# A47 North Tuddenham to Easton Dualling

## Scheme Number: TR010038

# Volume 6
# 6.5 EIA Scoping Report

APFP Regulation 5(2)(a)

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

# The A47 North Tuddenham to Easton Development Consent Order 202[x]

## EIA SCOPING REPORT

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# A47 North Tuddenham to Easton

# EIA Scoping Report

## PCF STAGE NO 3

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## Notice

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# 1. Scheme introduction

## 1.1. Purpose of the report

1.1.1. Scoping is an important part of the Environmental 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 report must satisfy the statutory requirements of the Environmental Impact Assessment Regulations 2017.

1.1.3. 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 in order to adopt an opinion. The ES will be submitted as part of the application for a Development Consent Order (DCO).

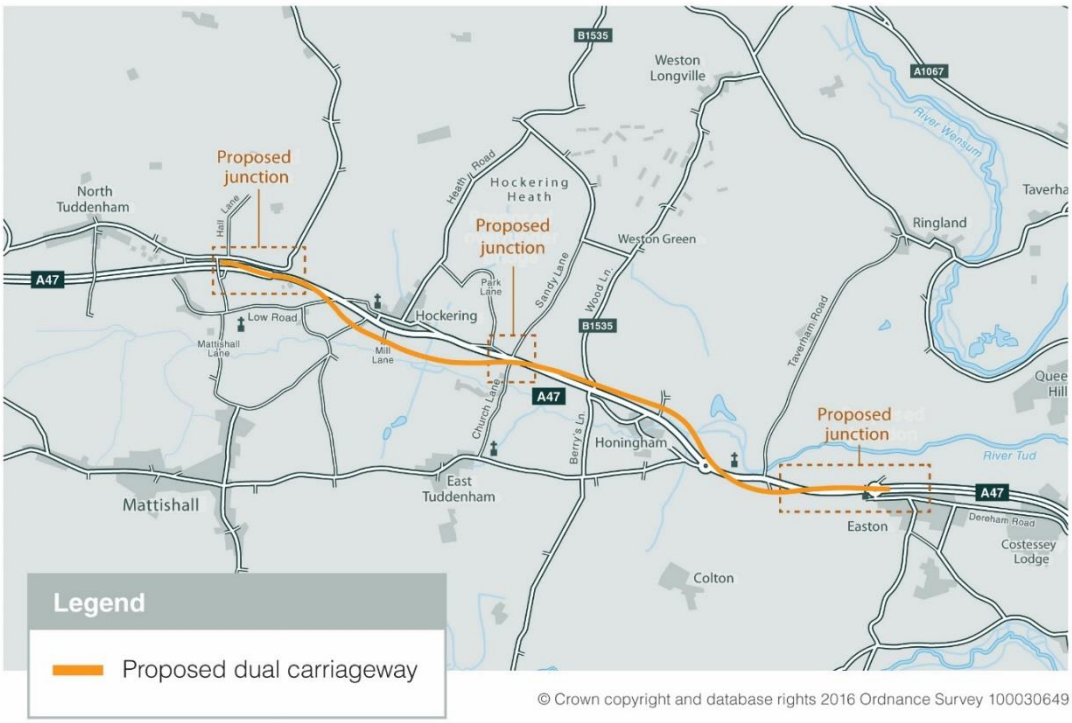
1.1.4. The scope of the EIA may be amended following receipt of the Scoping Opinion or if understanding of environmental conditions change. The final version of this EIA Scoping Report will be issued as a Technical Appendix of the ES. This will provide a full audit trail for the EIA process that is undertaken.

## 1.2. Proposed scheme location

1.2.1. The A47 trunk road form part of the Strategic Road Network (SRN) and provide 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), the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft.

1.2.2. The Proposed Scheme is located North Tuddenham to Easton 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




## 1.3. Proposed scheme overview

1.3.1. It is proposed to upgrade the existing section of single carriageway between North Tuddenham and Easton to a dual carriageway. The scheme runs south of Hockering before moving parallel and north east of Honingham. This scheme will henceforth be referred to as the 'Proposed Scheme'. The scoping boundary is shown on Figure A 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 an 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 are 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 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:

- It comprises the alteration of a highway.
- The highway to be constructed is wholly in England.
- Highways England ("a strategic highways company") will be the highway authority for the highway.
- 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 12.5ha.

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 1 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations), whereby the Descriptions of development for the purposes of the definition of "Schedule 1 development" Regulation 2(1), Paragraph 7 states: "(3) Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road would be 10 kilometres or more in a continuous length." The length of road to be constructed/altered is greater than 10km (upgrading of the existing single carriageway (approximately 8km), plus the tie-ins, junctions and side road requirements is anticipated to exceed 10km) and therefore an EIA is required.

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 ES will be submitted with the DCO Application for this project.

1.5.5. The Planning Inspectorate (the Inspectorate) is responsible for handling DCO applications for NSIPs. In its role, the Inspectorate will examine the application

for the Proposed Scheme and then 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 February 2019 (Ref 8) is 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 projects 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 one of the five significance categories enables different topic issues to be placed upon the same scale, to assist the decision-making process. These five 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. |
| 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. |

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 (Table 1-2).

1.6.6. 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 1-2 : Descriptions of the significance of effect categories

| | 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) has been 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 this conclusion, 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 in compliance with 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 control of major accidents hazards regulations (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 (EIA) 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 175km 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: 2km for internationally, nationally and locally designated nature conservation sites; 30km for SACs designated for bat populations; 10km for statutory sites designated for bird interest; 2km for locally designated nature conservation sites; 500m for Great Crested Newts; 250m for water vole, otter and crayfish; 100m buffer for other preliminary ecological assessments including Phase 1 habitat survey badger, reptiles, and breeding birds.
- Geology & Soils: limited to the works' footprint but extends to 1km beyond this in order to identify any past pollution incidents which may have affected soil within the works area.
- 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

1.11.1. The national policy is particularly relevant to developments that will be promoted as a NSIP. When the DCO application for the Proposed Scheme is to be progressed as an EIA development, an environment 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 1.11.2 to 1.11.5.

### National Networks National Policy Statement

1.11.2. The NNNPS sets out the need for, and the 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 Strategic Road Network (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 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 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.
- Cooperate with other persons or organisations for the purposes of coordinating 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 2017-2018 and sets out a clear programme of activity for 2018-2019, 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 have been set out from the January 2016 Operation Metrics Manual produced in collaboration with DfT and Office of Rail and Road. Environmental KPIs include:

- Number of Noise Important Areas (NIA) mitigated. Highways England aim to mitigate 1,150 NIA 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 ongoing annual basis.
- Helping cyclists, walkers, and other vulnerable users of the network through a number of new and upgraded crossing. 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 single carriageway section of the A47 from North Tuddenham to Easton is approximately 8km, acting as a bottleneck resulting in congestion and leading to longer and unreliable journey times.

2.1.2. There are several reasons for these delays. Investigations to date have highlighted the following issues:

- Development in the local area, which can lead to potentially more vehicles on the road
- Road layout
- Difficulty of accessing and crossing the A47
- Standard of the road and junctions
- Traffic levels outgrowing the capacity of the road, causing tailbacks and delays
- Limited opportunities for overtaking slower moving vehicles

2.1.3. 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 Scheme are:

- Encourage economic growth by providing additional capacity making journey times more reliable, enabling proposed economic growth and development to come forward at key regional locations.
- To make the network safer by improving operational safety issues at junctions along the A47.
- Support the smooth flow of traffic and improve journey time reliability by maximising the operational capability at the junctions and along the 9km of carriageway and improve user satisfaction by quicker and more reliable journeys.
- Deliver better environmental outcomes by reducing congestion at the junction contributing to better air quality and reduced noise.

- Help cyclists, walkers, and other vulnerable users of the Network by considering the needs of these users and how their requirements can be addressed with improved connectivity.
- Delivering better Environmental outcomes – Any negative impacts on landscape will be mitigated by native planting and habitat creation where possible.

## 2.3. Proposed scheme location

2.3.1. 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 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.

2.3.2. The Proposed Scheme involves the upgrading of the single carriage way between North Tuddenham and Easton (approximately 8km) to dual carriageway. The proposed option deviates locally from the existing A47 route alignment.

2.3.3. The start of the Proposed Scheme is located east of North Tuddenham close to Oak Farm National Grid Reference (NGR) TG06067 13529. The proposed route passes to the south of Hockering, and parallel to the River Tud. Woodland along the north and south bank of the River Tud are described as habitats of potential ecological importance in this area south of Hockering.

2.3.4. The proposed route crosses the current A47 at Church Lane and Sandy Lane. The proposed route then follows a just offline route the north side of the current A47 and then north east of Honingham. Close to this area are four woodland areas of potential ecological importance, within low lying agricultural land. East of Honingham the proposed route will make a perpendicular crossing of the River Tud.

2.3.5. The route crosses a single footpath that runs north south from Hockering to the River Tud and a Restricted byway also running north south from Honingham towards Weston Green.

2.3.6. Lastly the proposed route runs south and then north of the current A47 alignment before joining the current dual carriage way at Easton National Grid Reference (NGR) TG13102 11028. The Church of St Andrew and Church of St Peter are adjacent to the current A47 and the proposed route. A junction at the Easton end of the Proposed Scheme is proposed between Blind Lane, Taverham Road and the current Easton roundabout. The Easton roundabout would be removed as part of the proposals.

## 2.4. Proposed scheme description

2.4.1. The Proposed Scheme is intended to:

- Reduce the impact at the western end on Oak Farm, minimising the impact on the existing properties on Mattishall Lane.
- Minimise the impact on properties close to the existing A47 at Hockering.
- Reduce the impact of the road on the River Tud.
- Widen the road to the north side of the corridor as it passes Honingham.
- Keep the route to the north of the existing junction at Easton to maximise the chance of the local road reconnection being alongside and to the north of the church at Easton.
- Comprise 70mph high quality dual carriageway to current standards.

## 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 works – 2021/2022
- Estimated duration of construction – 26 months
- Open for traffic – 2023/2024

# 3. Consideration of alternatives

## 3.1. Alternative options considered

3.1.1. In seeking to resolve the transport problem, 14 potential options were developed and assessed to identify their performance against environmental, engineering, transportation and economic criteria so that they could be compared and contrasted to allow the most appropriate options to be taken forward.

3.1.2. This concluded that four options all solve the transportation problem by providing a dual carriageway link which will improve the traffic flow, reduce journey times on the route and increase the route safety and resilience. These options are described below.

### Option 1

3.1.3. Option 1 proposes building a new dual carriageway to the north of the existing A47. The single carriageway section of the A47 between North Tuddenham and Easton would be improved to dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements. The proposed new dual carriageway for this option follows an alignment running parallel and approximately 500m to the north of the existing A47 highway corridor. See Figure 3.1.

Figure 3-1 : Option 1

## Option 2

3.1.4. The new dual carriageway follows an alignment running as close as possible to the existing A47. Improvements to the existing alignment will be needed to bring the route up to dual carriageway standards. See Figure 3.2.

Figure 3-2 : Option 2


## Option 3

3.1.5. Option 3 proposes building a new dual carriageway to the south and to the north of the existing A47. The new dual carriageway follows an alignment running to the south of the A47 but to the north of the River Tud as the route passes the village of Hockering. The carriageway then switches to the north of the existing A47 as the route passes the village of Honingham. See Figure 3.3.

Figure 3-3 : Option 3


## Option 4

3.1.6. Option 4 proposes building a new dual carriageway to the south of the existing A47. The new dual carriageway follows an alignment running to the south of the existing A47 and to the south of the River Tud. At the western end of the Proposed Scheme, it crosses the River Tud before passing to the south of the village of Honingham and returning to the A47 at. See Figure 3.4.

Figure 3-4 : Option 4

## 3.2. Option taken forward – the Proposed Scheme

3.2.1. Upon review of the non-statutory consultation feedback and route option assessments, a variation on Option 2 was taken forward.

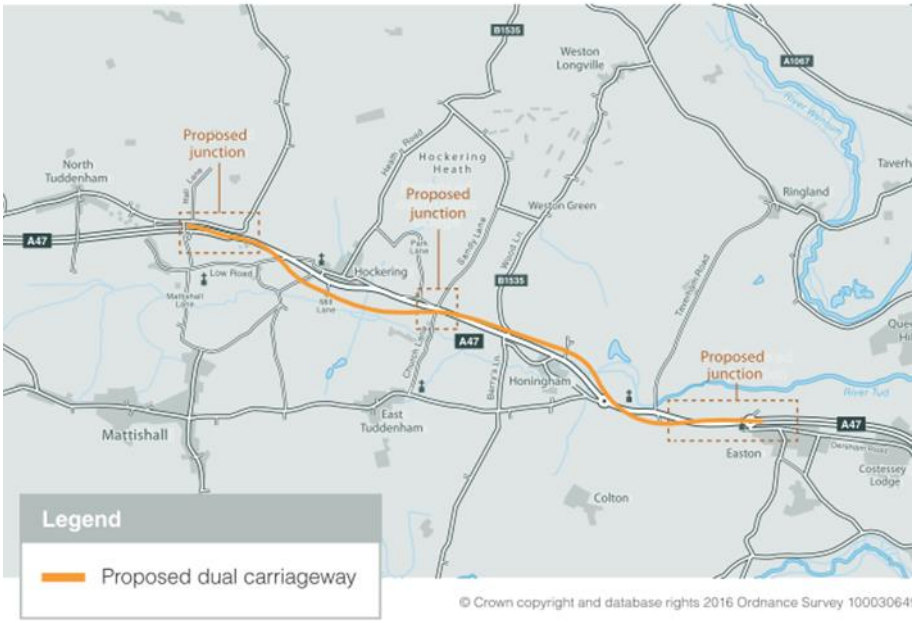
3.2.2. It is considered that the preferred route can be built with the least disruption to drivers during construction as the existing road can remain for local traffic. This option also has the least impact on the environment.

3.2.3. Over 482 people attended the three days of public events and Highways England received 532 responses to the non-statutory consultation on the options. 90% of the respondents supported that improvements were needed for the A47 North Tuddenham to Easton route.

3.2.4. A number of concerns were raised over access for pedestrians, horse riders and cyclists. Concerns were also raised around potential noise and traffic disruption during construction.

3.2.5. Concerns raised during non-statutory public consultation on options will be considered as part of the design process and development of the side road strategy. The final design and construction plan will be the subject of statutory consultation under the Planning Act 2008.

Figure 3-5 : Proposed option



# 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 six-week non-statutory public consultation of the options. The public information events were held on 6, 7 and 8 April 2017.

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

4.1.3. In addition to the public information exhibitions, public information points were made available throughout the duration of the consultation period. They were selected within the vicinity of the proposals, and in nearby neighbourhoods to ensure that all stakeholders had the opportunity to collect consultation materials if they were unable to attend one of the scheduled consultation events. The following consultation material was available at the public information points:

- Consultation scheme brochure
- Consultation scheme questionnaire and freepost envelope
- Poster detailing public events and scheme website

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 online. 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. Local MPs and Councillors were invited to attend a preview of the Public Information Exhibition before it opened to the public. The preview events were held on the 13 and 14 March 2017.

### Engagement with statutory environmental bodies

4.1.6. Highways England has not formally engaged with the Statutory Environmental Bodies during the route options development period and during the non-statutory public consultation period. Informal consultation has however been undertaken in support of individual technical assessments and this engagement is referenced within the individual technical chapters as appropriate.

### Engagement with landowners

4.1.7. Landowners were engaged as part of the non-statutory public consultation exercise.

### Engagement with the community

4.1.8. Non- statutory public consultation was undertaken over the period 13 March to 21 April 2017.

4.1.9. The scheme proposals were advertised by way of posters, distributing leaflets, brochures and advertisement in local newspapers, and other media sources within the Honingham, Hockering and Easton areas.

4.1.10. Three public information exhibitions were held on the 6, 7 and 8 April 2017.

4.1.11. Four hundred and eighty-two people attended the exhibitions with a total of 530 responses received.

4.1.12. Information on the scheme proposals were also made available on the Highways England website https://highwaysengland.co.uk/programmes/a47-corridor-improvement-programme/ and distributed to local public libraries and community halls.

## 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 technical chapter of this report.

### Engagement with hard to reach groups

4.2.2. It is anticipated that 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 walkers, cyclists and horse riders groups, ethnic organisations, local Traveller communities', disability groups and groups representing children and the elderly.

4.2.3. Scheme summary information, the Statement of Community Consultation, policy guidance documents and other relevant technical documents will be available online and at various information points in local community venues. These documents will be added to throughout the course of the Proposed Scheme.

# 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, with assessment undertaken to a Scoping Level. This chapter encompasses two sub-topics, as follows:

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

5.1.3. The potential requirement for assessment to either Simple or Detailed level will be identified within this chapter.

## 5.2. Study Area

5.2.1. The location of the Proposed Scheme and key environmental constraints are shown in Figure A, B1 and B2 (see Appendix A and B respectively).

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 are defined where:

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

5.2.4. Air quality construction impacts are expected to be restricted to within 200m of construction activities (as stated in DMRB Volume 11, Section 3, Part 1),

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

5.2.6. 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 Local Authority Boroughs that the Proposed Scheme passes through (Breckland Council, Broadland District Council and South Norfolk Council), Department for Environment, Food and Rural Affairs (Defra), and Highways England. The most recent full year of bias adjusted monitoring data is for 2016.

### Local authority review and assessment

5.3.2. In June 2017, an AQMA was declared in Swaffham for exceedances of the annual mean of $NO_2$. This is approximately 24km west of the site and is not expected to be impacted upon as a result of the proposed development.

5.3.3. There are currently no AQMAs declared in the Broadland Council or South Norfolk Council Boroughs.

5.3.4. The nearest AQMA to the proposed development is the Central Norwich AQMA approximately 9km east declared by Norwich City Council, the Proposed Scheme does not fall within the Norwich City Council authority. This AQMA is not expected to be impacted upon by the Proposed Scheme.

### Local Authority monitoring

5.3.5. There are no automatic monitoring sites within Broadland District Council or South Norfolk Council boroughs. Breckland Council undertakes continuous

automatic monitoring at two sites. These are located at East Wretham and Swaffham and neither are considered to be representative of the study area.

5.3.6. Breckland Council, Broadland Council and South Norfolk Council undertake diffusion tube monitoring for $NO_2$ within their respective borough's. However, there are no diffusion tubes representative of air quality at the Proposed Scheme.

