Section 2 Part 5. This will be updated as and when consolidated methodology or practice for this topic is published.

14.5 Guidance and Best Practice

14.5.1 The climate change assessment will be prepared following guidance provided in Highways England Major Projects' Instructions 'Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)' (MPI). In addition, the following guidance documents have been used to inform the assessment:

- Climate Adaptation Risk Assessment Progress Update (Highways England, 2016).
- IEMA Environmental Impact Assessment guide to Climate Change Resilience and Adaptation (IEMA, 2015).
- IEMA's Guidance on Assessing the GHG Emissions and Evaluating their Significance (IEMA, 2017).
- TAG Unit A3 Environmental Impact Appraisal (DfT, 2015). Chapter 4 Greenhouse Gases.
- PAS 2080:2016 Carbon management in infrastructure.

14.6 Consultation

14.6.1 To date, no topic-specific consultation has been undertaken. For Proposed Scheme-wide consultation refer to Section 4.

14.7 Potential Effects, including Monitoring and Mitigation Measures

Construction

Effects on Climate

14.7.1 The duration of the construction works for A47 Junction Improvement Wansford to Sutton would be approximately 16 months. Embodied carbon emissions from the use of construction materials are the main contributor to climate change, with additional greenhouse gas emissions arising from the use of plant and transport of materials. As outlined in Sections 5.7 and 10.7, mitigation measures to be included in the CEMP such as the reduction of raw material usage, recycling the use of local suppliers and ensuring vehicle engines and plant motors are switched off when not in use, would limit emissions as far as practicable. Further assessment appraising the Proposed Scheme greenhouse gas emissions will be carried out within the ES in accordance with TAG Unit A3 Chapter 4.

Vulnerability of the Proposed Scheme to Climate Change

14.7.2 During the temporary construction period, climate change is not expected to bring about a change in the risk of severe weather between now and the start of the period of construction. Despite this, the construction site may be vulnerable to extremes of weather, leading to the risk of delay in activities. However, adaptation measures included in the CEMP such as ensuring construction materials are covered when stored and pro-active planning would minimise adverse effects. Therefore, climate change effects are not expected to impact on Proposed Scheme construction.

Operation

Effects on Climate

14.7.3 The life of the Proposed Scheme is anticipated to be 60 years. Over this time, the operation of the Proposed Scheme has the potential to result in an increase in local CO_2 emissions due to changes in traffic flow and speed limits. An appraisal of greenhouse gases for the Proposed Scheme opening year and design year, to derive the change in carbon dioxide equivalent (CO_2e) emissions for the Proposed Scheme, will be assessed within the ES in accordance with TAG Unit A3 Chapter 4.

Vulnerability of the Proposed Scheme to Climate Change

14.7.4 During the Proposed Scheme's 60-year appraisal period, changes in climate as outlined in Table 14.2 would be experienced in the Study Area. This has the potential to pose a risk to the Proposed Scheme assets such as deformation

and deterioration of asphalt surfacing associated with temperature increase and changes in precipitation affecting the foundation strength and deterioration of the road surface, with the potential to lead to an increased flood risk. A Flood Risk Assessment (FRA) which is to be carried out will take into account the Environment Agency's 'Climate change allowances for planners' NPPF (2016) supporting guidance. In addition, the Proposed Scheme drainage design would be designed to accept flows generated by a rainfall event with a 1 in 100-year return period, plus an allowance for climate change. Higher temperatures and increased precipitation would increase the frequency of maintenance required for gantries. Also, higher wind speeds could pose a risk to gantries. Further assessment as outlined in Section 14.10 will be undertaken within the ES.

14.7.5 Changes in climate also have the potential to pose risks to the environmental receptors detailed throughout this report. For example, increased precipitation may impact the foraging habits and opportunities of bats and more frequent rainfall events resulting in higher runoff could increase pollutant concentrations within the receiving water. These will be assessed in further detail within the ES.

Summary

14.7.6 A summary of the potential effects on Climate as a result of the Proposed Scheme is presented in Table 14.3.

Table 14.3: Summary of Potential Climate Effects

Potential Construction Effects	Potential Operation Effects
Potential for increased CO_2 emissions. The construction site has the potential to be vulnerable to extremes of weather.	Potential for increased CO_2 emissions. Changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors.

14.8 Proposed Level and Scope of Assessment

14.8.1 The Proposed Scheme has the potential to contribute to climate change and be directly affected by climatic changes over the life of the Proposed Scheme. Therefore, further assessment is required in order to inform relevant mitigation and adaptation measures.

14.9 Proposed Methodology including Significance

14.9.1 There is at present no single accepted methodology for the assessment of climate change within EIA. A qualitative methodology for assessing the vulnerability of the Proposed Scheme to climate change has be produced in line with DMRB Volume 11 Section 2 Part 5.

14.9.2 It must be noted that no standard significance criteria currently exist, and MPI does not provide any guidance for assessing the significant of potential effects due to the vulnerability of the Proposed Scheme to climate change. However, the assessment will be undertaken in accordance with Highways England Major Projects' Instructions 'Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)' (MPI)

Scope of the Assessment

Effects on Climate

14.9.3 The assessment will consider the greenhouse gas emission potential throughout the lifecycle of the Proposed Scheme for both construction and operation.