## Scheme specific monitoring

5.3.7. An $NO_2$ diffusion tube monitoring survey, commissioned by Highways England, January to March 2017. The monitoring consists of four diffusion tubes placed at rural and roadside locations along the proposed route to identify $NO_2$ concentrations. The results of the monitoring are presented in Table 5-1 and show that there are no exceedances of the annual mean $NO_2$ objective along the proposed route. Currently, only three months of annualised data is available; however, further monitoring data should be available for the ES.

Table 5-1 : Scheme specific diffusion tube monitoring data for $NO_2$

| Site ID | Site location | Site classification | National grid reference | | Bias adjusted and annualised to April 2016 to April 2017 NO2 (µg/m3) |
|---|---|---|---|---|---|
| | | | X | Y | 2016 |
| Tuddenham A | St. Michael's Church | Rural | 607118 | 313290 | 16.9 |
| Tuddenham B | A47 near Honingham | Roadside | 610264 | 311988 | 25.6 |
| Tuddenham C | A47 near Church House Farm | Roadside | 611814 | 311119 | 19.3 |
| Tuddenham D | Lighting Column at A47/Dereham Road Junction | Roadside | 613146 | 311022 | 28.8 |

## Defra projected background concentrations

5.3.8. In addition to the data above, Defra provides estimates of background pollution concentrations for NOx, $NO_2$ and $PM_{10}$ across the UK for each 1km 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.

5.3.9. Table 5-2 presents the maximum background concentrations for the areas covered by the Proposed Scheme alignment for the year 2016.

Table 5-2 : Defra projected background concentrations for the Proposed Scheme (2016)

| NOx | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|
| 13.8 | 10.2 | 17.8 | 12.0 |

Note: Proposed Scheme covers multiple 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 = 60500, 313500 for NOx and $NO_2$; and 607500, 313500 for $PM_{10}$ and $PM_{2.5}$.

## EU limit value compliance

5.3.10. 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 most up to date PCM model outputs were released in August 2017, following the release of Defra's Air Quality Action Plan.

5.3.11. Based on projected roadside $NO_2$ concentrations in the current version of the PCM model, there are no PCM links within approximately 50km of the Proposed Scheme exceeding $40_{\mu g}/m^3$ for the year of 2017. The PCM link closest to the Proposed Scheme, (on the A1074) is located approximately 5km from the Proposed Scheme and has a reported annual mean $NO_2$ concentration in 2017 of $30_{\mu g}/m^3$, which is well below the annual mean limit value of $40_{\mu g}/m^3$ for $NO_2$ and therefore the Proposed Scheme is unlikely to cause a non-compliance with the Air Quality Directive.

5.3.12. The ES will identify 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

5.3.13. Diffusion tube monitoring being undertaken for the Proposed Scheme indicates that $NO_2$ concentrations are below the $NO_2$ annual mean air quality objective. There are also no AQMAs located within the vicinity of the Proposed Scheme, the nearest AQMA is the Central Norwich AQMA approximately 9km east that covers the entirety of the Norwich City Centre.

5.3.14. There is no monitoring data available for $PM_{10}$ or $PM_{2.5}$. Defra background concentrations as presented in Table 5-2 indicate that background concentrations are well below air quality objectives for the site and immediate surrounding areas.

## 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 the screening model predictions, including:

- Uncertainties with traffic forecasts
- Uncertainties with vehicle emission predictions
- Uncertainties with background air quality data
- Simplifications made within modelling 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 will be verified using the air quality measurements from the Highways England monitoring survey. 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 5-3 presents the relevant air quality objectives that the Proposed Scheme will be assessed against.

Table 5-3 : 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)] |
| | 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 NO2 limit values in some zones/agglomerations.
(d) Designated for the protection of vegetation and ecosystems and referred to as the 'critical level' for NOx.

## 5.6. Consultation

5.6.1. Consultation will be undertaken with Breckland Council, Broadland District Council and South Norfolk Council to discuss assessment approach and the study area once scheme specific traffic data for the ES is finalised.

## 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 effect air quality due to:

- Changes in emissions associated with changes in traffic flows (including composition and speed) on the local road network, and / or
- 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 (NOx), including $NO_2$
- Fine particles (particulate matter defined as those less than 10microns 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 (NOx), including nitrogen dioxide ($NO_2$)
- Fine particles (particulate matter defined as those less than 10microns 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 5-4 provides a summary of the potential construction and operational air quality effects for the Proposed Scheme.

Table 5-4 : 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 of scope and 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 updated traffic modelling 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 previous survey 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 will be identified in accordance with Best Practicable Means (BPM) which would be incorporated into the CEMP.

5.9.2. As the 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; and,
- 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 5-5.

Table 5-5 : Magnitude of change criteria

| Magnitude of change in concentration | Value of change in annual average NO2 and PM10 |
|---|---|
| Large (>4) | Greater than full MoU value of 10% of the air quality objective (4 µg/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 5-6.

Table 5-6 : 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 exceedance | Improvement of an air quality objective already above objective or the removal of an existing exceedance |
| 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 5-6 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 5-6 will then been 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 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 previously undertaken air quality survies. This will be reviewed again once traffic data is available and the ARN for the Proposed Scheme have been determined.

5.10.3. A simple level 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 within the 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 'heritage assets' 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.

## 6.2. Study Area

6.2.1. A study area has been defined to include designated and non-designated cultural heritage assets within 1km of the Proposed Scheme site boundary. Baseline heritage assets within the study area will be considered in order to make an informed assessment of archaeological potential for hitherto unknown heritage assets within the site boundary.

6.2.2. Though no physical impacts to designated assets are anticipated, it is considered that the 1km search area is proportionate to identify potential settings effects, as the Proposed Scheme is situated on the side of a valley.

6.2.3. A Zone of Visual Influence (ZVI), which will be produced as part of the Landscape Visual Impact Assessment (LVIA) in the ES, will be used to identify any designated assets that would potentially be affected by the construction or operation of the Proposed Scheme, and considered for detailed settings assessment in the ES Cultural Heritage chapter.

## 6.3. Existing and baseline knowledge

6.3.1. The information presented within this scoping report is based on previous stages of design development and assessment for the Proposed Scheme.

6.3.2. Data detailing nationally designated cultural heritage assets in the UK has been obtained from Historic England's National Heritage List for England (NHLE).

Information concerning designated and non-designated heritage assets was obtained from the Norfolk Historic Environment Record (NHER).

6.3.3. References used in this section refer to the National Heritage List for England list entry numbers (NHLE numbers) and Norfolk HER preferred reference numbers (MNF numbers).

6.3.4. Table 6-1 summarises the known baseline for the Proposed Scheme within the 1 km study area.

Table 6-1 Summary of existing baseline

| Existing Baseline |
|---|
| **Designated assets**<br>There are no scheduled monuments, conservation areas, registered parks and gardens or historic battlefields within the study area.<br><br>There are 19 Listed Buildings within the study area, three of which are grade I listed:<br>• Church of St Michael (NHLE 1077354), 130m to the north of the Proposed Scheme, at Hockering.<br>• Church of St Mary (NHLE 1169192), around 580m to the south of the western end of the Proposed Scheme.<br>• Church of St Peter (NHLE 1305921), within although excluded from the red line boundary some 30m to the south of the eastern end of the Proposed Scheme, at Easton.<br><br>Two grade II* buildings listed are situated within the study area:<br>• Church of St Andrew (NHLE 1170701), situated within the red line boundary to the east of Honingham, 70m to the north of the proposed route alignment; and<br>• West Lodge (NHLE 1050771), 880m to the north-east of the eastern end of the Proposed Scheme.<br><br>There are 14 grade II listed buildings within the study area. Of the 14, one terrace 39, 40 and 41, The Street (NHLE 1170745), is situated the closest to the Proposed Scheme, 100m to the south, on the northern edge of Honingham.<br><br>**Non-designated assets**<br>Sporadic pockets of peat are recorded in the immediate area surrounding the River Tud: two boreholes (TG11SW/106 and TG11SW/107) 270m to the south of the A47, at Honingham, revealed peat at ground level to a depth of 0.8m. Peat deposits provide anaerobic conditions which are suitable for preservation of organic archaeological material that, in normal circumstances, would not survive, such as wood, leather, string, hair and skin.<br><br>Evidence of prehistoric human occupation within the area surrounding the Proposed Scheme is represented by several flint tools and flakes found across the study area, and within the footprint of the Proposed Scheme. For example: NHER 35690, north-east of Rotten Row, on the southern side of the A47; NHER 60470 and east of Honingham, on the southern side of the A47. At least one probable Bronze Age round barrow is recorded 70m to the south of the A47, to the west of Easton (NHER MNF59554). A Bronze Age barrow cemetery is recorded further to the south-west of this, around 430m to the south of the A47, south of Church House Farm. One Iron Age toggle was found within the footprint of the Proposed Scheme (NHER 31498) at Sycamore Farm, north-east of Rotten Row, though the prehistoric evidence from within the study area is otherwise predominantly Neolithic and Bronze Age in date. The area is likely to have been conducive to human settlement and funerary activities due to the proximity of the River Tud and the favourable topography. |

| Existing Baseline |
| --- |
| The focus of Roman activity within the region was at Caistor St Edmund – *Venta Icenorum* – c. 12km to the south-east of the Proposed Scheme. However, the available archaeological evidence indicates that the study area formed part of the Romano-British agricultural hinterland. A possible Roman building (farmstead/villa?) with a hypocaust, indicative of a bath house, has been identified through ploughing and metal detecting at Hillcrest, 40m to the south of the Proposed Scheme red line boundary, between Hockering and Honingham (NHER7304). Cropmarks of possible Roman field systems are also recorded within the red line boundary, to the east of Honingham (NHER MNF59439 and NHER MNF60178).<br><br>A small number of Saxon finds have been recorded within the study area, the closest find was recorded around 50m to the north of the Proposed Scheme: A Middle or Late Saxon set of tweezers found through metal detecting in a field to the east of Honingham (NHER MNF29708). They were found in the same field as the Roman cropmarks at NHER MNF59439, hinting at a possible continued use of the site. The surrounding settlement place names have their origins in the Saxon period, with Hockering, Tuddenham and Honingham containing typically Saxon elements – *ing* and *ham*. Therefore, despite a paucity of physical evidence, this evidence demonstrates strong Saxon influences.<br><br>Medieval evidence within the Proposed Scheme red line boundary comprises chance finds recovered through metal detecting, including a sword- or belt-fitting (NHER MNF29044, at the eastern end of the Proposed Scheme), a coin (NHER 60352, at the junction of Church Lane and the A47, east of Hockering) and a vessel foot (NHER 25701 east of Church House Farm, Honingham). The villages of Hockering, Honingham, North Tuddenham and Easton are all recorded in the Domesday Survey of 1086 and their churches all date to the medieval period. It is likely that the land in between the villages was established agricultural land during this period. Former medieval tofts are recorded to the north of the Proposed Scheme, to the east of Honingham, on the western side of Taverham Road (NHER NMF28552). They are aligned on the course of the river, and cropmarks on a similar alignment are recorded in a field to the south, within the footprint of the Proposed Scheme (NHER 53683).<br><br>A milestone situated on the southern side of the A47, to the south of St Andrew's Church and within the red line boundary of the Proposed Scheme dates to the 19th century and marks the 7-mile mark from Norwich (NHER 56391). The road between Norwich and Swaffham was turnpiked in 1775 and the A47 largely follows its course, though 20th century modernisation of the road also diverted it from the village centres. The area remained rural agricultural throughout the post-medieval period. The Proposed Scheme runs through the southern tip of Honingham Park (NHER 44183), the parkland for Honingham Hall. The park is shown on late 18th century mapping onwards.<br><br>**Historic Landscapes**<br><br>The landscape comprises predominantly 20th century agricultural fields, though surviving 18th to 19th century enclosure is also identified. Areas of inland managed wetland are identified along the course of the River Tud and pockets of woodland survive along the valley sides. Parkland survives, particularly around Honingham Hall. Numerous field boundaries have evidently been lost throughout the later historic periods, with agricultural industrialisation requiring larger field sizes, however the general grain of field boundaries remains much as it is shown in the available superseded historic mapping sequence. |

## 6.4. Assumptions and limitations

6.4.1. The baseline information presented here is based on the information contained in documents from previous stages of the Proposed Scheme design and assessment: this includes NHLE and NHER data obtained in mid-2018. The data was gathered for a larger study area than the 1 km study area defined here, to inform context and is sufficient to cover changes in the scheme boundary and study area to date. Up-to-date data will be gathered for the ES impact assessment for the whole study area.

6.4.2. Buildings of local importance are not included within the Norfolk HER and have thus not been considered to date. The ES impact assessment will identify any such structures and will assess the impact and effect of the construction and operation of the Proposed Scheme upon them.

6.4.3. The assessment presented in this scoping report is based upon the scoping boundary shown in Figure A. Detailed design will be undertaken during preparation of the ES and will include associated construction elements such as compound locations, drainage and landscaping. As such, further design has the potential to alter the predicted effects of the construction and operation of the Proposed Scheme, and these will be fully assessed in the ES Cultural Heritage chapter.

6.4.4. 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 due to a lack of targeted research or investigation rather than the genuine absence of sub-surface archaeological deposits. Further, information can be held back under confidentiality agreements, usually for works carried out in advance of unsubmitted planning applications.

6.4.5. 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.

6.4.6. 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.

6.4.7. Conclusions may therefore be revised during the course of the EIA process on the basis of updated information following further research, survey, and 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 (2017) Historic Environment Good Practice Advice on Planning Note 3 (GPA3) - The Setting of Heritage Assets
- Standard and Guidance from the Chartered Institute for Archaeologists

## 6.6. Consultation

6.6.1. Non-statutory public consultation was undertaken between 13 March 2017 and 21 April 2017. Responses included concerns regarding impacts to St Andrew's Church, Honingham and St Michael's Church, Hockering. Norfolk County Council and Breckland District Council reserved judgement on the Proposed Scheme until further information regarding connecting roads is available.

## 6.7. Potential effects including monitoring and mitigation measures

**Construction**

6.7.1. Without mitigation, the Proposed Scheme has the potential to physically and permanently adversely affect designated and non-designated heritage assets during construction. Buried archaeological deposits and palaeoenvironmental remains, if present, may be damaged or destroyed by construction groundworks and other activities. Following the baseline surveys and assessment of the Proposed Scheme, measures will be detailed in the ES to mitigate potential impacts.

6.7.2. There is a potential for designed setting elements of a historic park (not registered), adjacent to the A47 at Taverham Road, to be affected by the Proposed Scheme through visual or indirect impacts.

6.7.3. The design and placement of development elements (such as bunds, drainage, landscaping, compounds, haul roads and planting etc) would consider the location of heritage assets, with a preference for preserving remains in-situ where warranted and achievable during the design process. Best practice measures to limit impacts on heritage assets would be employed during construction through the implementation of a CEMP.

6.7.4. For identified heritage assets located within the Scoping Boundary that cannot be avoided and would therefore be physically impacted by construction groundworks, mitigation would be achieved through 'preservation by record' (advance archaeological excavation and recording).

**Operation**

6.7.5. Below ground archaeological deposits will not be impacted by the operation of the Proposed Scheme, any impacts having been previously fully mitigated during the construction phase. However, the improvements have the 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. Where setting effects

are assessed as significant, mitigation will be proposed in the form of vegetation screening or noise barriers etc.

### Summary

6.7.6. 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 adverse direct effects on known and potential palaeoenvironmental and archaeological remains.<br>Potential adverse setting effect during construction due to close proximity of St Andrew's Church. | Potential adverse effects on the setting of designated heritage assets.<br>Potential adverse effects on the setting of non-designated historic park. |

## 6.8. Proposed level and scope of assessment

6.8.1. Assessment of likely significant construction effects will be necessary due to the potential for direct impacts on heritage assets and palaeoenvironmental remains. In addition, due to the presence of sensitive receptors within close proximity of the Proposed Scheme, assessment of potential operational impacts is required. Environmental Impact Assessment will be undertaken to a Detailed level and in accordance with regulations. Results of the EIA will be used to inform the design of an historic environment strategy, which would likely specify evaluation through geophysical survey and intrusive archaeological works. All investigations will be informed by and have aims and objectives based on the regional Framework for the East of England (Resource Assessment - Glazebrook 1997, Research Agenda and Strategy - Brown and Glazebrook eds 2000, East Anglian Archaeology Occasional Paper No.24 – Medlycott 2011).

## 6.9. Proposed methodology including significance

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

6.9.2. 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 a heritage asset or impacts on setting.

### Assessment of value / sensitivity

6.9.3. The assessment of 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. |
| 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 a matrix-led approach, combining 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.

6.9.7. These effects can be beneficial or adverse, 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.

6.9.8. Consideration will be given to potential enhancements that could be realised under the Environment Designated Fund objectives. This would include but not be limited to heritage, multidisciplinary measures and co-funded works with stakeholders such as the local planning authority, or English Heritage etc.

## 6.10. Conclusion

6.10.1. During construction, there is the potential for a direct effect upon the setting of: listed buildings, including the grade II* listed St Andrew's Church, Honingham; a non-designated historic park; and direct impacts to palaeoenvironmental and archaeological remains. Assessment of the likely significant effects of construction will therefore be necessary and reported in the Cultural Heritage chapter of the ES. In addition, due to the presence of sensitive receptors within 1km of the Proposed Scheme, assessment of operational impacts is also required.

# 7. Landscape

## 7.1. Introduction

7.1.1. The Landscape and Visual Impact Assessment (LVIA) chapter 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 requirements of the DMRB 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, IAN 135/10 and Institute of Environmental Management and Assessment 'Guidelines for Landscape and Visual Impact Assessment, Third Edition'. The potential requirement for assessment to either 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 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 study area coincides with two National Character Areas (NCAs); NCA 78 'Central North Norfolk' and NCA 84 'Mid Norfolk'. The transition between the two NCAs occurs in the vicinity of Honingham, with NCA 78 relating to the eastern extents of the study area and NCA 84 relating to the western extents of the study area.

7.3.2. The two NCAs share many landscape characteristics and features and are closely linked physically and ecologically. As such each associate with the same overall ancient countryside origins with a long-settled agricultural character, where arable land is enclosed by winding lanes and hedgerows, interspersed with woodland and remnant heath and dissected by lush pastoral river valleys. A patchwork of cultivated land, numerous church spires, distant wooded horizons and big skies dominate the landscape. There is however some subtlety in difference between the two whereby the Central North Norfolk NCA is more gently undulating relative to the broadly flat landscape of the Mid Norfolk NCA.

7.3.3. In terms of local Landscape Character Areas (LCAs), the western extents of the study area coincide with the coverage of Breckland District Council 'Breckland

District Landscape Character Assessment'. The eastern extents of the study area coincide with the LCAs defined in Broadland District Council's Landscape Character Assessment Supplementary Planning Document and South Norfolk District Council's 'South Norfolk Landscape assessment.