Vulnerability of the Proposed Scheme to Climate Change

Spatial Scope

14.9.4 The assessment will consider climate impacts on the Proposed Scheme assets such as pavements, drainage and geotechnical receptors in addition to the in-combination effects of climate change on the environmental receptors.

Temporal Scope

14.9.5 The construction and operational impacts on the Proposed Scheme as a result of climate change will be considered. The operational assessment will be informed by the lifespan of key elements within the Proposed Scheme design and availability of UK Climate Projections.

Proposed Methodology and Significance

Effects on Climate

14.9.6 The assessment of the effects of the Proposed Scheme on climate will include:

- The greenhouse gases and significant carbon dioxide emitted during the lifecycle of the Proposed Scheme using the Mott MacDonald Carbon Portal, which is PAS2080 compliant for the Proposed Scheme design.
- Comparison of greenhouse gas emissions for both construction and operation in relation to the baseline and compared to regional (if available) and UK emissions predictions.
- Opportunities for mitigation in the Proposed Scheme design.
- A conclusion about whether this level of assessment is sufficient to understand the effects of the project or whether further assessment is necessary. This will be completed in accordance with the findings in the Air Quality and Materials Chapters (Chapters 5 and 10 of this report).

Vulnerability of the Proposed Scheme to Climate Change

Proposed Scheme Assets

14.9.1 A qualitative methodology for assessing the vulnerability of the Scheme assets to climate change will be produced in line with DMRB Volume 11 Section 2 Part 5. In line with the IP EIA Regulations 2017 Schedule 4 Part 5, a description of the likely significant effects of the development on the environment, resulting from the vulnerability of the project to climate change, will be provided.

14.10 Conclusion

14.10.1 During construction and operation, the Proposed Scheme would increase CO_2 emissions, however further assessment appraising the Proposed Scheme greenhouse gas emissions is required. Also during construction, the construction site may be vulnerable to extremes of weather, however adaptation measures included in the CEMP would minimise adverse effects.

14.10.2 During the operation of the Proposed Scheme, changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors.

14.10.3 Further assessment for construction and operational effects is therefore required for the full Proposed Scheme. This assessment will be presented within the ES which is to be prepared.

15 Combined and Cumulative Effects

15.1 Introduction

15.1.1 Combined and Cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project, identified as:

- Combined effects from a single project (the interrelationship between different environmental factors)
- Cumulative effects from different projects (with the project being assessed)

15.1.2 DMRB Volume 11, Section 2, Part 6 states that, in general, cumulative assessment will be most successful when the assessment of all other environmental effects of the project is complete. The previous chapters presented in this report have identified that further assessment is required for a number of environmental topics, which would be prepared and presented within the ES. As a result, no assessment of combined and cumulative effects has currently been made within this report. Instead, this chapter provides an overview of the baseline, potential effects, and methodology of assessment for combined and cumulative effects, with further assessment recommended to be included within the ES.

15.2 Study Area

Combined Effects

15.2.1 The study area for the assessment of combined effects, for both construction and operation, would be defined by the study areas identified within the relevant environment topic chapters of this EIA Scoping Report.

Cumulative Effects

15.2.2 The search area for the identification of ‘other developments’ for inclusion in the assessment of cumulative effects would reflect a 2km Zone of Influence (ZOI) around the boundary of the Proposed Scheme, for both construction and operation. This 2km ZOI is large enough to cover the proposed developments likely to contribute to cumulative effects, whilst being proportionate to the scope and scale of the scheme. DMRB Volume 11, Section 2, Part 5, states that the study area for the assessment of cumulative effects should be defined on a case-by-case basis reflecting the scheme in question and the area over which significant effects can be reasonably be considered to have the potential to occur from both the scheme and in combination with other developments. As such, a 2km search area is deemed appropriate for this Proposed Scheme.

15.2.3 The study area used to identify the ZOI for environmental receptors included within the cumulative assessment, during both construction and operation, will reflect the individual ZOIs of the topic chapters.

15.3 Existing and Baseline Knowledge

15.3.1 The baseline for the combined effects is described in the individual environmental topic chapters that precede this chapter.

15.3.2 The baseline for the cumulative effects will include the proposed major developments identified within the study area, once confirmed. The proposed major developments will be identified from the Traffic Team's Uncertainty Log, Peterborough Site Allocations Development Plan Document (Peterborough City Council, 2012) as well as any additional planning applications listed on Peterborough City Council's website.

15.4 Assumptions and Limitations

15.4.1 At this stage of assessment, the proposed major other developments within the area have not been identified. Therefore, the environmental effects that would result from the other development have not been identified. The assessment of potential effects is therefore limited at this stage, and has focused on some of the main receptors that could be affected as a result of both combined and cumulative effects. The likely residual effects and proposed mitigation for each of the other developments would be identified and incorporated into the cumulative effects assessment of the ES.

15.5 Guidance and Best Practice

15.5.1 This chapter draws upon the following guidance:

- The Planning Inspectorate's 'Advice Note Seventeen: Cumulative Effects Assessment'
- DMRB Volume 11 Section 2 Part 5 'Assessment and Management of Environmental Effects

15.6 Consultation

15.6.1 Consultation with Peterborough City Council (PCC) as the Local Planning Authority will be undertaken in advance of the production of the ES, to agree a list of proposed developments to be included within the cumulative effects assessment.

15.7 Potential Effects, including Monitoring and Mitigation Measures

Combined Effects

15.7.1 During construction and operation, there is the potential for combined effects to all receptors including geology and soils, landscape/townscape, cultural

features, communities, vehicle travellers, water environment, biodiversity, climate, and material resources, as a result of the Proposed Scheme due to the potential effects reported in Chapters 5 to 14. However, during construction, effects would be temporary in nature and best practice mitigation measures included in the CEMP would ensure that combined effects are reduced as far as possible. Combined effects during operation, although may be permanent, would be reduced as far as possible through best practice mitigation, enhancement measures would be developed as part of the Proposed Scheme design, and any monitoring requirements would be specified.

Cumulative Effects

15.7.2 During construction, there would be the potential for cumulative effects on all receptors as a result of the Proposed Scheme with any of the other developments, where the construction stages overlap. However, effects would be temporary in nature and it is assumed that best practice measures would be included in a CEMP for each of the other developments, reducing the likelihood of significant cumulative effects.

15.7.3 Once operational there would be the potential for cumulative effects to receptors, including (but not limited to) habitats, protected species, agricultural land, noise and air quality. However, it is assumed that mitigation would be provided by the other developments to offset any significant environmental effects, and monitoring of residual effects would also be in place for those other developments that have gone through the statutory EIA process, which would reduce the likelihood of significant cumulative effects during operation.

15.7.4 The likely residual effects and proposed mitigation for each of the other developments would be identified and incorporated into the cumulative effects assessment of the ES.

Summary

15.7.5 A summary of the potential effects from combined and cumulative interactions as a result of the Proposed Scheme is presented in Table 15.1.

Table 15.1: Summary of Potential Climate Effects

Potential Construction Effects	Potential Operation Effects
During construction and operation, there is the potential for combined effects to all receptors including geology and soils, landscape/townscape, cultural features, communities, vehicle travellers, water environment, biodiversity, climate, and material resources.	Combined effects during operation, although may be permanent, would be reduced as far as possible through best practice mitigation, enhancement measures would be developed as part of the Proposed Scheme design, and any monitoring requirements would be specified.
During construction, there would be the potential for cumulative effects on all receptors as a result of the Proposed Scheme with any of the other developments, where the construction stages overlap.	For cumulative effects there would be the potential for cumulative effects to receptors, including (but not limited to) habitats, protected species, agricultural land, noise and air quality.

15.8 Proposed Level and Scope of Assessment

15.8.1 The assessment for combined and cumulative effects within the ES will be undertaken for the Proposed Scheme during both construction and operation.

15.9 Proposed Methodology including Significance

Combined Effects Methodology

15.9.1 The assessment methodology for combined effects would involve the identification of impact interactions associated with the Proposed Scheme upon separate environmental receptors, to better understand the overall environmental effect of the Proposed Scheme.

15.9.2 The significance of construction and operational phase environmental effects would be brought forward from the preceding chapters of the ES into matrices, providing an overview of the potential effects on individual receptors. The assessment considers adverse effects, after mitigation has been taken into account. The significance of combined effects upon each environmental receptor group would then be made based upon the balance of scores and using professional judgement.

15.9.3 The methodology for the assessment of combined effects would follow DMRB Volume 11 Section 2 Part 5: Assessment and Management of Environmental Effects. For the purposes of the assessment, combined effects of Moderate adverse or beneficial, and above would be considered significant.

Cumulative Effects Methodology

15.9.4 The assessment methodology for cumulative effects would involve the identification of incremental changes likely to be caused by potential 'other developments' together with the Proposed Scheme.

15.9.5 The assessment of cumulative effects would follow Advice Note Seventeen: Cumulative Effects Assessment (The Planning Inspectorate, 2015) with the four stages of assessment:

- Stage 1: Establish the Nationally Significant Infrastructure Project's (NSIP's) Zone of Influence (ZOI) and identify a long list of 'other developments'.
- Stage 2: Identify shortlist of 'other developments' for the cumulative effects assessment.
- Stage 3: Information gathering.
- Stage 4: Assessment.

15.9.6 The ES will set out the methodology recognising the requirements of the NNNPS and advice on development of threshold criteria in PINS Advice Note Seventeen: Cumulative Effects Assessment, giving particular regard to the size and spatial influence of developments on the proposed project.

15.9.7 Rather than reporting every interaction, the methodology for the assessment of cumulative effects concentrates on the main significant effects, and will aim to differentiate between permanent, temporary, direct, indirect and secondary effects, positive or negative.

15.9.8 Where significant cumulative effects, beyond those identified as residual effects of the Proposed Scheme in isolation, have been identified, additional mitigation measures will be developed to avoid significant effects.

15.9.9 The significance of cumulative effects upon each environmental resource would then be based on the balance of scores and using professional judgement. An on-balance approach would also be taken when identifying the overall cumulative effect for the Proposed Scheme in conjunction with the other proposed major developments.