7.3.4. Within the Breckland defined LCAs the study area coincides with the 'Upper Tud River Valley' and 'River Wensum and Tud Settled Tributary Farmland' LCAs.

7.3.5. The Upper Tud River Valley LCA, coincides with the mid and eastern extents of the study area in the vicinity of Hockering, and is characterized by its broad and shallow valley topography, geometrical field pattern defined by mixed species hedgerows, and occasional marshlands. Alder dominated woodland appears in linear bands along the river, screening views across the area. A network of Public Rights of Way (PRoW) affords non-motorised mobility through the area, and the towers of the churches, as exemplified by those in Hockering and East Tuddenham, are distinctive orientational landmarks on the skyline.

7.3.6. The River Wensum and Tud Settled Tributary Farmland LCA coincides with the mid and north-eastern extents of the study area in the vicinity of North Tuddenham. Its undulating topography associates with arable fields of variable size, commonly bounded by clipped hedgerows with occasional trees, and interspersed with areas of woodland which follow the geometrical pattern of the fields. A network of rural lanes interconnects the hamlets and settlements dispersed throughout the area.

7.3.7. Within the Broadland defined LCAs the study area coincides with the 'Weston Green Tributary Farmland' LCA which associates with the area east of Honingham. This area is isolated from the rest of the district by the River Wensum, with a gently rolling landform that forms an elevated plateau between the valleys of the River Tud and the River Wensum. Land use is characterised by arable and pastoral fields, together with estate plantations and belts of mixed woodland along the Tud valley. Honingham is the main settlement within an area otherwise characterised by dispersed hamlets and farmsteads. The skyline is dominated by a line of pylons that crosses the area on a south-east to north-west alignment.

7.3.8. Within the South Norfolk defined LCAs the study area coincides with the 'Easton Fringe Farmland' LCA associated with the western settled edge of Easton. The undulating landscape slopes towards a ridge between the valleys of the River Tud and the River Yare. The area is characterised by arable and pastoral farmland interspersed by wooded areas. Fields are irregular and bounded by mature tree lined hedgerows. Easton is the main settlement within the area with other settlement comprising isolated properties within agricultural areas.

7.3.9. Physical features in the immediate vicinity of the Proposed Scheme corridor which contribute to the landscape character of the wider area include agricultural fields enclosed by hedgerows with mature trees, small areas of woodland and waterbodies. The existing A47 highway boundary is partially delineated by mature trees, shrubs and hedgerows.

7.3.10. There are no notable landscape designations associated with the Proposed Scheme study area.

### Visual amenity

7.3.11. The study area associates with a wide, gently rolling topography with elevations of between 20 and 60m Above Ordnance Datum which affords the potential for extensive views. The extent of visibility is however notably influenced by local topographic ridges and hollows and by the partial enclosure afforded by mature tree cover within hedgerows and grouped as larger woodland blocks.

7.3.12. The potential for views of the Proposed Scheme most notably associates with residential properties, users of the local Public Rights of Way (PRoW) network and users of community facilities including a number of churches. The potential for views from residential properties includes the settlements of Hockering and Honingham and a wider, dispersed pattern of individual properties and small hamlets spread extensively across the study area. Various PRoW footpaths and bridleways coincide with the extent of the study area, with notable concentrations of routes in the vicinity of Hockering and Honingham. Community facilities with potential to experience views of the Proposed Scheme include St Michael's Church in Hockering, Honingham Village Hall and recreation ground, St Andrew's Church in Honingham and St Peter's Church in Easton.

7.3.13. Views of the Proposed Scheme will also be experienced by road users of the A47, B1147 and various minor roads within the extent of study area.

## 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 have informed understanding of 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 options was undertaken in March 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. As part of the assessment in the ES, 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. The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting (see Appendix C – Lighting Impact Assessment methodology) would potentially result in a significant adverse impact on local landscape elements and character during construction. In particular there would be loss of highway boundary trees, shrubs and hedgerow along the existing A47 corridor, loss of agricultural land (notably south-west and south-east of Hockering and east of Honingham) and loss of areas of woodland (notably north of Honingham).

### *Visual effects*

7.7.2. The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting would potentially result in significant adverse visual effects on residential properties, PRoW users, local community facilities and road users.

7.7.3. Receptors with potential to be adversely affected by the Proposed Scheme during construction include residential properties on the southern edge of Hockering, the northern edge of Honingham and a number of residential properties dispersed across the area located to either side of the Proposed Scheme route corridor. The potential for adverse effects would also extend to include recreational users of the local PRoW network and users of community facilities at St Michael's Church in Hockering, Honingham Village Hall and recreation ground, St Andrew's Church in Honingham and St Peter's Church in Easton. There would also be the potential for adverse visual effects on road users of the A47, B1147 and various other local minor roads within the study area.

## Operations

### *Landscape effects*

7.7.4. At year 1 of operation the juvenile state of mitigation planting associated with the Proposed Scheme would potentially result in significant adverse effects on landscape character due to the relative prominence of Proposed Scheme infrastructure prior to the establishment of integrating Proposed Scheme mitigation planting. The adverse effect would also associate with the initial year 1 loss of mature tree and hedgerow landscape elements relative to the existing baseline and to the loss of agricultural land.

7.7.5. By year 15 of operation, the establishment of Proposed Scheme landscape mitigation would contribute to a reduction in the extent and significance of landscape effects. There would however remain the potential for not significant adverse landscape effects as an outcome of the relative increase in highway infrastructure.

### *Visual effects*

7.7.6. At year 1 of operation, prior to the establishment of Proposed Scheme landscape mitigation, there would be potential for significant adverse visual effects associated with views of the road/highway infrastructure, including grade separated junctions, highway overbridges, and vehicles. Receptors with potential to be adversely affected by the Proposed Scheme during year 1 of operation include residential properties on the southern edge of Hockering, the northern edge of Honingham and a number of residential properties dispersed across the

area located to either side of the Proposed Scheme route corridor. The potential for adverse effects would also extend to include recreational users of the local PRoW network and users of community facilities at St Michael's Church in Hockering, St Andrew's Church in Honingham and St Peter's Church in Easton. There would also be the potential for adverse visual effects on road users of the A47, B1147 and various other local minor roads within the study area.

7.7.7. By year 15 of operation, the establishment of Proposed Scheme landscape mitigation would contribute to a reduction in the extent and significance of visual effects. There would however remain the potential for residual significant adverse visual effects on residential properties on the southern edge of Hockering and a number of residential properties dispersed across the area located to either side of the Proposed Scheme route corridor. The potential for residual adverse effects would also extend to include recreational users of the local PRoW network and users of St Andrew's Church in Honingham.

7.7.8. 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

7.7.9. Table 7-1 provides a summary of the potential construction and operational effects of the Proposed Scheme upon the surrounding landscape and visual receptors.

Table 7-1 : Summary of potential landscape and visual effects

| Potential construction effects | Potential operation effects |
|---|---|
| Landscape: Construction effects associated with the removal of vegetation and the presence of construction activity, plant, lighting, material stock piling and construction compounds. Potential significant adverse impact on local landscape elements and character. | Landscape: Year 1 operational significant adverse effects associated with a reduction in extent of tree and hedgerow cover, loss of agricultural land and prominence of highway infrastructure.<br>Landscape: Year 15 operational not significant adverse effects associated with the relative increase in highway infrastructure |
| Visual: Construction effects associated with the removal of vegetation and the presence of construction activity, plant, lighting, material stock piling and construction compounds. Potential significant adverse effects on; residential properties in Hockering and Honingham and individual properties in the wider area; recreational users of the local PRoW network; users of community facilities at Hockering, Honingham and Easton; and road users of the A47 and local roads within the study area. | Visual: Year 1 operational significant adverse effects associated with visibility of the road/highway infrastructure and vehicles.<br>Potential adverse effects on; residential properties in Hockering and Honingham and individual properties in the wider area; recreational users of the local PRoW network; users of community facilities at Hockering, Honingham and Easton; 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<br>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 Hockering and individual properties in the wider area; recreational users of the local PRoW network; and users of community facilities at Honingham. Potential adverse night time visual effects on residential receptors as a result of the influence of vehicle headlights are not considered significant. |

## 7.8. Proposed level of scope and 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 in Section 7.5 above.

7.9.2. As part of the ES assessment work, 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:<br>• With either a very simple or a very complex pattern.<br>• With limited presence of existing built features or linear infrastructure, including highways.<br>• Associating with areas of intimacy or tranquillity.<br>• Of high quality with distinctive elements and features making a positive contribution to character and sense of place.<br>• Likely to be designated e.g. National Park and AONB, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale.<br>• Areas of special recognised value through use, perception or historic and cultural associations.<br>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:<br>• With a distinct, coherent pattern.<br>• With notable presence of existing built features or linear infrastructure, including highways.<br>• Associating with a broad sense of enclosure brought about by landform or vegetation cover.<br>• Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place.<br>• Locally designated, or their value may be expressed through non-statutory local publications.<br>• Containing some features of value through use, perception or historic and cultural associations.<br>• 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:<br>• Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place.<br>• Not designated.<br>• Containing few, if any, features of value through use, perception or historic and cultural associations.<br>• 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. |

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 identity

| Sensitivity | Typical receptors |
|---|---|
| High | Residential properties.<br>Users of PRoW or other recreational trails (e.g. National Trails, footpaths, bridleways etc.).<br>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.).<br>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<br>Users of scenic roads, railways or waterways or users of designated tourist routes.<br>Schools and other institutional buildings, and their outdoor areas. |
| Low | Indoor workers<br>Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes.<br>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. |
| 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 (vegetation loss) and operation (residual change in views) and the scale of the proposed works, the Proposed Scheme meets the criteria set out in IAN 135/10 LVIA for a ‘Detailed’ level of assessment.

7.10.2. Assessment will be presented in the form of a Detailed LVIA within 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 assessment to either Simple or Detailed level will be identified. The potential impacts on these receptors as a result of the Proposed Scheme have been assessed. 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 and 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 : Study area boundaries 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 Sites of special scientific Interest (SSSI) | 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), breeding, wintering and migratory birds | 500m |
| Water vole, otter and white-clawed crayfish | 250m |
| Aquatic invertebrates from within wetland habitats | 500m |
| Terrestrial invertebrates | Within scoping boundary |
| Badger and bat roosts | 50m |
| Other ecological assessments including Phase 1 habitat survey, botanical, fungi, reptiles and bat activity | 100m |

## 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 baseline

| Summary of existing baseline |
| --- |
| • River Wensum SAC/SSSI 1.6km north-east<br>• Hockering Wood SSSI 0.55km north<br>• Rosie Curston's Meadow SSSI 1.7km south-west<br>• No Bat SACs within 30km<br>• Fen West of East Tuddenham County Wildlife Site (CWS) 0.2km south.<br>• Land adjoining River Tud CWS 0.16km north<br>• Fen Plantation CWS 0.3km south<br>• River Tud (west) CWS 0.4km east<br>• Park Grove CWS 0.5km north<br>• Harman's Grove CWS 0.4km north<br>• Old Covert, Wood Lane CWS adjacent to the northern boundary<br>• Hall Hills/ Ringland Covert CWS 0.1km north<br>• Clippings Green Farm CWS 0.8km south-west<br>• Gravel pits, E Tuddenham CWS 0.6km south<br>• Mouse Wood CWS 0.5km north<br>• Holly Woods CWS 0.9km east<br>• Land adjoining Foxburrow Plantation CWS 0.5km north<br>• Ringlands Hills CWS 1.3km north-east<br>• Lord's Hill and Easton Reeds and Blackhill Wood CWS 1.5km east<br>• Old Hall Meadow CWS 1km south<br>• Ringland Pits CWS 1.6km north-east<br>• Yare Valley CWS 1.8km south-east<br>• North Tuddenham Common CWS 1.7km west<br>• Long Dale CWS 1.6km east<br>• Pasture at Easton College CWS 1.9km south-east |

8.3.2. Online resources (MAGIC[1]) identify pockets of ancient woodland within the study area, they are all additionally CWSs (or SSSI) including:

- Park Grove
- Harman's Grove
- Mouse Wood
- Holly Woods
- Lords' Hill and Easton Reeds and Blackhill Wood

[1] Multi-Agency Geographic Information for the Countryside

- Hockering Wood SSSI

8.3.3. Data from the Norfolk County botany recorder, and subsequent discussions, indicate that some areas of land within the study area may be designated as CWSs in the future due to the diversity of plants species, including some regionally rare specimens. For the purpose of this assessment these areas have been classified as 'Habitat Suitable of CWS Designation', these areas are highlighted in the environmental constraints plan.

8.3.4. 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 North Tuddenham to Easton Stage 2 Preliminary Ecological Appraisal.

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

- Botany
- Bats
- Breeding birds
- Wintering birds
- Migratory birds
- Great crested newts
- Other amphibians
- Badgers
- Reptiles
- Otters
- Water voles
- Fungi
- Aquatic invertebrates (including white-clawed crayfish)
- Terrestrial invertebrates
- Invasive species, both terrestrial and aquatic

8.3.6. The main habitat types recorded within the study area were arable, semi-improved neutral grassland, broadleaved woodland, including semi-natural and plantation, marshy grassland, dense and scattered scrub, running water, standing water, hedgerows (some species rich), buildings, unimproved neutral grassland, recently felled woodland, bare ground and tall ruderal.

8.3.7. Surveys to date have taken place to support previous stages of design development and assessment. Surveys are also being carried out to inform the ES which have taken place in 2016 and 2017 and are ongoing in 2019, as detailed in Table 8-3.

Table 8-3 : Ecology surveys to date

| Survey | Dates Undertaken | Study area (including areas not surveyed) | Survey Methodologies (methods, frequencies |
|---|---|---|---|
| Phase One Habitat Survey / Preliminary Ecological Appraisal | March 2016 to July 2016. | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer either side. | • JNCC's Handbook for Phase 1 Habitat Survey - a technique for environmental audit.<br>• CIEEM's Guidelines for Preliminary Ecological Appraisal. |
| Invasive species surveys | June 2017-September 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer either side. | - |
| Phase 2 Botanical Surveys- including aquatic species | June 2017-July 2017 | River Tud and associated tributaries Some woodland areas | • Aquatic NVC<br>• Woodland - list of species using DAFOR. |
| Hedgerow surveys | September 2017 | Targeted areas | • Guidance in The Hedgerow Regulations (1997) |
| Fungi | September 2017-October 2017 | Targeted areas | - |
| Great crested newt | March – June 2017 April to June 2019. | Ponds within 500m of the Proposed Scheme. | • English Nature (2001) Great Crested Newt: Mitigation Guidelines<br>• Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000) Evaluating the suitability of habitat for the Great Crested Newt (Triturus cristatus).<br>• Biggs J et al 'Analytical and methodological development for improved surveillance of the Great Crested Newt.<br>• Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. |
| White-clawed crayfish | August 2017-September 2017 | River Tud | • Peay (2003) |

| Survey | Dates Undertaken | Study area (including areas not surveyed) | Survey Methodologies (methods, frequencies |
|---|---|---|---|
| Terrestrial and aquatic invertebrates | June 2017 to October 2017 | Targeted areas | • Drake et al (2007) |
| Badgers | April 2017 to October 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer either side. | • Standard methodology [Harris et al (1989)].<br>• 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 either side. | • 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 Emergence/Re-Entry Surveys | May 2017 to September 2017. | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer either side. | • 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 | Sept / Oct 2016.<br>April to September 2017. | All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer either side. | - |
| Birds - Breeding | May to June 2016, April 2017 to June 2017. | All accessible land within the footprint of the Proposed Scheme, plus a 500m buffer either side. | • Bibby et al (2000)<br>• Gilbert et al (1998)<br>• Birds were recorded by walking, listening and scanning by eye and with binoculars.<br>• 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 - wintering | March 2016, November 2016 to March 2017.<br>January and February 2019. | All accessible land within the footprint of the Proposed Scheme, plus a 500m buffer either side. | • As the breeding bird survey above.<br>• As above, birds were recorded by walking, listening, and scanning by eye and with binoculars.<br>• All birds were recorded, regardless of the activity/behaviour. |

| Survey | Dates Undertaken | Study area (including areas not surveyed) | Survey Methodologies (methods, frequencies |
|---|---|---|---|
| | | | |
| Autumn passage birds | September 2017 to October 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 500m buffer either side. | • The 'look-see' method (Gilbert et al., 1998) |
| Reptiles | Reptile surveys commenced in May 2016, then in September and October 2016. September/ October 2017. | All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer either side. | • 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 and sustained visual observation of banks and other suitable habitat within the site. |
| Water Vole and Otter | Spring surveys took place from April 2017 until 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.<br>• 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).<br>• Surveys involved searching for spraints, footprints, feeding remains, slides and haul-outs, couches and holts. |

8.3.8. Biodiversity Action Plan (BAP) Priority Habitats present within 2km include; lowland fen habitat, traditional orchard habitat, coastal floodplain grazing marsh habitat, pond habitats, good quality semi-improved neutral grassland habitat, lowland meadows habitat, and lowland mixed deciduous woodland habitat.

8.3.9. Protected species surveys were undertaken for a number of species. Surveys have identified the presence of white-clawed crayfish *Austropotamobius pallipes* and signal crayfish *Pacifastacus leniusculus* in the River Tud and confirmed the presence of a number of bat roosts. Great crested newts have been found in several ponds and Schedule 1 bird species such as barn owl T*yto alba*, fieldfare

*Turdus pilaris* and red kite *Milvus miluvs* have been recorded within the study area.

8.3.10. There are a number of notable records of plant species from Norfolk Biodiversity Information Service (NBIS) including one record of Deptford pink *Dianthus armeria* designated under Schedule 8 of the Wildlife and Countryside Act 1981 (as amended). The most recent information from Plantlife only identifies 34 sites where this species is found. Tower mustard *Arabis glabra* has also been recorded within the area of search. This species is considered to be rare in the UK, with only 30 sites identified since the 1980s.

8.3.11. NBIS records also identified 59 veteran trees within the study area including ash *Franxinus excelsior*, beech *Fagus sylvatica*, holly *Ilex aquifolium*, common lime *Tilia x euopaea*, pedunculate oak *Quercus robur* and small-leaved lime *Tilia cordata*. Veteran trees are defined as 'a tree that is of interest biologically, culturally or aesthetically because of its age, size or condition'.

8.3.12. There are a number of hedgerows within the study area. These may meet the criteria to be Important under The Hedgerow Regulations. Surveys of hedgerows were undertaken in 2017.