Significance Criteria

15.9.10 The assessment of significance of the combined and cumulative effects would be determined in accordance with the significance criteria contained in Table 15.4 of DMRB Volume 11, Section 2, Part 5 (HA 205/08), which is described in more detail in Section 1.6 of this EIA Scoping Report. Typically, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the greater the effect. In this way, the consequences of a highly value resource suffering a major detrimental impact would be a very large adverse effect, as shown in Table 1.2 contained in Chapter 1 of this EIA Scoping Report, and outlined in DMRB Volume 11, Section 2, Part 5 (HA 205/08).

15.9.11 For the purposes of this cumulative effects assessment, the value of a resource and magnitude of impact is determined according to the criteria set within the preceding chapters of this ES. The significance of effect is then carried forward from preceding chapters to enable an on-balance assessment of combined significance upon environmental receptors, as well as to identify the significance of cumulative effects with other developments. Typical descriptors of cumulative significance are included within Table 15.3, which reflects this on balance approach. Overall significance is determined with mitigation included, as shown in Table 1.2 contained in Chapter 1 of this EIA Scoping Report.

15.9.12 Significance descriptors have also been aligned with the considerations included within PINS ‘Advice Note Seventeen: Cumulative Effects’. Accordingly, where impacts are likely to be temporary, the overall significance of effect is considered to be reduced from a permanent impact on a receptor of the same value. Equally, localised and infrequent impacts are likely to be of lower magnitude than those that cover a greater geographical scale and/or regularly occur, resulting in a reduced significance of effect. Effects can be additive (such as the loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (two discharges combining to have an effect on a species not affected by discharges in isolation).

15.9.13 Where an effect is Moderate or above, adverse or beneficial, it is deemed to be significant.

Table 15.2: Combined and Cumulative Significance Criteria

Significance Category	Definition
Very Large (Adverse or Beneficial)	Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain future major development upon an individual or collection of environmental receptors would be highly significant. Effects would be: • Permanent and far reaching for receptors of very high value
Large (Adverse or Beneficial)	Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain major future developments upon an individual or collection of environmental receptors would be highly significant. Effects would be: • Permanent and far reaching for receptors of high value • Localised for a receptor of very high value, or • Temporary for a receptor of very high value
Moderate (Adverse or Beneficial)	Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain major development upon an individual or collection of environmental receptors would be significant. Effects would be: • Permanent and far reaching for receptors of medium value • Localised for receptors of high value, or • Temporary for receptors of high value
Slight (Adverse or Beneficial)	Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain future major developments upon an individual or collection of environmental receptors would be noteworthy but not significant. Effects would be: • Permanent and far reaching for receptors of low value • Localised for receptors of medium value, or • Temporary for a receptor of medium value
Neutral	Where the combined effects of the Proposed Scheme or the cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain future major developments would balance.

Source: Based on DMRB Volume 11 Section 2 Part 5 and professional judgement

15.10 Conclusion

15.10.1 The baseline and methodology for the assessment of combined and cumulative effects has been considered within this chapter. The assessment for combined and cumulative effects will be undertaken and presented within an ES.

15.10.2 The assessment will draw upon the guidance outlined in the DMRB Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects, and

the more recently published Advice Note Seventeen: Cumulative Effects Assessment (The Planning Inspectorate, December 2015).

16 Conclusions

16.1.1 This EIA Scoping Report has identified the potential for significant effects that may result during construction and operation of the Proposed Scheme. This information has been used to make recommendations for whether further environmental assessment is necessary for individual topics. Where required, further assessment will be presented within the ES.

16.1.2 Table 16.1 provides an overview of what level of assessment each topic will be undertaken for each topic.

Table 16.1: Level of Assessment by Topic

Topic	Environment Statement – Level of Assessment
Air Quality	Simple
Cultural Heritage Landscape	Detailed
Landscape	Detailed
Biodiversity	Detailed
Geology and Soils	Simple – detailed if required
Materials	Detailed
Noise & Vibration	Detailed
People and Communities	Various across sub-topics
Road Drainage and the Water Environment	Simple – detailed if required
Climate	Simple
Combined and Cumulative	Scoped in

16.1.3 Table 16.2 provides a summary of the potential effects of the Proposed Scheme and identifies whether further assessment is required on a topic-by-topic basis for the Proposed Scheme.

Table 16.2: Summary of Potential Effects and Further Environment Assessment Requirements

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
Air Quality	Construction	Production of on-site dust emissions arising from construction activities and vehicle movements.	Assessment required to simple level for regional emissions and a detailed level of assessment will be undertaken for local emissions.	No further topic specific consultation is required.
	Operation	Impacts on ambient concentrations of Nitrogen Oxides (NOx) including NO2 and fine particulates (PM10) as a result of changes to traffic.	Assessment required to Simple level.	
Cultural Heritage	Construction	Potential moderate adverse effect due to potential physical impact on archaeological remains. Potential moderate adverse effect through physical alteration or demolition of a building of local importance.	Assessment required to Detailed level.	Further consultation will be undertaken specifically with Historic England and the County Archaeologist.
	Operation	Potential to impact to a varying degree on the setting of some heritage assets through changes in noise levels and visual impact of the movement of traffic.	Assessment required to Detailed level.	
Landscape	Construction	Clearance of vegetation during construction has the potential to result in the opening up of views from nearby receptors The removal of existing vegetation and presence of construction plant, materials, machinery, construction compounds and construction lighting would potentially result in a temporary impact on local landscape elements and character.	Assessment required to Detailed level.	Consultation required with Local Planning Authority to agree representative viewpoints to inform the assessment of visual effects.
	Operation (visual effects)	Year 1 – Potential significant adverse effects associated with a reduction in extent of tree		