8.3.13. There was one record of a notable fungi species within the study area: sandy stilt puffball *Batterrea phalloides*, which is designated under Schedule 8 of the Wildlife and Countryside Act 1981 (as amended) and identified as a national (UKBAP) and local (LBAP) species. This species is rare within the UK and has only been recorded in the south and east of England, therefore the two records of sandy stilt puffball may represent a significant population within the UK. Fungi surveys were undertaken in the autumn of 2017.

8.3.14. Habitat Suitability Index (HSI) assessments in 2016 of 108 ponds within a 500m radius of the Proposed Scheme indicated that 53 were potentially suitable for breeding great crested newt *Triturus cristatus*. Subsequent eDNA surveys in 2016 returned 37 negative results, three indeterminate, nine that could not be assessed due to lack of access and four positive results. The 16 ponds with positive or indeterminate eDNA results, or where access had not been possible were surveyed in 2017. Six ponds were found to contain small or medium populations of great crested newts and two ponds could not be accessed. An additional two ponds were found in the summer of 2017. These will be subject to HSI assessment to identify any requirement for subsequent eDNA or trapping and torching surveys of these ponds.

8.3.15. The extended Phase 1 survey identified four main badger *Meles meles* setts (one of which was active), one inactive subsidiary sett, four inactive annex setts, and three outlier setts (one of which was active). Further surveys in 2017

identified an additional two main setts (one in use, one inactive), six outlier setts, one subsidiary sett and three annex setts. Due to limitations such as access and vegetation, not all areas could be fully assessed, therefore there may be additional setts within the study area. There were also field signs identified throughout the site such as dung pits. There is ample foraging habitat within the survey area including deciduous woodland and semi-improved grassland. The landscape is generally open with frequent gaps in hedgerows allowing badgers to commute over a large area.

8.3.16. An otter *Lutra lutra* spraint and otter slide were identified on the River Tud. Otter tracks and potential holts were found within 250m of potential river crossings. The River Tud provides suitable habitat for otter with high potential for foraging and commuting throughout the survey area.

8.3.17. Water vole *Arvicola amphibius* are present in the wider area, including on the River Tud. No records were provided within the area of search. However, the extended Phase 1 survey identified suitable habitat. Targeted water vole surveys in 2017 have identified burrows, latrines, feeding signs and pathways along the River Tud, confirming water vole presence.

8.3.18. The extended Phase 1 survey identified 241 trees and groups of trees for bat potential, 33 areas of woodland (50.85ha), nine buildings with confirmed bat roosts and four anecdotal bat roosts informed by local residents. To date 10 buildings have confirmed bat roosts including brown long eared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri* and pipistrelle *Pipistrellus spp*. roosts. Roosts have also been identified in four trees, with one containing a hibernacula.

8.3.19. The landscape is well connected by hedgerows and pockets of woodland and scrub. The surrounding habitat provides high quality foraging habitats for various species. Features such as the River Tud offer opportunities for species such as Daubenton's bat Myotis daubentonii to forage. The open arable landscape offers habitat for species such as noctules *Nyctalus noctula* and possibly common pipistrelles *Pipistrellus pipistrellus* to forage. Bat activity surveys have identified extensive noctule activity indicating that there may be a roost nearby. The woodland areas have potential to support species such as brown long-eared bats and barbastelle bats *Barbastella barbastellus*.

8.3.20. Four species of reptile were recorded within the study area including slow worm *Anguis fragilis*, grass snake *Natrix natrix*, adder *Vipera berus* and common lizard *Zootoca vivipara*. The extended Phase 1 survey identified several areas of suitable habitat for all of the above reptile species including grassland, hedgerows, woodland and marshy grassland.

8.3.21. The wintering bird survey identified several notable species including species protected under Schedule 1 of the Wildlife and Countryside Act (WCA) 1981, species of principal importance for the purpose of conserving biodiversity covered under Section 41 (S41) of the Natural Environment and Rural Communities (NERC) Act 2006, and red and amber listed species in 'Birds of Conservation Concern'.

8.3.22. The River Tud, associated tributaries and drainage ditches provide habitat for a wide range of aquatic invertebrates throughout the survey area. Likewise, the grassland, woodland and hedgerows provide suitable habitat for a diverse range of terrestrial invertebrates. Terrestrial and aquatic invertebrate surveys have been undertaken in 2017.

8.3.23. The River Tud and associated tributaries have the potential to support a range of fish, including species listed on the River Wensum SAC citation. A number of bullhead *Cottus gobio* were caught on the River Tud during the aquatic invertebrate surveys, indicating a breeding population within the Tud. Dedicated fish surveys have not been undertaken as it is considered that sufficient data will be available from other sources, including Natural England, the IDB and local angling clubs.

8.3.24. Non-native invasive species previously recorded within the study area include Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens gladulifera*, American mink *Neovision vison*, Rhododendron *Rhododendron ferrugineum*, Chinese water deer *Hydropotes inermis*, Muntjac deer *Muntiacus reevesi*, Canada goose *Branta leucopsis*, Egyptian goose *Alopochen aegyptiacus*, Ring-necked parakeet *Psittacula krameri* and Red-eared terrapin *Trachemys scripta*. Specific surveys will not be undertaken for non-native invasive species, although their presence will be recorded if any non-native invasive species are found during surveys and recommendations will be made for appropriate mitigation.

8.3.25. A Habitat Regulations Assessment Screening Report (HRA) was undertaken to determine whether any adverse impacts on Natura 2000 sites are likely as a result of the Proposed Scheme. It is considered that there is potential for an adverse impact on the habitats and species which are a qualifying reason for selection of the European sites due to the proximity of the Proposed Scheme or hydraulic connectivity.

8.3.26. Data from the 2016 and 2017 surveys will be used to assess any impacts upon the River Wensum SAC. There is the potential for likely significant effects upon white-clawed crayfish during construction. As a mobile species, any populations in the River Tud may represent part of a wider metapopulation of the SAC. Therefore, any impact on the River Tud habitat may impact the River Wensum

population of white-clawed crayfish. A likely significant effect cannot be ruled out at this stage.

8.3.27. The River Wensum SAC/SSSI is designated for the presence of the Annex II species; Desmoulin's whorl snail Vertigo moulinsiana. There was one record included within the study area (located in the River Wensum SAC). This species may be relatively mobile and any within the area of the Proposed Scheme may be connected to the River Wensum population via the closest route (1.6km across land). There are a number of areas within the study area which may provide suitable habitat for Desmoulin's whorl snails and these were surveyed in the autumn of 2017. None were found.

8.3.28. Changes in water quality or hydrology have the potential to impact other qualifying features of the SAC, including brook lamprey *Lampetra planeri* and bullhead. Specific surveys are not proposed for these species, but the impact will be assessed within the HRA using the results of the hydrology assessment and implementation of appropriate mitigation.

## 8.4. Assumptions and limitation

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 2019 with access granted to areas previously not surveyed.

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 2019 and 2020 (as described below) to ensure that the sufficient survey effort has been undertaken, and that surveys at the sensitive early part of the season are included for assessment.

8.4.4. This assessment has assumed that significant in-channel works, and potential river diversions will be necessary on the River Tud, east of Honingham, where a proposed bridge is required as part of the realignment, and also at a crossing over a smaller Ordinary watercourse to the south of Hockering.

8.4.5. There is also an assumption that suitable attenuation will be provided for additional run-off and that this may be in the form of new ponds which could compensate for the potential loss of any reedbed or marshy grassland habitats.

## 8.5. Guidance and best practice

8.5.1. 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 various statutory and non-statutory bodies including Natural England, Environment Agency, Norfolk Council, Norfolk Wildlife Trust and the RSPB.

8.6.2. A consultation response has been received from Norfolk Wildlife Trust, this highlighted the importance of the River Tud and the River Wensum, the value of the landscape for bats, key ecological networks including woodland and wetland along the Tud, the need to maintain ecological connectivity and the presence of a number of priority habitats.

8.6.3. Consultation with other groups may also be required, including:

- Local wildlife organisations and groups
- Land owners

## 8.7. Potential effects including monitoring and mitigation measures

### Construction

8.7.1. Due to the proximity of designated sites to the Proposed Scheme (Appendix B and Table 8-1), appropriate avoidance measures, mitigation and compensation will be assessed in detail with the design.

8.7.2. Design mitigation for International and European designated sites (River Wensum SAC is outlined in the Habitats Regulations Assessment (HRA).

8.7.3. This assessment will be updated within the ES. Mitigation includes, for example, timing of works to avoid sensitive periods for the qualifying features such as migratory fish or breeding white-clawed crayfish. Where direct impacts cannot be

avoided (e.g. hedgerow loss) they may be mitigated by habitat replacement and habitat improvement.

8.7.4. Impacts on the River Wensum SAC qualifying species that inhabit the River Tud during operations are deemed possible. White-clawed crayfish may be affected by destruction of habitat and potential pollution run off. Bullhead may be impacted by any potential pollution run off, sediment disturbance, habitat loss or overshadowing. These impacts have the potential to be moderate intermediate negative. Appropriate mitigation will be identified, and assessments made as part of the HRA process.

8.7.5. No sites suitable for brook lamprey spawning have been identified. If suitable sites are found, appropriate mitigation will be addressed and implemented as part of the HRA process.

8.7.6. The River Tud is ecologically and hydrologically connected to the River Wensum SAC. Construction and operation of the road may impact the hydrology by altering the flow, quality and quantity of surface water entering the Tud. Significant in-channel works and potential river diversions will be necessary on the River Tud, east of Honingham, where a proposed bridge is required as part of the realignment, and also at a crossing over a smaller Ordinary Watercourse to the south of Hockering. Construction impacts upon the River Tud and the smaller watercourse have the potential to be significant, intermediate negative and large. Appropriate mitigation will be identified, and assessments made as part of the EIA process.

8.7.7. Mitigating impacts on white-clawed crayfish in the River Tud will also predominantly depend upon maintaining the quality of the water environment and surrounding habitat where possible. Therefore, pollution prevention and sediment control measures should be in place to ensure impacts are minimised (Chapter 13 Road Drainage and the Water Environment).

8.7.8. Additional compensatory measures may be required which may require licensing from Natural England and could include:

- Providing habitat to replace any lost
- Retention of habitat in the river and banks
- Habitat enhancement
- Inclusion of suitable inverts (channel bed) where new culverts / bridges are proposed
- Translocation (under licence and within the catchment of the River Tud / River Wensum)

8.7.9. At this stage, the impact upon white-clawed crayfish has been assessed as moderate intermediate negative.

8.7.10. It is assumed that during road construction there will be adherence to best practice measures to prevent water pollution and to control sediment generation and runoff. These measures will be identified in Chapter 13 Road Drainage and the Water Environment; and will ensure temporary impacts on water quality from pollution are minimised.

8.7.11. The Proposed Scheme is not anticipated to directly or indirectly impact Hockering Wood SSSI due to distance and lack of ecological connectivity.

8.7.12. The Proposed Scheme will not directly impact a number of CWS. However, some areas of land categorised as suitable for CWS designation will be significantly impacted through habitat loss. This will have a moderate intermediate negative impact on the conservation value of the area.

8.7.13. These impacts may be mitigated by measures such as:

- habitat replacement and/or habitat improvement;
- ensuring new proposed culverts and works to existing culverts do not alter the hydrology; and
- timing of works to avoid sensitive periods for associated species (e.g. breeding bats).

8.7.14. Appropriate mitigation and compensation for impacted habitats will be assessed in more detail with the final design and will be reported in the ES. However, mitigation is likely to include habitat replacement where priority habitat is directly impacted by land-take. Impacts on running water habitats and aquatic species (i.e. the River Tud and connected drains, white-clawed crayfish may be partly mitigated against by adhering to pollution prevention measures identified in Chapter 13 Road Drainage and the Water Environment.

8.7.15. During the construction phase, vegetation clearance is likely to be required for Proposed Scheme. Priority habitats will be directly impacted due to habitat loss, this includes:

- Deciduous woodland
- Lowland fen habitat
- Floodplain grazing marsh
- Good quality semi-improved grassland

8.7.16. This will have a moderate minor negative impact on these priority habitats and the biodiversity associated with them.

8.7.17. The Proposed Scheme would directly reduce and fragment the available terrestrial habitat for species, such as badgers, reptiles, otters, bats, great crested newts, terrestrial invertebrates and breeding and overwintering birds. This could require the provision of badger fencing, badger tunnels/underpasses or artificial setts under a derogation licence from Natural England.

8.7.18. Hedgerows will be permanently severed at various points. Long term impacts on hedgerow habitat will be minimal as mitigation is likely to include planting new hedgerows. Therefore, this impact is considered to be insignificant.

8.7.19. There will be a direct loss of habitat of value to foraging and roosting birds in winter. Mitigating impacts on wintering birds is likely to include retention of important habitats where possible, such as favoured, open arable habitat and grassland, and the creation of lost habitats such as replacing woodland/ and hedgerows. The final design is likely to include Sustainable Drainage Systems (SuDS) which may provide suitable habitat for wetland birds. There will also be the potential for significant noise and other disturbance to wintering birds during construction. The impact upon wintering birds has been assessed as moderate minor negative.

8.7.20. Removal of trees will result in the loss of identified bat roosts. 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. Any loss or disturbance of bat roosts will require appropriate mitigation and licensing from Natural England. The impact upon bats has been assessed as moderate minor negative.

8.7.21. No direct loss of great crested newt breeding ponds is anticipated. The Proposed Scheme will result in destruction of suitable great crested newt terrestrial habitat and potential hibernacula and could result in fragmentation of the metapopulation. Great crested newt surveys have been undertaken in Spring 2019 to inform, together with the 2016 and 2017 results, any requirement for licensing. At this stage, the impact upon great crested newt has been assessed as slight minor negative. Impacts to great crested newts could require fencing, translocation and enhancement works under a derogation licence.

8.7.22. Development adjacent to the River Tud and other watercourses has the potential to impact water voles, otter, breeding and wintering birds, aquatic and terrestrial invertebrates and fish. Given the requirement for significant in-channel works and potential river diversions, the impact upon water voles, otter, aquatic invertebrates and fish has been assessed as large intermediate negative.

8.7.23. 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. Changes in the drainage condition have the potential to have a negative impact upon aquatic vegetation, fish, aquatic invertebrates, wildfowl, otters and water voles.

8.7.24. Construction could involve the destruction of water vole habitat, including areas identified as feeding stations, latrines and burrows. Destruction of burrows and any translocation of water voles would require licensing by Natural England. The Proposed Scheme would also result in severance and an increase in disturbance from noise sources.

8.7.25. There will be a small amount of habitat loss associated with the new bridge; this is considered not to be significant for otter as this is a highly mobile species. With mitigation in place such as otter ledges this impact is not expected to be significant as it will not impact the population or the distribution of otter in the area. Pollution prevention and sediment control measures will ensure a continued food source and no significant impact.

8.7.26. Any night-time works required may directly disturb nocturnal species such as bats, otters and badgers as a result of 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 through the use of hoods, cowls or shields to prevent back spill. Additional best practice measures would also be included within and implemented through a CEMP so as 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. Licences granted from Natural England with respect to protected species may also be required.

## Operation

8.7.27. Impacts on the qualifying species of sites of International importance during operations are possible. This may include white-clawed crayfish and bullhead impacted by any potential pollution run off.

8.7.28. Operation of the road may impact the hydrology of River Tud by altering the flow, quality and quantity of surface water entering the river. The scale of this impact is not expected to be significant with control measures in place.

8.7.29. Once operational the Proposed Scheme would result in the permanent loss and potential severance of habitats of biodiversity value such as broad-leaved semi-natural woodland, marshy grassland, lowland fen, 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. As a result, it is anticipated that there is the potential for significant adverse effects upon nature conservation features once operational which warrants 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

8.7.30. There are also likely to be impacts during the operational phase as a result of any proposed new lighting or changes to existing lighting. This may result in adverse impacts upon potential bat roosts or foraging routes and otter or badger activity. 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 scale of this impact is not expected to be significant with these measures in place.

## 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 ecological surveys to October 2017, it is proposed that the following surveys take place after October 2017 and will be reported in the ES:

### Phase 1 habitat survey

8.8.3. This survey took place in Spring 2019 to update existing survey data, to the geographical extents used to date.

### Great crested newts

8.8.4. These surveys will update existing survey data and inform any licensing requirements. This took place between March and June 2019 and included two additional ponds that were found in 2017 after the end of the great crested newt survey season.

### Badgers

8.8.5. This survey took place in spring 2019 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.

### Bats

8.8.6. A number of bat surveys will take place between May and September 2019 to update the existing survey data and monitor activity at the known roost sites. It is proposed that emergence/re-entry surveys would be carried out for high and medium potential trees, and high, medium and low potential buildings and structures.

8.8.7. In addition, monthly transects and the associated static monitoring will take place, between May and October 2019.

8.8.8. 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.

### White-clawed crayfish

8.8.9. White- clawed crayfish surveys of the River Tud will be undertaken between July and October 2019 to identify population size and inform suitable mitigation or any licensing requirements.

### Wintering birds

8.8.10. Wintering bird surveys took place in January and February 2019 and the remaining surveys will complete all months over a winter survey period. The survey methodology (times, durations, survey locations, recording methods, acceptable weather conditions etc.) would replicate that used to date. Wintering

bird surveys are proposed to take place over winter of 2019/2020. They would begin in October 2019, taking place monthly for three months.

### Water vole and otters

8.8.11. 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 2019.

### Proposed surveys

8.8.12. It is also proposed to carry out the following surveys due to previous data from 2016 and 2017 being out of date:

- Phase 2 Botanical Surveys including hedgerows and fungi
- Aquatic invertebrate surveys
- Breeding bird surveys
- Migratory bird surveys
- Reptiles
- Terrestrial invertebrate surveys

8.8.13. Fish surveys will not be undertaken as it is assumed that the Natural England data will be sufficient to inform the ES.

### Survey methodologies

8.8.14. All protected species surveys proposed for 2019 onwards would be undertaken to the standard methodologies as described in Table 8-3 Table 8-

8.8.15. 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 and Marine, Third Edition (September 2018).

### Evaluation of effects

8.8.16. 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.

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

8.8.18. 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;<br>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; and<br>Any regularly occurring population of an internationally important species, which is threatened or rare in the UK i.e. red data book species. |
| **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<br>Ancient woodland on NE register;<br>A viable area of a priority habitat identified in the UK BAP; and<br>Any regularly occurring population of a nationally or regionally important species which is threatened or rare in the UK or national level. |
| **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, where their loss would affect the population's conservation status at this scale;<br>Any County and other sites which the designating authority has determined meet the published ecological selection criteria for designation, including county wildlife sites; and<br>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; and<br>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. |

8.8.19. 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. |

8.8.20. The significance of the impacts will be considered during the following phases of the Proposed Scheme:

## Construction phase

8.8.21. 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

8.8.22. 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.