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
		cover and increased prominence of highway infrastructure. Year 15 Potential insignificant effects associated as planting aided screening matures. There is also potential for adverse night-time visual effects as a result of the influence of vehicle headlights on residential properties.		
	Operation (landscape)	Year 1 – Potential effects associated with visibility of the road/highway infrastructure and vehicles. Year 15 – Potential effects are unlikely to be significant once the planting aided screening matures.		
Biodiversity	Construction	Potential significant direct and indirect impacts to protected species and habitat due to construction activities and land take, particularly Sutton Meadows CWS and Sutton Disused Railway CWS.	Assessment required to a Detailed level.	Detailed consultation to be undertaking with Natural England, Environmental Agency, Local Planning Authority and RSPB.
	Operation	There is the potential for significant effect as on the Sutton Disused Railway CWS due to a loss of habitat. The potential for effects on Stibbington Pits and Sutton Heath & Bog SSSI will also be assessed.		
Geology and Soils	Construction	No significant adverse effects anticipated.	Assessment Required to Simple level.	Consultation with the Environment Agency will be necessary to discuss the impact of the Proposed Scheme.

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
	Operation	No significant adverse effects anticipated.	No assessment required.	
Materials	Construction	Potential for significant adverse effects from the use of material resources. Unlikely that significant adverse effects would result from waste generation.	Assessment required to Simple level for construction only.	None.
	Operation	No significant effects anticipated.		
Noise & Vibration	Construction	No significant effects with CEMP and appropriate mitigation measures in place.	Assessment to Detailed level.	Consultation with Local Planning Authority and discussion will take place with the Environmental Health Officers on potential impacts and mitigation.
	Operation	Potential for significant adverse effects to noise sensitive receptors.		
People and Communities	Construction	**NMUs** Direct impact on 8 footpaths, as well as the undesignated cycle paths on the east roundabout of the dumbbell junction with the A1/A47. This would result in increased journey times and lengths during the temporary construction period. NMU facilities would be temporarily impacted through the presence of construction plant, machinery, materials, construction compounds and construction lighting and changes to barriers and traffic flows.	Assessment is required to a Simple level in the first instance.	Specific consultation required as per sub-topic.

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
		Amenity Amenity is likely to be temporarily impacted. Construction activities may cause indirect effects for NMUs, due to noise, dust and the presence of construction plant, materials, compounds sites and machinery for a temporary period.	Assessment is required to a Simple level in the first instance.	
		MTs Driver Stress Driver Stress for MTs would increase with changes in traffic flows and speeds, however these effects are not considered to be significant.	Assessment is required to a Simple level in the first instance.	
		Community Severance Possible that access to the businesses located close to the A47 such as Sacrewell Farm and the BP garage will be affected during construction.	Assessment is required to a Simple level in the first instance.	
		Community Land and Community Facilities There are not anticipated to be any effects on community land or community.	Detailed assessment is required.	
		Development Land There are not anticipated to be any effects on development land.	Detailed assessment is required.	
		Demolition of Private Property and Associated Land Take Permanent land take and property demolitions are expected to result in significant adverse effects for landowners.	Detailed assessment is required.	

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
		Local Economy If the Scheme results in new employment in the area, this could have a slight beneficial impact on employment rates.	Detailed assessment is required.	
		Agricultural Land and Individual Farm Business The Proposed Scheme would require land-take (temporary and permanent) from the BMV (Grade 2) and Grades 3 and 4 agricultural land which shall also impact on the individual farm businesses.	Assessment is required to a Simple level in the first instance.	
	Operation	**NMUs** Potential for the Proposed Scheme to deliver NMU enhancement opportunities through the provision of new or improved facilities.	Assessment is required to a Simple level in the first instance.	
		Amenity There is likely to be an improvement in amenity when the Proposed Scheme is operational associated with NMU provision.	Assessment is required to a Simple level in the first instance.	
		MTs Driver Stress There is likely to be a decrease in driver stress from decreased journey times**.**	Assessment is required to a Simple level in the first instance.	
		MTs View from the Road (Operation only) Prior to the establishment of Proposed Scheme mitigation planting, there would be ‘open’ views	Assessment is required to a Simple level in the first instance.	

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
		from the road to the south of the Proposed Scheme. By year 15 of operation the establishment of roadside vegetation would broadly re-define the existing situation in terms of establishing 'intermittent' views from the road.		
		Community Severance There will be permanent access and egress alterations to both Sacrewell Farm and the BP petrol station.	Detailed assessment is required.	
		Community Land and Community Facilities There are not anticipated to be any effects on community land and community facilities.	Simple assessment is required.	
		Development Land There are not anticipated to be any effects on development land.	Simple assessment is required.	
		Demolition of Private Property and Associated Land Take It is likely that one residential property will be demolished for the Proposed Scheme. The property is located to the east of the disused railway. This is likely to result in a significant adverse effect on residents.	Detailed assessment is required.	

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
		Local Economy If the Proposed Scheme results in new employment in the area, then this could have a slight beneficial impact on employment rates. However, because of the size of the Proposed Scheme, this effect is unlikely to be significant.	Detailed assessment is required.	
		Agricultural Land and Individual Farm Business The Proposed Scheme would also require land-take (temporary and permanent) from Grade 2, Grade 3 and Grade 4 agricultural land which may also impact on the individual farm businesses.	Detailed assessment is required.	
Road Drainage and the Water Environment	Construction	Potentially significant effects on water quality due to spillage and routine runoff, should traffic flows increase (to be confirmed by quantitative assessment). Potential increase in flood risk due to reduced floodplain storage and increased runoff will be mitigated by provision of adequate storage within the design. Residual impacts are predicted to be of neutral significance.	An assessment is required to Simple level in the first instance, including a Flood Risk Assessment (FRA).	Consultations will be an ongoing process with the appropriate IDB bodies; EA; Local Planning Authority Flood and Water Team who are the designated Lead Local Flood Authority (LLFSA).
	Operation	Potential for increased CO_2 emissions. The construction site has the potential to be vulnerable to extremes of weather.	Assessment required to Simple level in the first instance.	

Topic	Stage	Potential Effects	Requirement for Further Assessment	Requirement for Further Consultation
Climate	Construction	Potential for increased CO_2 emissions. Changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors.	Simple assessment is required.	No further topic specific consultation is required.
	Operation	Potential for increase or decrease in CO_2	Simple assessment is required.	No further topic specific consultation is required.
Combined and Cumulative Effects	Construction	No assessment has been made at this stage.	The assessment for combined and cumulative effects will be undertaken and presented within the ES.	Consultation with Local Planning Authority will be undertaken during the EIA Process to agree a list of proposed developments to include within the cumulative effects assessments.
	Operation	No assessment has been made at this stage.		

17 References

Introduction

- Highways Agency (2008) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2 Part 4 Scoping of Environmental Impact Assessments (HA2/08)
- PINS (2017) Advice Note Seven: EIA: Process, Preliminary Environmental Information and Environmental Statements.

Air Quality

- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1 Air Quality (HA 207/07)
- Highways Agency (2013) Interim Advice Note (IAN) 170/12v3: Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality.
- Highways Agency (2013) Interim Advice Note (IAN) 174/13: Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Par 1 'Air Quality (HA207/07)
- Highways Agency (2013) Interim Advice Note (IAN) 175/13: Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 'Air Quality
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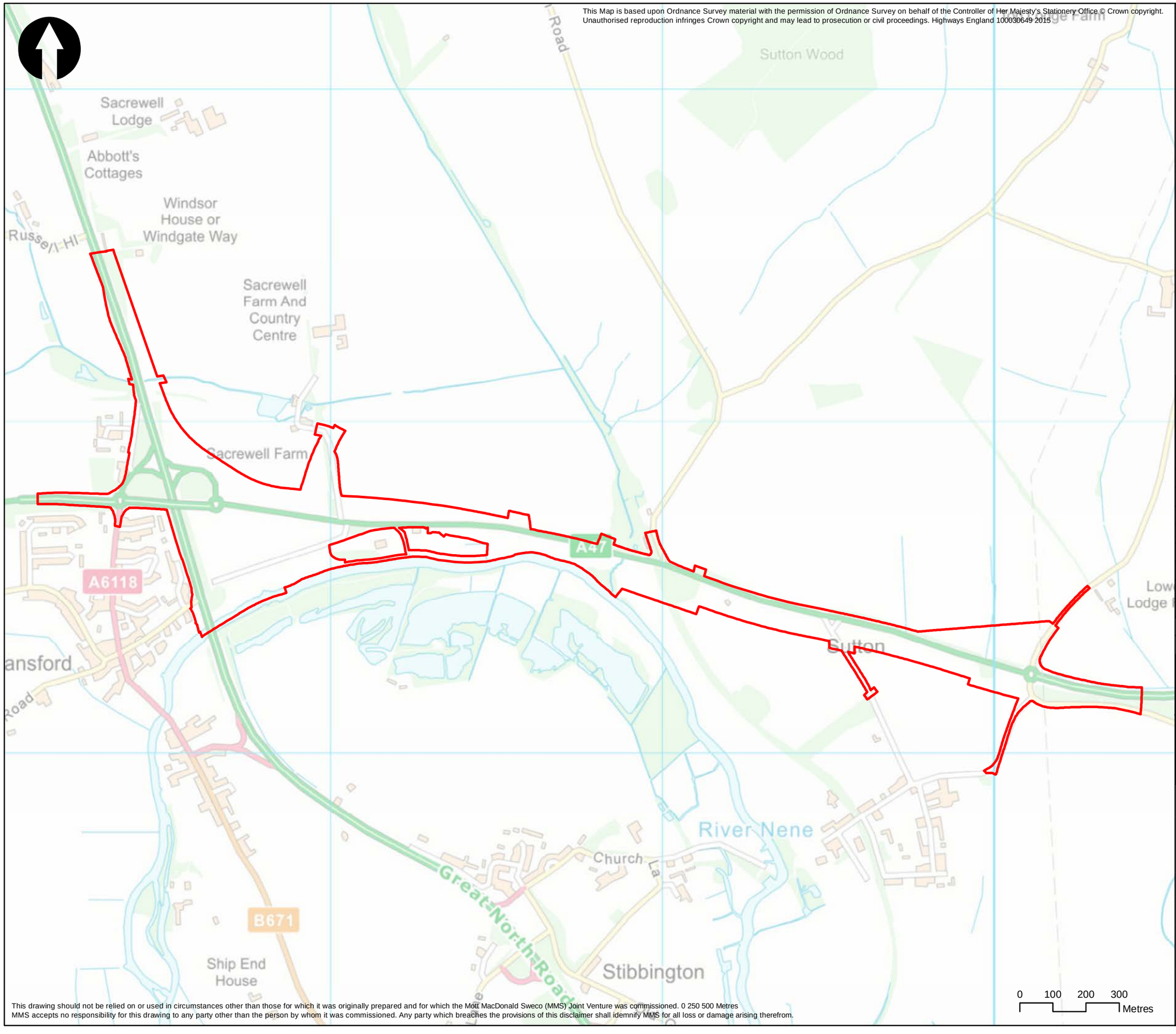
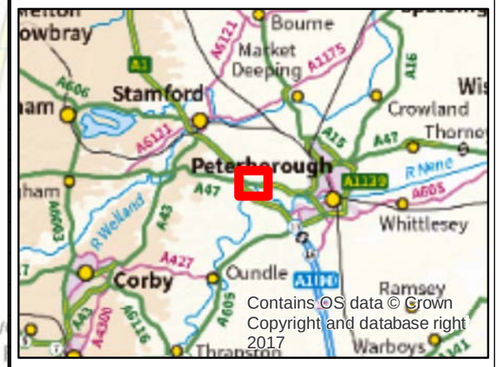
Appendix A – DCO Site Boundary