8.8.23. 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.

8.8.24. 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.

8.8.25. 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. |

8.8.26. The scope of the works and the potential significance of direct and indirect effects warrants assessment to a Detailed level, 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, 2018) 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. The Proposed Scheme has the potential to result in significant direct and indirect effects for both the construction and operational phases to protected species, designated sites and sensitive habitats. This meets the criteria of an assessment to a Detailed level, in accordance with IAN 130/10 and will be presented within the ES.

# 9. Geology and soils

## 9.1. Introduction

9.1.1. This chapter assesses the geology and soils issues (including contaminated land) which may impact, or may be impacted by, the construction and operation of the Proposed Scheme. This chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 11, to a Scoping Level. The Proposed Scheme could have an impact upon both the geology and soils of the area, and constraints could be imposed on Proposed Scheme construction as a result of existing ground conditions. The potential requirement for assessment to either Simple or Detailed level will therefore be identified. Where required, this will be presented within the ES.

9.1.2. 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 for this assessment considers all locations where physical works and ground disturbance would take place, and in addition extends to 1km beyond this in order to identify any past pollution incidents which may have affected soil within the works area.

## 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:

- Environmental Constraints Plan (refer to Appendix A).
- Road Investment Strategy East Area 6 Geotechnical Preliminary Sources Study Report A47 Tuddenham to Easton (Document Ref: A47IMPS2-AME-TE-ZZ-DO-J0049 Tuddenham to Easton PSSR) (AMEY 2017).
- A47 Improvements Programme – North Tuddenham to Easton Dualling Scheme Addendum Preliminary Sources Study Report (Document Ref: HETUDHAM-MMSJV-HGT-000-RP-CE-00001) (HAGDMS: 29917) (MMSJV 2018).
- Envirocheck Report (Landmark, 2017).
- Unexploded ordnance (UXO) detailed threat and risk assessment (HAGDMS:29967) (6ALPHA, 2017).

9.3.2. Baseline data for the Proposed Scheme is set out in Table 9-1.

Table 9-1 Baseline data

| Aspect | Details |
|---|---|
| Geology | ***Published Geology***<br>**Solid Geology** - The solid geology comprises chalk of the White Sub-Group, formerly known as the Upper Chalk Formation. The BGS lexicon indicates that the sub-group includes the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation.<br>The chalk is not indicated to be exposed below or in close proximity to the Proposed Scheme.<br>The BGS sheet memoir states the rockhead of the Upper Chalk Formation bedrock is generally planar at an elevation of between 20 and 30m AOD. However, glacial and post-glacial erosion has resulted in steep-sided valleys (palaeochannels) being incised into the chalk giving rise to variable sub-drift topography over a short distance. Such a feature is present directly below the route and the potential exists for variation in rockhead elevation over short distances.<br>**Superficial Deposits** – The superficial deposits comprise a succession of head deposits and alluvium (clay, silt, sand and gravel) and river terrace deposits (sand and gravel) overlying diamicton (glacial till) of the Lowestoft Formation and sands and gravels of glacial origin (Sheringham Cliffs Formation). Head deposits comprising a blanket of pebbly clay are present along much of the route to a depth of 1.0m. The glacial deposits of the Lowestoft Formation are indicated to underly the full route alignment with the Sheringham Cliffs Formation occurring locally (east of Fox & Hall Lane) although they are generally present to the north of the existing A47.<br>The alluvium and river terrace deposits are indicated to be present within close proximity to the River Tud and its tributaries.<br>Available published mapping does not indicate the presence of faults which will impact on the scheme.<br>***Geology & ground conditions from other sources including historical mapping and BGS borehole records (from PSSR).***<br>Made ground is not shown on the published geological maps to be present either directly below or within close proximity to the route alignment. However, many sand and gravel pits, localised 'heaps' and old / overgrown pits are in evidence on the large-scale geological maps. It is likely that these localised areas of worked ground contain backfill material.<br>The composition and total thickness of the superficial deposits beneath the route is variable owing to the complex history of glacial events and presence of the palaeochannel.<br>Available information indicated a change in depth to rockhead between 30m to circa 4.0m depth shallowing from west to east. |

| Aspect | Details | |
|---|---|---|
| Sites of Geological Interest & Natural Mineral Extraction | Historic Quarrying | Many disused marl, sand, and gravel pits in close proximity to the route alignment are in evidence on historical Ordnance Survey (OS) maps. A former brick field and associated kiln was previously located at the start of the alignment close to what is now known as Fox Lane. Similar features may be present which are not shown on the available historical maps. There are none known of geological interest. |
| | BGS Recorded Mineral Sites | According to the Envirocheck report there are three recorded BGS mineral sites within the study area. The status for these is noted to be 'ceased'.<br><br>One quarry site (Costessey Quarry) is listed as currently active in proximity to the existing A47 alignment at Easton.<br><br>Within the county of Norfolk extraction of the extensive sand and gravel deposits which can be up to 40m thick, is undertaken for aggregate material. |
| Hydrogeology | The study area is underlain by a Principal Aquifer (Chalk) which is highly permeable.<br><br>The White Chalk Subgroup has been classified by the BGS aquifer designations as a Principal Aquifer. Principal Aquifers are defined as aquifers that "support water supply and/or river base flow on a strategic scale." Within the bounds of the proposed site, the aquifer likely provides base flow to the River Tud.<br><br>The alluvium, Lowestoft Formation sand and gravels and Sheringham Cliffs Formation sand and gravels are classified by the British Geological Survey aquifer designations as Secondary 'A' aquifers.<br><br>Secondary 'A' aquifers are defined as "permeable layers capable of supporting water supplies at local rather than strategic scale". These formations are in good hydraulic connectivity with the underlying bedrock aquifer. Base flow to the River Tud may occur from these aquifers.<br><br>The Lowestoft Formation (diamicton) is classified by the BGS aquifer designations as a Secondary (undifferentiated) aquifer. Secondary (undifferentiated) aquifer designations are assigned where "the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type". It is considered that this formation may partially confine the underlying aquifer where thick and less permeable zones occur.<br><br><u>Groundwater Vulnerability</u><br><br>Groundwater vulnerability varies across the study area. The majority of the route is classified in terms of aquifer vulnerability as "Major Aquifer Intermediate" and is generally associated with superficial cover of diamicton and alluvium.<br><br>The eastern section of the proposed route, approximately from Honingham, is classified as "Major Aquifer High", and is associated with the higher permeability of the Lowestoft Formation undifferentiated, and the Sheringham Cliffs Formation sand and gravel, but may also be associated with higher permeability or thinner zones of the overlying Secondary (undifferentiated) Lowestoft Formation diamicton aquifer. | |

| Aspect | Details |
|---|---|
| | The route option is within a groundwater Nitrate Vulnerable Zone (NVZ) at the route's eastern extent, and locally around Honingham.<br><br>Water Framework Directive<br><br>Groundwater within the study area is classified under the Broadland Rivers Chalk and Crag groundwater body [ID GB40501G400300], which has Poor Chemical and Quantitative status (2016 cycle 2). Objectives are to achieve Good Quantitative status by 2021, and Good Chemical Status by 2027. The waterbody is protected under the Nitrates Directive and is a Drinking Water Protected Area.<br><br>Water Abstraction and Source Protection Zones<br><br>The proposed route crosses a source protection zone (SPZ) 3 (Total Catchment) generally west of Oak Farm, south of Hockering and east of Honingham (Figure 13.2) This source protection zone conforms to a palaeochannel and is associated with major strategic water abstractions at Costessey to the east-northeast of the proposed route. Any groundworks within the SPZ3 have the potential to affect this abstraction.<br><br>There are 25 small and medium private licenced groundwater abstractions within the study area. These are for agricultural and industrial purposes. See Chapter 13 Road Drainage and the Water Environment for more information. |
| Hydrology | Surface Water Features<br><br>The proposed route crosses the River Tud, a main river and tributary of the River Wensum SSSI and two of its tributaries. There are a number of small ponds within the vicinity of the proposed route, one of which located to the east of Oak Farm, is indicated to directly underlie the Proposed Route.<br><br>Surface water features within the vicinity of the proposed route may be partially groundwater dependent and receive base-flow from underlying superficial and bedrock aquifers. The route option is entirely within a surface water Nitrate Vulnerable Zone (NVZ).<br><br>Water Framework Directive<br><br>The entire route option is within the Tud surface waterbody [ID: GB105034051000], which is designated as heavily modified. The Tud waterbody achieved its 2015 objectives for Good Chemical Potential and Moderate Ecological Potential (2016 Cycle 2), has two linked protected areas (Norfolk Valley Fens and the River Wensum), and is protected under the Nitrates Directive.<br><br>Surface Water Abstractions<br><br>There are 17 licenced surface water abstractions within the study area.<br><br>See Chapter 13 Road Drainage and the Water Environment for more information. |

| Aspect | Details |
|---|---|
| Soil Survey | The MAGIC online map viewer provides information for the soil types present along the proposed route. Three different soil types are shown - The route is predominantly underlain by soil described as “Slightly acid loamy and clayey soils with impeded drainage”. However, from south of Hockering and Honingham, generally in associated with the River Tud and the tributaries, the soil is described as “Loamy and clayey soils of coastal flats naturally high groundwater.” As the proposed route approaches Easton, the soil is described as “Freely draining slightly acid sandy soils”. |
| Landfill Records | One historical landfill site has been identified located approximately 400m south of the proposed route at a location within 500m south west of Hockering, accessed from Mill Close. The landfill is Mattisall Landfill, operated by Thomson Brothers, with the licence commencing 31 December 1968. The closure date is not provided.<br><br>The specified accepted waste type is ‘inert’. |
| Current Land Use and Man-Made Features | The existing A47 road infrastructure is the most prominent man-made feature which exists within sections of the footprint of the proposed route. The majority of the route lies within undeveloped agricultural land.<br><br>The proposed route follows the existing A47 road for approximately 1km from the start of the alignment to east of Oak Farm, where it deviates into the surrounding fields. It then crosses the existing A47 at three other locations before re-joining the A47 at the roundabout at Easton.<br><br>The proposed route crosses six minor roads; Low Road, Mattishall Lane, Mill Lane, Church Lane, Wood Lane and Blind Lane. There are likely to be services associated with these roads, however, their exact position is not known at this stage.<br><br>Industrial land use was dominated by local extraction of gravel, clay, marl and sand by quarrying. Due to the dominance of this industry within the wider area many pits have been excavated both along the route and within close vicinity to the route. Many of these pits have subsequently been infilled as the industry has declined, of which some have flooded, creating ponds.<br><br>Residential and commercial development is extant at the settlements of North Tuddenham, Honingham, Hockering and Easton. Additional land uses within the study area include a sewage treatment works, two grave yards (St. Andrew’s Honingham and St.Peter’s Easton), a scrap yard (identified as Thomson’s on internet satellite imagery), garage / fuel station (Hockering Motor Services), a timber yard and a building material reclamation and plant hire firm (Mooney’s). |
| Route History | It is understood that a road has been in existence on this alignment since Roman times. The road has been subject to gradual improvements and upgrades, notably in the 1970’s and 1980’s.<br><br>The available historical OS maps indicate that the off-line route comprised agricultural fields, rough pasture and woodland with several gravel, clay, marl and sand pits. Notably a brick field with kiln and well were present to the south of the route at Field Lane prior to 1883. It is indicated to be disused by circa 1906. |

| Aspect | Details |
|---|---|
| | Hockering Wood was developed as a former WWII munitions store with purpose built roads and bomb stores. This is now a SSSI.<br><br>The UXO Threat and Risk Assessment report by 9 Alpha Associates for the study site has rated the overall risk to the site as 'medium'. |
| Potential Contamination Risks | No site-specific baseline land quality data has been obtained for the PSSR.<br><br>Historical mineral working at pits is considered as the predominant former land use along the route alignment with a potential to give rise to localised soil and groundwater contamination. Other plausible sources comprise residues of petroleum hydrocarbons and chemicals accidentally released from vehicles although the Envirocheck report records no pollution incidents associated with spillage of vehicle fuel or chemical loads.<br><br>Other localised potential sources comprise the Grave Yards at St. Andrew, Honingham and St. Peter's, Easton, the timber yard, sewage treatment works and Mooney's plant hire and building material reclamation yard. It is also possible that minor leaks and spillages of fuel at off-site farms and works, where stored in bulk tanks, may have locally impacted soil and groundwater without giving rise to reported pollution incidents.<br><br>It is noted that the Envirocheck report does not reference any notifications for land which has been formally determined as 'Contaminated Land' by the local authorities in the area under consideration.<br><br>Hockering Motor Services, Mooney's scrap yard, and Mattisall former landfill site are considered to be located remote from the proposed improvements work and, therefore, unlikely to represent a plausible risk.<br><br>The potential environmental risks above 'low' associated with possible localised extant on-site sources of contamination comprise:<br><br>• Potential risks to road construction and maintenance workers are considered to be moderate/low due to the higher likelihood of workers coming into contact with potential localised contamination sources during in-ground works. However, the adoption of site health and safety measures may reduce this risk further; and<br><br>• Potential risks to groundwater, abstractions and surface water courses are considered to be moderate / low. |

## 9.4. Assumptions and limitations

9.4.1. The baseline information on the Proposed Scheme has been based on a desk study 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 the 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.

9.4.4. To the extent that this chapter uses information obtained from a GI, 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.

## 9.5. 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. Consultation with the Environment Agency and Anglian Water will be necessary to discuss the impact of the Proposed Scheme within the SPZ and in proximity to the River Tud. This consultation primarily concerns the risk to groundwater resources (and surface water), as well as obtaining necessary permits for both investigation and works activities.

9.6.2. The proposed works are not considered to warrant specific consultation in respect of land quality issues i.e. potential sterilization of mineral reserves and contaminated land risks. The former is unlikely to be a material consideration as the alignment does not impinge upon expanses of surface sand and gravel deposits. That latter can be addressed as part of routine investigation and assessment procedures which do not require a specific permit.

## 9.7. Potential effects including monitoring and mitigation measures

*Construction*

9.7.1. The primary concern for detailed assessment centres on the potential impact on groundwater resources by the Proposed Scheme. The excavation of superficial deposits which are a Secondary ‘A’ Aquifer, and the construction of

embankments and deep foundations at the proposed River Tud crossing will require prior examination in this context. This is considered in detail in Chapter 13: Road Drainage and Water Environment.

9.7.2. The proposed alignment is indicated to pass close to two grave yards and a sewage works. It also traverses land occupied by a timber yard and Mooney's plant hire and building material reclamation yard located in proximity to the River Tud. Further examination of the potential contaminated land risks is recommended in accordance with good practice. Further work comprising site reconnaissance, intrusive investigation, sampling and analysis is necessary to support an environmental risk assessment. This should be incorporated into proposed ground investigation to supplement the existing geotechnical data for design purposes. There are several issues for further examination and investigation including:

- Extent, depth and composition of any contaminated soils
- The characterisation of waste for disposal
- Monitoring of ground gases and vapours
- Monitoring of groundwater quality and depth
- Environmental risk assessment considering short-term and chronic risks to controlled waters, ecosystems and health and safety risks

9.7.3. The findings of the environmental risk assessment would identify the requirement and scope of any necessary remediation works. The remediation strategy should examine feasible and sustainable options to manage, remove/dispose or treat identified contaminated material where it is cost effective and practicable to do so. These techniques could include a range of biological, chemical and physical treatments such as biopiles, air sparging or soil washing.

9.7.4. The strategy should also address any particular regulatory requirements under development control for managing any previously unknown contamination encountered during the works.

9.7.5. Where practicable, material should be re-used on site provided performance criteria are met with respect to chemical composition and geotechnical parameters. This may be managed under a Materials Management Plan prepared in accordance with the CL:AIRE Code of Practice.

9.7.6. In addition, the implementation of a Construction Environmental Management Plan (CEMP) would affect controls to ensure identified risks associated with contamination are appropriately managed and minimised. Mitigation measures within the CEMP would include best practice environmental management procedures and appropriate waste management, such as:

- Ensuring adequate space for storage of topsoil and subsoil which must be segregated during excavation;
- Protection of watercourses from entry of polluting matter;
- Stripping, storing and reinstating of soils using best practice measures to minimise the risk of degradation to soils; and,
- Suppression of odour and dust using best practice measures

### *Operation*

9.7.7. It is anticipated that the operation of the Proposed Scheme would not give rise to any significant effects upon geology or soils.

### *Summary*

9.7.8. 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 Operational Effects |
|---|---|
| Potentially significant adverse direct effects owing to direct encroachment of the Proposed Scheme on potentially contaminated land adjacent to the River Tud. | No significant effects anticipated. |
| Potentially significant adverse direct effects of the Proposed Scheme on groundwater resources (shallow Secondary 'A' Aquifers / SPZ & deeper Principal Aquifer) at the proposed River Tud crossing. – Please refer to Section 13. | Please refer to Section 13. |

## 9.8. Proposed level of scope and assessment

9.8.1. The proposals for the assessment of potential impacts on groundwater resources are outlined in Chapter 13: Road Drainage and Water Environment and are not considered here.

9.8.2. 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 GI to further establish the baseline information of the Proposed Scheme area. Detailed investigation will examine the areas identified as detailed in Section 9.7.3. A remediation strategy will then be developed to consider the appropriate methods of treatment if necessary. Assessment would be undertaken to a Simple Level in the first instance.