Key to symbols

DCO site boundary

References drawings



Rev	Date	Amendment Details	Drawn	Chk'd	App'd
01	22/01/18	Drawing Produced	BO	JF	MG

Mott MacDonald Sweco
Grove House
Mansion Gate Drive
Leeds
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Tel : +44 (0)113 262 0000

Client: highways england

Drawing Status: For Information

Suitability: S0

Project Title: A47 Wansford to Sutton

Drawing Title: Figure B.1 Environmental Constraints Site Level

Scale	Designed	Drawn	Checked	Approved
1:11,000	O'Hickey Ben	O'Hickey, Ben	Fookes, Jackie	Gordon, Malcolm
Original Size	**Date**	**Date**	**Date**	**Date**
A3	22/01/18	22/01/18	22/01/18	22/01/18

Drawing Number: HEWNSFRD - MMSJV - EGN - 000 - RP - LX - 00001
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: HEWNSFRD

Revision: P01

Appendix B - Environmental Constraints Plan

- Site Level – 500m buffer
- Wider Context – 5km buffer (reduced site area detail)

West Abbot's and Lound Woods

Sutton Heath and Bog

Wansford Pasture

Old Sulehay Forest

0 100 200 300 Metres

Key to symbols

- DCO site boundary
- Indicative 500m buffer
- Scheduled Monument
- Site of Special Scientific Interest (SSSI)
- Noise Important Areas (NIA)
- Listed Building - Grade
  - I
  - II
  - II*

References drawings

Rev	Date	Amendment Details	Drawn	Chk'd	App'd
01	22/01/18	Drawing Produced	BO	JF	MG

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Client: highways england

Drawing Status	Suitability
For Information	S0

Project Title: A47 Wansford to Sutton

Drawing Title: Figure B.1 Environmental Constraints Site Level

Scale	Designed	Drawn	Checked	Approved
1:15,000	O'Hickey, Ben	O'Hickey, Ben	Fookes, Jackie	Gordon, Malcolm
Original Size	**Date**	**Date**	**Date**	**Date**
A3	22/01/18	22/01/18	22/01/18	22/01/18

Drawing Number: HEWNSFRD - MMSJV - EGN - 000 - RP - LX - 00001
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: HEWNSFRD

Revision: P01

Racecourse Farm Fields
Whitewater Valley
Barnack Hills & Holes
Southorpe Roughs
Southorpe Meadow
Southorpe Paddock
Castor Hanglands
Bonemills Hollow
West Abbot's and Lound Woods
Collyweston Great Wood and Easton Hornstocks
Sutton Heath and Bog
Bedford Purlieus
Wansford Pasture
Old Sulehay Forest
King's Cliff Banks
Castor Flood Meadows
Orton Pit

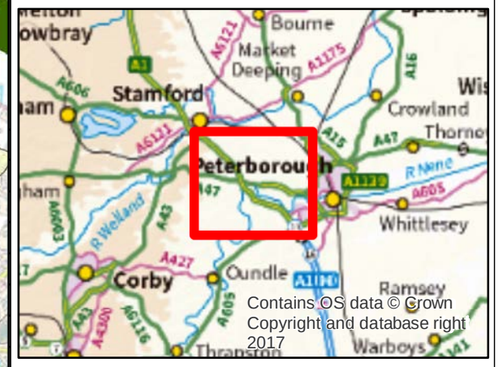
0 250 500 Metres

Mott MacDonald

Key to symbols

- DCO site boundary
- Indicative 5km buffer
- Registered Parks & Gardens
- Scheduled Monument
- Site of Special Scientific Interest (SSSI)
- Special Area Conservation (SAC)
- Noise Important Areas (NIA)
- Listed Building - Grade
  - I
  - II
  - II*
- Country Parks
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