9.8.3. With the possible exception of works affecting the SPZ (Refer to Chapter 13: Road Drainage and Water Environment), 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:<br>• Geology: World Heritage Sites.<br>• Soils: Agricultural soils of Grade 1 quality.<br>• Minerals: Energy minerals – minerals used to generate energy such as coal oil and gas.<br>• 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.<br>• Future site users: Very sensitive land uses proposed such as residential housing with gardens, allotments.<br>• Built Environment: Sites of international Importance, World Heritage Sites. |
| **High** | National Scale: High importance and rarity, limited potential for substitution | Important in the UK:<br>• Geology: Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site).<br>• Soils: Agricultural soils of Grade 2 quality.<br>• Minerals: Poor quality energy minerals or silica (industrial) sand for use in glass making.<br>• Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing locally important resource or supporting river ecosystem; SPZ II.<br>• Future site users: Sensitive land uses proposed such as schools, residential housing without gardens, open spaces.<br>• Built Environment: Listed buildings, Scheduled Monuments**.** |
| **Medium** | Regional Scale: Medium quality and rarity | Important in the context of the South West:<br>• Geology: Regionally Important Geological Sites (RIGS).<br>• Soils: Agricultural soils of Grade 3 quality.<br>• Minerals: Construction aggregates – minerals used in building and engineering or to manufacture building and engineering products such as concrete. |

| Sensitivity | Criteria | Typical Examples |
|---|---|---|
| | | • Controlled Water: Moderate classification of groundwater vulnerability; Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ III.<br>• Future site users: Moderately sensitive land uses such as commercial developments and open spaces.<br>• 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:<br>• Geology: Rock exposures.<br>• Soils: Agricultural soils of Grade 4-5 quality.<br>• Minerals: Poor quality materials suitable for us as general fill only.<br>• Controlled Water: Deep Secondary aquifer with poor water quality not providing baseflow to rivers; Aquifer not used for water supplies (public or private).<br>• Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail.<br>• Built Environment: Infrastructure (e.g. Roads, railways, tramways). |
| **Negligible** | Local Scale: Very low importance and rarity | Important within and adjacent to site (~2km of site):<br>• Geology: No rock exposures.<br>• Soils: Urban classified soils.<br>• Minerals: No minerals.<br>• Controlled Water: Non-aquifer.<br>• 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. |
| **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. |

| Magnitude of Effect | Geological Changes | Soils Including Waste | Human Health | Groundwater | Surface Water |
|---|---|---|---|---|---|
| **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<br>• Minor loss of urban soils<br>• No discernible negative effect to buildings / infrastructure | **Not Significant** |
| **Slight** | **Adverse** | • Changes to Made Ground deposits only;<br>• Moderate/major loss/degradation of Grade 4 or 5 soils<br>• Minor/moderate loss/degradation of Grade 3 soils<br>• Easily preventable, non-permanent health effects on humans<br>• Minor low-level and localised contamination of on-site soils<br>• Easily reparable damage to buildings / infrastructure | |
| | **Beneficial** | • Remediation of localised low levels of contamination<br>• Remediation of non-sensitive water resource<br>• contamination<br>• Minimal improvements to overall soil and water quality | |
| **Moderate** | **Adverse** | • Superficial disturbance to near surface deposits<br>• Changes in geomorphology, large loss/degradation of Grade 3 soils<br>• Minor loss/ degradation of Grade 1 or 2 soils<br>• Sterilisation of low quality mineral resources<br>• Easily preventable, permanent health effects on humans<br>• Pollution of non-sensitive water resource or Low long term risk of pollution to sensitive water resource<br>• Localised damage to buildings/infrastructure (on or off site) | **Significant** |
| | **Beneficial** | • Remediation of localised moderate levels of contamination<br>• Remediation of moderate, localised sensitive water resource contamination | |
| **Large** | **Adverse** | • Moderate/ large loss/ Degradation of Grade 2 soils<br>• Moderate loss/degradation of Grade 1 soils<br>• Sterilisation of high quality mineral resource<br>• Medium/ long-term (chronic) risk to human health<br>• Medium long-term risk of pollution of sensitive water resources<br>• Contamination of off-site soils | |

| Significance Category | Description and Examples | | Significance |
|---|---|---|---|
| | **Beneficial** | • Remediation of localised high levels of contamination<br>• Remediation of significant localised sensitive water resource contamination | |
| **Very Large** | **Adverse** | • Loss of exposed designated geological feature or large loss/degradation of Grade 1 soils<br>• Short-term (acute) risk to human health<br>• Short- term risk of pollution of sensitive water resources<br>• 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 detailed investigation in order to examine the localised identified areas of potential land contamination. The investigation will identify the contaminants present and confirm extant ground conditions. A remediation strategy will then be developed to consider the appropriate methods of treatment if necessary.

9.10.2. 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. The potential impacts on groundwater resources are not included here and addressed in Chapter 13: Road Drainage and Water Environment.

# 10. Materials

## 10.1. Introduction

10.1.1. This chapter assesses the potential impact on materials 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:

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

## 10.2. Study area

10.2.1. Following Highways England guidance on major projects' instructions MPI-57-052017(Rev 1) on material assets and waste, the assessment will establish two geographically different study areas:

1. based on the area of completed works within the redline/application (project) boundary. Within this area, construction materials will be consumed (used, reused and recycled) and waste will be generated.

2. Based on professional judgement to define this study area on a project by project basis. This should be sufficient to identify:

    - suitable waste infrastructure that could accept arisings and or waste generated by the project; and
    - feasible sources and availability of construction materials typically required for motorway and all-purpose trunk road projects.

10.2.2. As the design is progressed, a suitable study area will be defined for the ES.

## 10.3. Existing and baseline knowledge

10.3.1. Estimates on material resource use and waste generation during the site remediation/preparation, demolition and construction phases are based on the latest design information.

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 has 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. Baseline information from the Defra, Environment Agency and County Council on current waste generation and operational waste management facilities in Norfolk will be collated 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 quantify 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 2016
- 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 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.

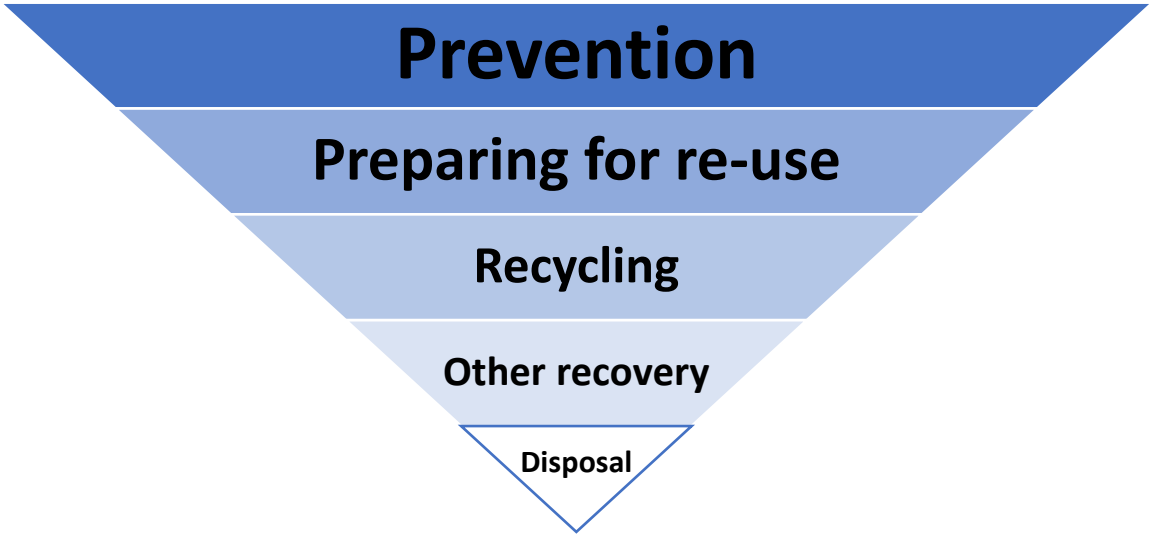
10.5.3. Where there is a need to demonstrate that a material re-use strategy does not pose any risk to human health or the environment a Materials Management Plan (MMP) would form part of the SWMP. This is in accordance with ‘The Definition

of Waste: Development Code of Practice' Version 2 CLAIRE March 2011, and 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). These principles are carried into the design process and reported in the ES.

Figure 10-1 : Waste Hierarchy




Source: Guidance on applying the Waste Hierarchy, Defra 2011

## 10.6. Consultation

10.6.1. No specific consultation has been undertaken to date regarding materials and waste. 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. Construction of the Proposed Scheme will involve the production, procurement, transport and use of material resources and the production of waste streams which have the potential to generate significant environmental effects, as summarised in Table 10-1.

Table 10-1 : Summary of materials and waste that have the potential to generate significant environmental effects

| Activity | Material use and potential to generate significant effects | Potential waste arisings and potential to generate significant effects |
|---|---|---|
| Site remediation / preparatory / earthworks | Potential direct effects associated with the import and use of materials, including: depletion of natural resources; noise and air emissions associated with their transportation; energy/fuel consumption through plant use and transportation; energy/fuel consumption through manufacture. | Potential direct effects associated with the generation of waste arisings (inert, non-hazardous, green and hazardous) including: demand on handling/disposal capacity of regional waste management facilities; release of contaminants to air, land or water; noise and air emissions associated with their transportation; energy/fuel consumption through plant use and transportation. |
| Demolition | N/A | Demolition waste from removal of surge chamber, footways and culvert modifications |
| Construction | • Road sub-base and surface materials<br>• Concrete, steel and other structural materials<br>• Pre-cast and prefabricated products (e.g. kerbs, gullies, barriers, manholes, drainage)<br>• Signage, lighting columns and markings<br>• Timber (e.g. for temporary use for shuttering)<br>• Topsoil | • Non-reusable demolition material<br>• Surplus earthworks<br>• Surplus, damaged and ‘cut-off’ construction materials |
| Operation and maintenance | • Materials use expected to be minimal. | • Waste arisings generated expected to be minimal. |

## Construction

10.7.2. Specific quantities of materials and waste have not been quantified at this stage and will be estimated at a later stage as the design is progressed. An opportunity to re-use surplus material on other sections of the A47 where improvements are planned which would reduce the effects from the generation of waste arisings, as well as any other projects within the region.

10.7.3. The Proposed Scheme includes earthworks, culverting, and diversion of the River Tud, construction of a new bridge, link roads, embankment ramps, piled foundations, reinforced concrete abutments and use of precast deck beams.

10.7.4. Where the existing A47 carriageway is unaffected by the dualling, it will become part of the local road network. Opportunities for the re-use of surplus excavated materials will be sought within landscaping and potential habitat creation along the route of the existing A47, as well as potential use for earth bunds as part of noise mitigation measures.

10.7.5. Given the scale of the construction requirements, of the Proposed Scheme, including; cut and fill, new structures and new carriageway, there is the potential for significant adverse effects during construction due to the use of materials and generation of waste. Mitigation measures to further reduce the effects from the use of materials may be achieved through reducing the material requirements through design, re-use of site-won or recycled materials and use of materials with a high proportion of recycled content.

10.7.6. In accordance with the waste hierarchy, consideration will also be given to the re-use of waste on-site before waste is transported off-site for re-use or disposal. Where waste cannot be re-used either on or off-site, direct effects may result from the demands on the capacity of waste management facilities and landfills and impacts associated with transport.

10.7.7. The preparation of a SWMP and inclusion of mitigation measures with the appointed Contractor's Construction Environmental Management Plan (CEMP) would ensure that adverse effects associated with materials use, waste generation and required transport are managed accordingly.

10.7.8. Mitigation measures to be included in the SWMP and CEMP may include (but not limited to):

- Implementation of the waste hierarchy and avoiding generation of waste through design.
- Use of site-won or recycled materials as opposed to sourcing new materials.
- Where surplus materials cannot be re-used on-site, seek opportunities for re-use off-site, including other A47 schemes or other projects off-site (e.g. quarry restoration scheme).
- Encourage local and responsible resourcing of materials (e.g. through adoption of BES 6001) and efficiencies 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 taken to a recycling/disposal site, ensure these sites hold the appropriate permits.

### Operation

10.7.9. Significant environmental effects from the use of materials and generation of waste are unlikely during the operation of the Proposed Scheme since there would be minimal requirements for materials, besides infrequent maintenance activities.

## 10.8. Proposed level and scope of assessment

10.8.1. There is a potential for significant volumes of earthworks and material use during construction, resulting in the need for potential off-site re-use of disposal of wastes generated. A Simple Assessment is proposed at this stage for both the use of materials and generation of waste during the construction. This will be followed by a Detailed Assessment, if considered necessary following assessment and volume estimates.

10.8.2. No further assessment is likely to be 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 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.

10.9.2. 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. 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 could result in adverse or beneficial effects. This section identifies the key noise and vibration impacts, describes the study area and key receptors. The potential requirement for assessment to either Simple or Detailed level will also be identified. This will then be presented within the ES.

11.1.2. This Chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 7.

## 11.2. Study area

11.2.1. The DMRB Volume 11 Section 3 Part 7, HD 213/11 *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 $L_{A10,18h}$ upon Proposed Scheme opening, or 3dB $L_{A10,18h}$ 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 1dB $L_{A10,18h}$ on opening or 3dB $L_{A10,18h}$ 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. A review of noise-sensitive receptors and an initial noise survey was undertaken in previous stages of design development and assessment.

11.3.2. The Proposed Scheme is located in a rural area, with three main villages in the vicinity of the Proposed Scheme; Hockering, Honingham and Easton. Sensitive receptors include dwellings, schools, care homes and churches in addition to other community facilities. Of particular sensitivity in Honingham are two specialist schools and a care home. Over 800 noise sensitive receptors have been identified within 600m of the Proposed Scheme.

11.3.3. Further sensitive receptors within the study area include designated areas. These are four Noise Important Areas (NIA), identified on the A47 at Hockering and to the east of Hockering. These are indicated on Figures B.1 and B.2 and consist of the following:

- IA_ID:5200, asset owner HE
- IA_ID:5201, asset owner HE
- IA_ID:5202, asset owner HE
- IA_ID:6287, asset owner HE

11.3.4. Table 11-1 identifies sensitive receptors, which includes typical examples identified in DMRB.

Table 11-1 Summary of Existing Noise and Vibration Baseline

| 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. |

11.3.5. Further surveys will be necessary to inform the baseline and the following information will be referred to prior to deciding locations:

- Noise mapping undertaken as part of the requirements of The Environmental Noise (England) Regulations 2006
- OS mapping
- Traffic flows
- Previous surveys and assessments in the vicinity of the Proposed Scheme.

11.3.6. The local authority environmental health department will also be consulted.

11.3.7. Surveys will comprise both long-term and short-term monitoring 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 also unavailable. Discussion on potential impacts and effects within this Scoping Report have therefore been undertaken in the absence of this information. As 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 considered to be relevant to the Proposed Scheme.

- The National Planning Policy Framework 2019.
- 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'*, BSI, 2014.
- BS5228-2:2009+A1:2014, *'Code of construction practice for noise and vibration control on construction and open sites - Part 2: Vibration'*, BSI, 2014.
- BS 7385:1993 '*Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration'*, BSI, 1993.

- Design Manual for Roads and Bridges, 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), HMSO, 1988.
- '*Guidelines for Noise Impact Assessment'*, Institute of Environmental Management & Assessment (IEMA) 2014.
- *'Noise control on building sites',* Advisory Leaflet 72, Department of the Environment, HMSO, 1976.

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

## 11.6. Consultation

11.6.1. Consultation with Environmental Health Officers (EHOs) of Broadland District Council, Breckland District Council and South Norfolk Council will be progressed following the consultations undertaken to date. As a result of consultation to date an interest has been expressed in viewing noise calculations and mitigation options. Discussion on methodology for the EIA chapter and proposed survey locations will also 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 receptors located in the vicinity of the Proposed Scheme option envelope, and receptors located adjacent to the road network used for 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 BS 5228 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 NIAs.

However, with the implementation of appropriate mitigation, such as the provision of noise barriers/bunds and low noise road surfacing, the potential for significant adverse effects will be minimised. Nonetheless, it is considered that there is the potential for significant residual adverse effects to noise sensitive receptors which warrants detailed assessment.

11.7.3. There is potential for changes to traffic flows and the road alignment to result in both adverse and beneficial impacts at noise sensitive receptors. There will be opportunity to incorporate mitigation as part of scheme design in order to reduce adverse impacts.

## 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 is necessary to determine the Lowest Observed Adverse Effect Level (LOAEL) and the 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. BS 5228–1:2009+A1:2014 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.

11.9.3. Fixed thresholds will be adopted above which significant effects due to construction noise could occur, as follows:

- 75dB(A) (façade) at receptors facing the existing A47 and within 30m of the kerb.
- 70dB(A) (façade) at receptors in all other locations.

11.9.4. This approach is based on the method promoted by the Wilson Committee and included in Advisory Leaflet 72. This approach aims to avoid construction noise levels within nearby properties that would make conversation difficult, assuming windows are closed.

### *Construction vibration*

*11.9.5.* BS 5228 '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 vibration levels 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".*

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

11.9.7. 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*

11.9.8. 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.

11.9.9. 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.

11.9.10. 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

11.9.11. In the above scenarios, 'Do Minimum' means a scenario including committed developments only. 'Do Something' means a scenario including committed developments and the Proposed Scheme.

11.9.12. 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).
- 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*

11.9.13. 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).

11.9.14. DMRB notes that traffic induced vibration is expected to affect a very small percentage of people at noise exposure levels below 58dB $L_{A10,18h}$.

### *Summary of proposed significance criteria*

11.9.15. 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.

11.9.16. 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

| Source | Time Period | Effect Level | Noise Level |
|---|---|---|---|
| Operational Noise | Day | LOAEL | Free-field 50dB $L_{Aeq,16h}$ |
| | | SOAEL | Façade 67.5dB $L_{A10,18h}$ |
| | Night | LOAEL | Free-field 45dB $L_{Aeq,8h}$ |
| | | SOAEL | Free-field 55dB $L_{Aeq,8h}$ |
| Construction Noise | Day | LOAEL | Facade 50dB $L_{Aeq,16h}$ |
| | | SOAEL | Façade 75dB $L_{Aeq,12h}$ |
| | Night | LOAEL | Façade 45dB $L_{Aeq,8h}$ |
| | | SOAEL | Facade 55dB $L_{Aeq,8h}$ |
| Construction Vibration | Any | LOAEL | PPV 0.14 mm/s |
| | | SOAEL | PPV 1.0mm/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 appropriate CEMP and mitigation in place. Nonetheless, assessment to a more 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, 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 adverse effects due to noise and vibration 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:

- Walkers, cyclists and horse riders (WCH)
- 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 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 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:

- **WCH:** The study area will comprise all WCH facilities including Public Rights of Ways (PRoW), footways, long distance walks and cycle routes within 250m of the Proposed Scheme.

- **Amenity:** The study area will comprise all WCH 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.
- **MTs Views from the Road:** considers views from the route of the existing A47 and Proposed Scheme during construction and the Proposed Scheme alignment during operation.
- **Community Severance:** The study area will include community facilities and connecting WCH 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. Wider social and community effects and effects on the local economy will be considered within a Wider Impact Area (WIA) which in this case will be the three districts that the route passes through, which are South Norfolk, Broadland, and Breckland Districts.

12.2.4. Because the scheme is one of several along the A47, the cumulative impacts of the Scheme (particularly on the local economy) may be felt more widely than both the LIA and WIA and as such, the County of Norfolk will also be considered.

## 12.3. Existing and baseline knowledge

12.3.1. The Proposed Scheme comprises the section of the A47 located between its junction with Fox Lane and Main Road in North Tuddenham and Longwater Interchange to the east of Easton.

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 section of the A47 in the study area is an extremely busy single carriageway road. Given the surrounding land use and the fact that the road is a key link between major conurbations, HGVs and large agricultural vehicles are common. The prevalence of these slow moving vehicles leads to driver frustration, in turn leading at times, to unsafe overtaking manoeuvres. Overall stress levels for users of the A47 are likely to be high particularly during peak periods.<br>• The use of junctions, both for leaving the A47 and joining it, is consistently stressful for users due to limited emerging opportunities and often fast moving traffic.<br>• Stress experienced by users of side roads is considered to be lower although these roads can be busy. Driver stress within villages is low. |
| MTs: View from the Road | Within the study area, the view from the A47 is largely obscured by mature highway boundary vegetation. Where gaps in this vegetation do allow drivers to see beyond the highway boundary (most noticeably to the east of Hockering and north of Easton), views extend further to the north than the south as a result of the variable topography of the area. Such views are predominantly of the surrounding arable agricultural land, interspersed with frequent wooded areas. Individual features visible to road users include St Andrew's Church and the tower of St Michael's Church. A line of high voltage pylons are also a notable feature of the view between Easton and Honingham. Overall the view from the road can be categorised as 'restricted' |
| WCH | • Two Public Rights of Way (PRoW) within the study area will be severed by the Proposed Scheme. These routes provide an important means of access for local people to community facilities and the wider study area and are shown in Figure 12.1.<br>  ○ Honingham RB1(PRoW 4): a restricted byway running north— south from Dereham Road to the south of the existing A47 to Wood Farm to the north of the existing A47.<br>  ○ Hockering FP7 (PRoW 5): a footpath running east-west from Whitford Bridge alongside the River Tud's northern bank before turning north along Gypsy Lane to connect with the existing A47.<br>No WCH surveys have been have been undertaken at this stage. |
| Amenity | Summary of the amenity levels likely to be experienced using the WCH routes and the local side roads within the study area which are affected by the Proposed Scheme:<br>• Honingham RB1 (PRoW 4): This route makes use of farm tracks along field boundaries. Hedgerows are high allowing only views of fields through which the route runs. This limits the extent to which the user gains a sense of the landscape through which they are passing, reducing the amenity values of the route. Users of the PROW are, however, separated from traffic.<br>• Hockering FP7 (PRoW 5): This route requires the user to follow a narrow unsurfaced path through an area of woodland adjacent to Whitford Bridge following the line of the river. The route then emerges into an area of unimproved, and in places, marshy, scrub/grassland where the path becomes faint. WCH must then traverse a field boundary before crossing a livestock paddock and then turning towards the A47 along an access track lined by tall trees. Views are heavily restricted due to the location of the path within the Tud's shallow river valley and the relatively dense vegetation in places along the route. |

| Topic | Summary |
|---|---|
| | There are a number of obstacles along the route such as styles, uneven paths, tree routes, etc.<br>• Low Road: A single track road with no footways, however traffic levels are low. Views are expansive in most places due to the lack of established field boundaries and hedgerows. Verges are generally well-kept.<br>• Mattishall Lane: A single track road with no footways, however, traffic levels are low. Views are limited to the south-east by vegetation and of limited amenity due to nearby fields being left fallow. Views in the opposite direction are relatively open and of arable fields. Verges are maintained but heavily vegetated and steep in areas.<br>• Church Lane: A single track road that is not used frequently by motorists. There is no provision of footway and verges, although well maintained, are embanked along much of the route. Views over the surrounding arable land are expansive, although obscured in some areas by high hedges or residential properties close to the river.<br>• Wood Lane: A single carriageway road with significant levels of fast moving traffic. There is no footway provision and the road is largely enclosed by high hedges and mature trees. Verges are maintained but not suitable for use by WCH.<br>• Berrys Lane: A single carriageway road used frequently by motorists. It features no footway provision and is largely enclosed by hedges and trees. Verges are very heavily vegetated with limited space available at carriageway edges for WCH.<br>• Taverham Road: A single track road with no footway provision. Towards the north of the route within the study area views from the elevated position allow users to see as far as Easton. Elsewhere views are restricted by sections of woodland, residential properties and high verges. Verges are generally well-maintained but are steep in places and heavily vegetated in others.<br>• Blind Lane: Blind Lane is in cutting for most of its northern extent. To the south, views through gaps in hedges are relatively frequent and given its elevated position, allow WCH to see across to the northern side of the Tud valley. The road is very narrow with no footway provision and is seldom used by motorists. Verges are well-maintained throughout, but very steep towards the north of the route.<br>• Main Road: A single carriageway road that is used by relatively high volumes of fast-moving traffic. There is no footway provision. Views are limited, as the road is bounded for most of its length within the study area by well-established and heavily vegetated verges. |
| Community Severance | No specific baseline information is included for Community Severance. |
| Demolition of Private Property and Associated Land Take | • There are a large number of residential properties located in the LIA. These are primarily located in Hockering, Honingham and Easton. Smaller clusters of residential properties are also located on Hall Lane, Mattishall Lane, Church Lane and Taverham Road.<br>• There are also a large number of businesses located in the LIA. The majority of the businesses are located in the villages of Hockering, Honingham and Easton, with a small number of businesses in more isolated locations along the route.<br>• In Hockering, businesses include Hockering Motor Services, Kerrie Woollen Cakes and Claxtons Home Improvements. Just south east of Hockering (and |

| Topic | Summary |
|---|---|
| | south of the A47) is also Mooney Demolition, Reclaimed Building Materials and Plant Hire.<br>• Business located in Honingham include Hulbert West financial advisors, H Smith and Sons Construction Company, the Honingham Buck restaurant and LS Sewing Services.<br>• Easton is the largest village with the most facilities. However, as it is located at the most easterly point of the scheme, not all businesses fall within the LIA. Business that do, however, include Easton Guesthouse, The Salon hairdressers and Adams Automotive Engineering. Business also located in Easton but just outside the LIA include TSM Drainage Engineers and Rembrandt restaurant.<br>• Businesses located outside of the above villages and more rurally (but still within the LIA) include A-Six Taxis and Thomson's scrap yard. |
| Agricultural Land and Individual Farm Business | • The following information has been taken from previous stages of design development and assessment and confirmed through the Natural England land capability for agriculture maps. No further desk study or site walkover has been possible.<br>• The above documents state that the quality of the agricultural land for the footprint and 250m buffer zone of the North Tuddenham to Easton scheme varies between Grade 4 (poor quality) to Grade 2 (very good quality), with two areas within the study area classified as non-agricultural land.<br>• 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:<br>○ Grade 2 land is largely situated to the north and west of Hockering.<br>○ Grade 3 land dominates the majority of the study area. |
| Community Land and Community Facilities | • Community land and facilities located in the LIA of the Scheme are located in the three villages mentioned above and are shown in Figure 12.1. In Hockering, community facilities include St Michael's Church, Hockering playing field, Hockering CofE Primary Academy, Hockering Village Hall. Victoria Inn public house, Hockering Nursery and Hockering Post Office and shop<br>• In Honingham there is a Village Hall, children's play area, Honingham Buck public house and St Paul's Chapel of Ease. Further east of Honingham itself and north of the A47 is Saint Andrew's Church, Honingham. West of Honingham, and just outside the LIA (265m south of the current A47) is Merrywood House Residential Care for children.<br>• In Easton, community facilities include Saint Peter's Church, Allotment gardens, the village hall and Easton Post Office. |
| Development Land | • Development plans for South Norfolk, Breckland and Broadland districts have been considered to show any developments planned in, or within close proximity to, the LIA.<br>• Broadland District Council is currently preparing a Local Development Order (LDO) for a 20-acre area south of the A47 (between Blind Lane and Dereham Road) to help facilitate development at the Greater Norwich Food Enterprise Zone (FEZ). An LDO seeks to simplify the planning process in certain areas by allowing the Local Planning Authority to grant Planning Permission for certain forms of development. The LDO, in this instance, aims to provide greater flexibility for new food related business and institutions to be located within the site. According to a Cabinet meeting in May 2017, adoption of the LDO is likely |

| Topic | Summary |
|---|---|
| | to go ahead, subject to certain matters relating to the routing of HGVs and the request of an EIA Screening from the Secretary of State.<br>• Hornsea Project Three offshore windfarm is also being proposed by Dong Energy. Should these plans go ahead, construction is anticipated to take place between 2022 and 2025. The proposals feature plans to lay an underground cable to the Norwich main substation from Weybourne on the coast. The cable, should the plans go ahead, would run through the LIA in a southerly direction between Easton and Honingham, crossing the A47.<br>• According to the Breckland Council Local Plan Preferred Sites and Settlement Boundaries 2016, 25 residential dwellings are set to be built between 2026 and 2036. The site is located on 0.8 acres of agricultural land to the north of the A47, with access set to be gained from Heath Road. An alternative site has also been provided which is accessed via The Street.<br>• The South Norfolk Local Plan states that 52.6ha of land has been allocated for housing and its associated infrastructure. The designated land is positioned to the south, east and west of Easton. The land will accommodate approximately 900 dwellings and a new village centre featuring recreation space, a post office and a village hall. The land will also be used for expanded primary school provision in agreement with the Education Authority. The Local Plan also states that 1.4ha of land has been allocated for a new gymnastics centre as a facility for the Easton Gymnastics Club. The facility is set to be surrounded on three sides by the new residential dwelling site.<br>As well the above large-scale developments, a number of smaller scale residential developments are proposed in close proximity to the LIA. According to Breckland District Council's Statement of Five Year Housing Land Supply, several sites in, and in close proximity to, Hockering are proposed to be used for housing. For example, land to the east of the playing field and west of Heath Road has permission for 18 dwellings to be built. |

## Local economy baseline

12.3.3. The Proposed Scheme is located on the A47 to the west of Norwich. As the stretch of road set to be dualled falls within three local authority districts, an average of these districts has been combined to create a demographic profile of the Scheme location.

12.3.4. The LIA has a working age population (16-64 years old) of 58%. Children (aged under 16 years) make up 17% of the population, which is slightly lower than the national average of 19%. Older people (over 65 years) comprise 24% of the LIA population, which is higher than the national average of 18%.

12.3.5. Table 12-2 below outlines the economically active population and, amongst them, those who are in employment and those who are unemployed. It shows there are proportionally more economically active people in Great Yarmouth than in England (80% compared with 78%). It also shows that unemployment is higher in Great Yarmouth at 7% (compared to 5% nationally). In Norfolk, the economically active population is proportionally higher than the English average (80%) and the proportion of unemployed is slightly lower (4%).

Table 12-2 : Employment and unemployment (April 2016 – March 2017)

| All people | LIA average** (%) | Norfolk* | Norfolk** (%) | England** (%) |
|---|---|---|---|---|
| Economically active | 83 | 441,800 | 80 | 78 |
| In employment | 80 | 424,100 | 77 | 74 |
| Unemployed | 3 | 17,700 | 4 | 5 |
| Working age population (16-64) | 58 | 259,396 | 59 | 63 |
| Children (aged under 16) | 17 | 150,457 | 17 | 19 |
| Older people (over 65 years) | 18 | 213,017 | 24 | 18 |

Source: ONS annual population survey, and, ONS, mid-year population estimates by single year of age (2016)
* Numbers are for those aged 16 and over
** % are for those aged 16-64

12.3.6. 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 Scheme spans four neighbourhoods which are ranked 16,873, 14,658, 17,441 and 24,480 out of 32,844 in England, with 1 being the most deprived. This indicates that two of the four neighbours are in the 50% least deprived in England, one in the 30% least deprived, and the remaining in the 50% most deprived.

## 12.4. Assumptions and limitations

12.4.1. This assessment heavily relies on desk-based information, using publicly available information where available. This information includes strategic documents, Geographical Information Science (GIS) software, and the 2017 Environmental Assessment Report for the Scheme. No WCH surveys have been undertaken at this stage.

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 area. 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. In order to prevent double-counting of significant effects, effects relating to other environmental topics are not considered in detail as part of this social and community 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 social and community chapter. Any potential effects arising for human health are set out in the impacts section below.

12.4.5. The LIA 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 for the Proposed Scheme has not yet been prepared so has not been used as part of this scoping exercise but, where stated, assumptions have been made as to its proposed or recommended content.

12.4.7. The construction footprint (site boundary)and the locations of the construction compounds are currently unknown, 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 design stage progresses.

## 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, 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. Assessment of the Proposed Scheme is informed by the responses to both statutory and non-statutory consultation and reported in the ES. In addition, consultation will be required with landowners who have land within the Scoping Boundary for assessment on agricultural and individual farm business.

## 12.7. Potential effects including monitoring and mitigation measures

### Construction

#### *WCH*

12.7.1. The Proposed Scheme would have a direct impact upon users of the restricted byway referenced as Honingham RB1 and the footpath referenced as Hockering FP7 (PRoW 4 and 5) since it would sever both these routes. This will result in increased journey times and lengths during the temporary construction period.

#### *Amenity*

12.7.2. Amenity is likely to be temporarily impacted for users of Honingham RB1 and, Hockering FP7 (PRoW 4, PRoW 5), Low Road, Mattishall Lane, Church Lane, Wood Lane, Berrys Lane, Taverham Road, Blind Lane and Main Road during construction through the presence of construction plant, machinery, materials, construction compounds and construction lighting, whilst there is also potential for barriers and traffic flows to change.

12.7.3. In addition, construction activities may cause indirect effects for WCH, 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 the Chapter 5 Air Quality, Chapter 7 Landscape and Chapter 11 Noise and Vibration.

#### *MT: Driver stress*

12.7.4. During construction works, it is possible that overnight working may be undertaken. This could cause temporary disruption for motorised users along the A47 and adjoining side roads. Traffic management would be likely to result in temporary reduced speeds and potentially narrow lanes, which would increase journey times. This could temporarily increase stress for MTs and cause disruption for local communities. However, this would be managed through the implementation of a Traffic Management Plan and therefore temporary effects, whilst slight adverse, are unlikely to be significant.

#### *MT: View from the Road*

12.7.5. It is anticipated that the construction of the Proposed Scheme would be undertaken whilst retaining the existing A47 as the ‘live’ highway corridor for a large part of the construction period. Within this scenario, construction of the Proposed Scheme would be experienced as a change to the landscape to the south and north of the A47 whereby the change would be perceived as detrimental to the relative quality of the view from the road.

12.7.6. Where construction activity associates more directly with the existing A47 at either end of the Proposed Scheme or following a switch of traffic to the route of the Proposed Scheme the driver view would associate the influence of construction more directly with the highway corridor and less so as one of change to the view out from the road.

12.7.7. The Proposed Scheme would result in vehicle travellers experiencing views outside of the visual containment afforded by vegetation along the existing highway corridor once traffic is diverted onto the new A47 alignment. This would however be likely to associate with a relatively limited duration of the overall construction stage and would associate with an outlook influenced by temporary construction earthworks and other construction activity that would limit the potential for uninterrupted 'open' views from the road. Overall the nature of the outlook from the road during construction would change from that of 'restricted' to that of 'intermittent'.

### *Community severance*

12.7.8. Residents who currently use the stretch of A47 which forms part of the Scheme to access their home and local facilities are likely to experience temporary severance during the construction period as a result of works associated with road widening. Affected community facilities include Hockering nursery, while affected businesses could include Mooney Demolition, Reclaimed Building Materials and Plant Hire.

12.7.9. It is also possible that local villages will become 'rat-runs' for vehicle traffic, potentially resulting in further severance arising from congestion and increased traffic volumes.

12.7.10. The Proposed Scheme could cut off Saint Andrew's Church from the village of Honingham, therefore causing severance for congregants (of whom many are elderly) with regards to attending Church services.

### *Community land and community facilities*

12.7.11. No impacts are anticipated to arise effecting community land or community facilities with the study area

### *Development land*

12.7.12. No impacts are anticipated to arise effecting development land within the study area.

### *Demolition of private property and associated land take*

12.7.13. There is likely to be both temporary and permanent land take as a result of the Proposed Scheme. In terms of temporary land take, a construction site compound will be approximately located at the west end of the Site to the south of the existing A47 in fields behind Old Oak farm. A satellite compound will also be required at approximately the east end to the north of the existing A47 with access off Church Lane.

12.7.14. A small number of buildings are potentially set to be demolished under the Proposed Scheme. While compensation and other mitigation will be offered to residents and owners, this nonetheless represents a major impact on these receptors who are considered to be highly sensitive to the Proposed Scheme. This impact is considered to be major adverse and potentially a significant effect.

### *Local economy*

12.7.15. The Proposed Scheme will require new construction workforce to deliver it. At present, no Construction Strategy for the Scheme is available. There is currently, therefore, no information on whether the workers required will be new or existing employees of the designated contractor, 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 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 Scheme, this effect is unlikely to be significant.

### *Agricultural land and individual farm businesses*

12.7.16. 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 Scheme becomes operational.

12.7.17. 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 Scheme.

12.7.18. The Proposed Scheme is likely to require both temporary and permanent land-take of some Grade 2 (very good quality), some Grade 3 (good to moderate quality), some Grade 4 (poor quality) agricultural land and two areas of non-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 this 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.

12.7.19. 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.

12.7.20. 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), 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.

12.7.21. The construction footprint (site boundary) 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 design is refined. A definite figure will be available as the design stage progresses.

## Operation

### *WCH*

12.7.22. The Proposed Scheme would have a direct impact upon the restricted byway referenced as Honingham RB1 and the footpath referenced as Hockering FP7 (PRoW 4 and PRoW 5) since it would sever both routes. At this stage, it is not clear if these alignments would be maintained or be permanently diverted. The magnitude of the effect would be either moderate beneficial or major adverse depending upon the strategy to be adopted.

### *Amenity*

12.7.23. The Proposed Scheme would result in a moderate adverse effect for users of the restricted byway referenced as Honingham RB1 and the footpath referenced as Hockering FP7 (PRoW 4 and PRoW 5) since the new alignment of the A47 would sever these routes and move traffic closer to users. This would lead to increased noise levels and pollution. At this stage, it is not clear how much of the routes would remain usable.

### *MT: Driver stress*

12.7.24. Driver stress would be reduced as a result of the Proposed Scheme owing to the reduction in the number of side roads with access to the carriageway. The upgrading of the road to a dual carriageway would provide greater overtaking opportunities. Despite this, the severance of many of the site roads would lead to a concentration of traffic on those which will maintain access to the A47, potentially increasing stress.