References drawings



Rev	Date	Amendment Details	Drawn	Chk'd	App'd
01	22/01/18	Drawing Produced	BO	JF	MG

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Client: highways england

Drawing Status: For Information
Suitability: S0

Project Title: A47 Wansford to Sutton

Drawing Title: Figure B.2
Environmental Constraints Wider Context

Scale	Designed	Drawn	Checked	Approved
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Original Size	**Date**	**Date**	**Date**	**Date**
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Drawing Number: HE PIN | Originator | Volume
HEWNSFRD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEWNSFRD

Revision: P01

Appendix C - Lighting Impact Assessment Methodology

Introduction and Study Area

A Lighting Impact Assessment will be included as part of the EIA process to determine the likely effects of this design on the surrounding environment. The assessment will ensure that the preliminary lighting design will conform to maximum allowable obtrusive lighting levels and will provide recommended luminaire types, mounting heights and angles for use within various areas of the Proposed Scheme.

The lighting assessment will inform the landscape and ecology Environmental Impact Assessments and will be included as a technical appendix to the Landscape and Visual Impact Assessment. The assessment is considered important to evaluate possible impacts on the Sutton Heath and Bog SSSI, Local/County Wildlife Sites any identified bat roosts or foraging routes and nearby residential properties.

Guidance and Best Practice

In considering the potential effects of the proposed development, the following aspects of obtrusive light, taken from the Institute of Lighting Professionals Guidance Note for the Reduction of Obtrusive Light GN01:2011 must be considered and assessed:

- Sky Glow
- Light Intrusion
- Luminaire / Luminous Intensity
- Building or Façade Luminance

The assessment will be in accordance with the following legislation and guidance. Further guidance documents will be consulted as appropriate – the following list is not exhaustive:

- Environmental Protection Act 1990
- Clean Neighbourhoods and Environment Act 2005
- DEFRA: Statutory Nuisance from Insects and Artificial Light
- The Landscape Institute and Institute of Environmental Assessment, 3rd Edition 2013
- Institution of Lighting Professionals (ILP) *Guidance Notes for the Reduction of Obtrusive Light* (GN01):2011)
- Institution of Lighting Professionals (ILP): Professional Lighting Guide 04,
- *Guidance on Undertaking Environmental Lighting Impact Assessments* (2013)

- Commission Internationale de l'Eclairage (CIE) 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations
- CIE 126: Guidelines for Minimising Sky Glow
- The Chartered Institution of Building Services Engineers (CIBSE) LG06 The Exterior Environment 2016
- BS EN 12464 Part 2 Outdoor Lighting
- BS EN 13201 European Norm for Road Lighting
- BS 5489-1:2013 Code of Practice for the Design of Road Lighting and Public Amenity Areas
- Bat Conservation Trust and the ILP: Bats and Lighting in the UK: 2009
- Bat Conservation Trust: Statement on the Impact and Design of Artificial Light on Bats. 2011
- Bat Conservation Trust: Landscape and Urban Design for Bats and Biodiversity. 2012
- Bat Conservation Trust: Artificial Lighting and Wildlife Interim Guidance: Recommendations to Help Minimise the Impact of Artificial Lighting, 2014

Proposed Methodology and Scope

The assessment will follow best practice guidance detailed in 'Institution of Lighting Professionals (ILP) Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments'. Potential receptors will be identified and discussed with the Local Planning Authority (LPA) as well as landscape and ecology teams to agree the proposed receptor locations and identify any further survey requirements or assessment methodology.

A baseline survey will be carried out, this will provide lux measurements and photographs taken at a survey viewpoint for each receptor and will provide a baseline against which any obtrusive light from the proposed development can be compared.

Information gathered on baseline surveys will facilitate agreement with the LPA in determining which environmental lighting zone the site falls under and therefore the maximum permissible levels of obtrusive light. Environmental zones are set out in Table C.1

Table C.1: Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town / city centres with high levels of night-time activity

Source: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

Potential Effects, including Monitoring and Mitigation Measures

The Proposed Scheme is likely to result in obtrusive light impacts associated with construction such as temporary lighting for safety and security, lighting of haul routes, laydown areas, offices and temporary parking areas etc. There are also likely to be obtrusive lighting impacts during the operational phase as a result of proposed lighting or changes to existing lighting.

Where mitigation is required, it will be zone and use specific i.e. it will be specific to areas of the Proposed Scheme and further assessed by the proposed use of the zone. Specific construction activities may require high lux-level task lighting and therefore this lighting should be directional and sighted appropriately to minimise obtrusive light, whilst lower mounting height lighting or the restriction of working hours may be appropriate for other areas. Mitigation measures will also take into account the findings of the landscape / ecological assessment and any such mitigation which is proposed in the associated reporting.