### *MT: View from the road*

12.7.25. At year 1 of operation, prior to the establishment of Proposed Scheme mitigation planting, there will be localised 'open' views from sections of the A47 and new link roads, but overall users of the Proposed Scheme will experience 'intermittent' views from the road. Juvenile mitigation planting associated with the highway boundary will take time to establish, however the general extents of tree and hedgerow cover within the setting of the Proposed Scheme will limit the extent of views from the road. The nature of view experienced by users of the A47 at year 1 of operation (relative to the existing baseline) will change to one of accentuated highway prominence as a result of the change from a single to dual carriageway layout.

12.7.26. Views from other local minor roads within the study area will experience change at year 1 of operation as a result of visibility of the Proposed Scheme, notably where new junctions are formed with the Proposed Scheme, but will not typically experience change in the relative 'openness' of views from such roads.

12.7.27. By year 15 of operation the nature of views from the Proposed Scheme and other roads in the vicinity will typically revert to a state comparable to that of the existing baseline and thereby associate with 'restricted' views from the road.

### *Community severance*

12.7.28. The Proposed Scheme could cause permanent severance for local communities due to some villages and facilities being cut off from one another. The dualling of the A47 could, in some cases, become a barrier for some types and areas of

local travel. This will be considered in the design and reported as the design progresses through the EIA process.

### *Community land and community facilities*

12.7.29. No effects on community land and community facilities are expected to arise during the operation of the Proposed Scheme.

### *Development land*

12.7.30. Beneficial impacts are likely to arise due to the unlocking of development sites such as the FEZ. The Scheme is likely to improve access to new developments for both employees and members of the public.

### *Demolition of private property and associated land take*

12.7.31. There is anticipated permanent effects due to land take with compulsory purchase of land along the route. This will be confirmed as the design is refined. To avoid double counting of potential effects, these have been captured at the construction stage where these effects will arise.

### *Local economy*

12.7.32. Direct operational employment is not expected to be created as a result of the Proposed Scheme.

12.7.33. 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*

12.7.34. During the operational phase, the Proposed Scheme would require permanent land-take of some Grade 2 (very good quality), some Grade 3 (good to moderate), some Grade 4 (poor quality) agricultural land and two areas of non-agricultural land. Grade 2 agricultural land is categorised as the Best and most versatile (BMV) agricultural land, therefore permanent land-take of this, as well as the land-take of Grade 3 and 4 agricultural land, has the potential to have significant adverse effects during operation.

12.7.35. 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. 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.

12.7.36. 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), where possible, mitigation would include the provision of new agricultural land of the same classification with an alternative means of access, or financial compensation.

## Summary

12.7.37. Table 12-4 provides a summary of potential construction and operational stage effects on people and communities for the Proposed Scheme.

Table 12-3 : Summary of potential people and communities effects

| Topic | Summary |
|---|---|
| WCH | • Construction: Direct impact upon users of Honingham RB1 and Hockering FP7 (PRoW 4 and PRoW 5) since it would sever these routes. This would result in increased journey times and lengths during the temporary construction period.<br>• Operation: Direct impact upon users of Honingham RB1 and Hockering FP7 (PRoW 4 and PRoW 5) since it would sever these routes although it is not clear at this stage if the alignments would be maintained or permanently diverted. The magnitude of the effect would depend upon the strategy to be adopted by the Proposed Scheme. |
| Amenity | • Construction: WCH 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.<br>• Operation: Would result in a moderate effect on amenity for users of both Honingham RB1 and Hockering FP7(PRoW 4 and PRoW 5) since the new alignment of the A47 would sever both routes and move traffic closer to users. The Proposed Scheme would have a minor effect on amenity for users of the local side roads. |
| MTs: Driver Stress | • Construction: Driver Stress for MTs would increase with changes in traffic flows and speeds, however these effects are not considered to be significant.<br>• Operation: A reduction in the number of side roads with access to the carriageway and the upgrading of the road to a dual carriageway would reduce driver stress on the A47. Despite this, the severance of many of the side roads may potentially increase driver stress. |
| MTs: View from the Road | • Construction: Views from the road would be subject to the detracting influence of construction operations including earthworks and construction vehicles and |

| Topic | Summary |
|---|---|
| | views would change from 'restricted' to 'intermittent' to include increased views of the wider surrounding area.<br>• Operation: At year 1 of operation, prior to the establishment of Proposed Scheme mitigation planting, there will be localised 'open' views from sections of the A47, but overall resulting in an 'intermittent' viewing experience. By year 15 views will become 'restricted' following the establishment of Proposed Scheme highway boundary mitigation planting. The nature of view out from the road throughout operation will however remain comparable to that of the baseline, comprising views across agricultural fields, interspersed with wooded areas and punctuated by landmark church towers. |
| Community Severance | • Construction: Residents who currently use the stretch of road to access their homes and facilities are likely to experience temporary severance. Affected community facilities include Hockering nursery, while affected businesses could include Mooney Demolition, Reclaimed Building Materials and Plant Hire. Local villages may become 'rat runs' for vehicle traffic, potentially causing traffic and congestion. The scheme could cut off Saint Andrew's Church from the village of Honingham, thus causing severance for congregants.<br>• Operation: Permanent severance could be caused for local communities due to some villages being cut off from one another depending upon the strategy to be adopted. |
| Community Land and Community Facilities | • Construction and Operation: No impacts are anticipated to arise. |
| Development Land | • Construction: No impacts are anticipated to arise.<br>• Operation: The unlocking of development sites in the area is likely to be assisted by the scheme by improving access to development sites. |
| Demolition of Private Property and Associated Land Take | • Construction: There is likely to be both permanent and temporary land take. In terms of temporary land take, a construction site compound would likely be approximately located at the west end of the scheme to the south of the existing A47 in fields behind Old Oak farm. A satellite compound would likely be required at approximately the east end to the north of the existing A47 with access off Church Lane. In terms of permanent land take, a total of four residential properties are set to be demolished.<br>• Operation: Permanent land and property effects will arise due to the compulsory purchase of land and residential sites along the route. |
| Local Economy | • Construction: The scheme requires a new construction workforce to deliver it therefore potentially creating new employment in the area.<br>• Operation: Direct operational employment is not expected to be created due to the scheme. |
| 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. Therefore, the Proposed Scheme has the potential to have significant effects on agricultural land. The full extent of land-take both permanent and temporary is currently undefined, therefore the extent of any effects to agricultural land are unknown. |

| Topic | Summary |
|---|---|
| | • Operation: The effects and impacts to landowners caused by temporary land-take will be alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner. 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. The full extent of permanent land-take is currently undefined, therefore the extent of any effects to agricultural land are unknown. |
| Individual Farm Business | • Construction: 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 operation phases. This land-take has the potential to have significant effects. The full extent of land-take, both permanent and temporary is currently undefined, therefore the extent of any effects to landowners and agricultural land are unknown.<br>• Operation: The effects and impacts to landowners caused by temporary land-take will be alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner. Permanent land-take is required for the new road layout once the Proposed Scheme is operational. This land-take has the potential to have significant effects. The full extent of permanent land-take is currently undefined, therefore the extent of any effects to landowners and agricultural land are unknown. |
| WCH | • Construction: Direct impact upon users of Honingham RB1 and Hockering FP7 (PRoW 4 and PRoW 5) since it would sever these routes. This would result in increased journey times and lengths during the temporary construction period.<br>• Operation: Direct impact upon users of Honingham RB1 and Hockering FP7 (PRoW 4 and PRoW 5) since it would sever these routes although it is not clear at this stage if the alignments would be maintained or permanently diverted. The magnitude of the effect would depend upon the strategy to be adopted by the Proposed Scheme. |

## 12.8. Proposed level of scope and assessment

12.8.1. Further assessment is required for WCH, Amenity, and MTs Views from the road and Driver Stress, to a Simple Level during construction and operation.

12.8.2. Detailed Level assessment is required to determine the significance of the of effects associated with Demolition of Private Property and Associated Land Take, Community Severance, Community Land and Community Facilities, Development Land, and Local Economy during both construction and operation.

12.8.3. Due to the potential for significant effects, assessment to a Simple Level is also required for Agricultural Land and Individual Farm Businesses during construction and operation.

## 12.9. Proposed methodology including significance

### WCH

12.9.1. The assessment of effects of the Proposed Scheme on WCH will be undertaken using the guidance contained within the DMRB Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects (or DMRB 11.3.8) and by applying professional judgement. The assessment will examine the likely detriment or improvement to WCH journeys, including changes to journey length and quality of a journey.

### Amenity

12.9.2. Amenity is described as the "relative pleasantness of a journey" in DMRB 11.3.8. As such, the assessment will consider the PRoW 4, PRoW 5 and the local side roads 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 11 Noise and Vibration, Chapter 5 Air Quality, and Chapter 7 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. 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

12.9.4. The view from the road component of this chapter assesses views from the road during construction and operation. The DMRB methodology does not provide assessment criteria for determining a significance of effect on views from the road but instead provides a qualitative assessment of relative change in the nature of the view using the categories set out above. Detail on the significance of visual effects on road users are included in Section 7 of this scoping report (Landscape).

### MTs: Driver stress

12.9.5. 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 forecasts and consider changes in traffic flows with and without the Proposed Scheme scenarios in the first 15 years after opening.

### Community severance, community land and community facilities, development land, demolition of private property and associated land take, local economy

12.9.6. Assessment will be undertaken in accordance with DMRB Volume 11.3.6 and 11.3.8, and will consider both direct and indirect effects arising as a result of the construction and operational 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.

12.9.7. 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; and
- Users of community facilities in nearby villages, such as educational establishments, health facilities, recreational facilities, places of worship and public transport.

12.9.8. Social and community resources include existing and potential:

- Residential, business, community and development land affected by the Proposed Scheme, construction works, and compounds; and
- 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

12.9.9. Assessment will need to be undertaken in accordance with DMRB Volume 11, Section 3, Part 6 (amendment number one): '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, 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 limitation on agricultural use for food production.

12.9.10. The quality of the agricultural land, within the study area varies between Grade 2 (very good quality) Grade 3 (good to moderate quality) and Grade 4 (poor quality) with two areas of non-agricultural land. The occurrences and broad locations of the different Grades of agricultural land as defined by MAFF are summarised as follows: Grade 2 land is largely situated to the north and west of Hockering, Grade 3 land is located on the majority of the study area, Grade 4 land is found close to the River Tud and there are two areas of non-agricultural land to the north of Easton and north of Honingham. This information has been taken from the previous stages of design development and assessment and confirmed through the Natural England land capability for agriculture maps and shall be refined as part of our assessment work.

12.9.11. It should be noted that the maps provided by 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.

12.9.12. Based on the information above, it will be required to undertake an Agricultural land classification survey (ALC) and Soil resource survey (SRS). The methodology required to be followed for both are set out below.

12.9.13. The purpose of the ALC survey is to categorise the agricultural land at the site in accordance with the ALC 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 1 to 5, 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 (BS) 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.

12.9.14. The purpose of the SRS is to further classify the soils of the site and to identify potential topsoil and subsoil resources present within the redline 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 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.

12.9.15. 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 0.07m 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 0.2m auger segments for inspection and logging. Each excavated auger profile shall be photographed, and horizon depths recorded to 0.1m accuracy.

12.9.16. 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).

12.9.17. Soil profile observations shall be supplemented by observation of field conditions (e.g. relief, vegetation cover) 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 characteristic shall be logged on-site for each horizon observed.

12.9.18. 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.

12.9.19. 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 analyses 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

12.9.20. 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.

12.9.21. The results of the SRS shall inform the Soil management plan (SMP). DEFRA (2009) state:

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

12.9.23. 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.

12.9.24. 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 at stage three 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.

12.9.25. 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 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.

12.9.26. This information will be combined with local land registry data on the location and size of the 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 a percentage of the total area of land utilised by the farm.

## Significance of effects

*WCH, amenity and MTs*

12.9.27. Criteria defining significance of effects are not outlined within DMRB Volume 11 Section 3 Part 6 or Part 8. However, DMRB Volume 11 Section 2 Part 5 provides an approach to determining significance of effects as outlined in Table 12-5. The significance of effects for each effect category have been assigned interpreting the guidance from DMRB and using professional judgement.

12.9.28. Walking, Cycling & Horse-Riding modes (or users) are primarily defined within this document as:

a) Pedestrians – including mobility impaired and vulnerable pedestrians.

b) Cyclists – including mobility impaired and vulnerable cyclists.

c) Equestrians – including mobility impaired and vulnerable equestrians.

Table 12-4 : 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 Proposed Scheme |
| 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

12.9.29. Interpreting guidance from DMRB, the effect categories have been allocated the following significance (Table 12-6). All WCH 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 WCH (Table 12-7) and amenity (Table 12-8).

12.9.30. DMRB methodology provides a framework for qualitative assessment of change in the nature of the Views from the Road. Detail on the approach to determining the significance of visual effects on road users are included in Section 7 of this scoping report (Landscape). 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 12-9 and Table 12-10).

Table 12-5 : Value of magnitude and significance assigned to the effect categories

| Effect Category | Value | Magnitude | Significance |
|---|---|---|---|
| Walkers, cyclists and horse riders | 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 (refer to Table 12-8) | Slight, Moderate, Large or Very Large (depending on value and magnitude) |
| 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 12-6 : Impacts and magnitude of change on walkers, cyclists and horse riders

| Description of impacts on walkers, cyclists and horse riders | Magnitude |
|---|---|
| • Substantially improve WCH network through the provision of new amenities for WCH where none existed previously.<br>• Length of journeys decreased by over 500m. | Major Beneficial |
| • Improve existing WCH network through the provision of new amenities for pedestrians and cyclists where few or none existed previously.<br>• Length of journeys decreased by 250-500m. | Moderate Beneficial |
| • Improve existing WCH network through the upgrading of existing amenities or provision of new amenities for WCH where some already exist.<br>• 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 WCH amenities are not provided.<br>• Length of journeys increased by up to 250m. | Minor Adverse |
| • Existing WCH facilities are degraded.<br>• Length of journeys increased by 250-500m. | Moderate Adverse |
| • Closure/ removal of WCH amenities where they previously existed.<br>• 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 12-7 : Impacts and magnitude of change on amenity

| Description of impacts on amenity | Magnitude |
|---|---|
| • Substantial improvement to WCH 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 WCH network through the provision of new amenities for pedestrians and cyclists where few or none existed previously. | Moderate Beneficial |
| • Improve existing WCH 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 8000 vehicles per day (AADT)<br>• A new bridge would need to be climbed or a subway traversed | Minor Adverse |
| • Pedestrian at grade crossing of a new road carrying between 8000 - 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 16000 vehicles per day (AADT) in the opening year | Major Adverse |
| • Description of impacts on amenity | Magnitude |
| • Substantial improvement to WCH 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 12-8 : 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 12-9 : 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

## Community severance, community land and community facilities, development land, demolition of private property and associated land take and local economy

12.9.31. 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 Table 12-11.

Table 12-10 : Socio-economic sensitivity criteria

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

12.9.32. 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 (Great Yarmouth and Norfolk), 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

12.9.33. 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 12-12.

Table 12-11 : Socio-economic and community impact magnitude criteria

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

12.9.34. The significance of any potential effects is evaluated by combining the assessment of magnitude of each of the impacts 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 12-13.

Table 12-12 : Evaluation of significant 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 business

12.9.35. 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.

12.9.36. The significance of effects on agricultural land and individual farm businesses will be determined in accordance with Table 12-14.

Table 12-13 : Significance of effects table: value, magnitude and significance assigned to effect categories

| Effect Category | Value | Magnitude | Significance |
|---|---|---|---|
| Agricultural Land | Dependent on Agricultural Land Classification (refer to Table 12-16). | Dependent on the area of land lost (refer to Table 12-17). | Slight, Moderate or Large (depending on value and magnitude) (refer to Table 12-18). |
| Individual Farm Businesses | Dependent on area of land-take (refer to Table 12-19). | Dependent on the proportion of land lost to the business (refer to Table 12-20). | Slight, Moderate or Large (depending on value and magnitude) (refer to Table 12-21). |

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

Table 12-14 : Value assigned to the assessment of agricultural land based on the ALC grading criteria

| Effect Category | Value |
|---|---|
| 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 12-15 : Magnitude of impact assigned to the assessment of agricultural land based on the ALC grading criteria and area of land take

| Grade | Land Take | | |
|---|---|---|---|
| | >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 12-16 : Overall effect assigned to the assessment of agricultural land based on the ALC grading criteria and area of land

| Value | Magnitude | | |
|---|---|---|---|
| | 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 12-17 : Value assigned to the assessment of individual farm businesses which is based on area of land take

| Value | Receptor |
|---|---|
| High | Total area <20ha and / or limited or highly specific range of high-value crops or livestock and low operational flexibility |
| Medium | Total area 20-50ha and / or some diversification or range of crop or 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 12-18 : 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 or livestock and low operational flexibility | Major | Moderate or Major | Minor or Moderate |
| Total area 20-50ha and / or some diversification or range of crop or livestock types | Moderate or Major | Moderate | Slight |
| Total area >50ha and / or highly diversified income and flexibility management | Minor or Moderate | Minor | Neutral or Minor |

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

Table 12-19 : 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

### WCH, amenity and MTs

12.10.1. Assessment is required to a Simple Level in the first instance for Walkers, cyclists and horse riders and Amenity for the Proposed Scheme, during both construction and operation. This will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 9 'Vehicle Travellers' and Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects' respectively.

12.10.2. Assessment is also deemed necessary for Motorised Travellers Driver Stress, for the Proposed Scheme to a Simple Level initially, as there would be the potential for significant effects associated with the Proposed Scheme. This will be undertaken in accordance with DMRB Volume 11, Section 3, Part 9 'Vehicle Travellers'.

12.10.3. Whilst the assessment of Views from the Road does not directly associate with a measure of significance of effect, as defined in preceding sections above, the scale and nature of change associated with the Proposed Scheme merits assessment in the ES. Assessment is therefore required for Views from the Road to a Simple Level during construction and operation. The significance of visual effect experienced by road users as a result of the Proposed Scheme will be represented within Section 7 'Landscape and Visual Impact Assessment' of the ES.

### Community severance, community land and community facilities, development land, demolition of private property and associated land take and local economy

12.10.4. The Scheme is likely to result in a number of effects on social and community receptors during construction and operation, some of which are potentially significant.

12.10.5. In particular, land take will be required from private receptors, including potential demolition of property, giving rise to potentially significant effects.

12.10.6. Construction of the Scheme is also likely to result in temporary severance for residents who use the A47 to access their homes and local community facilities. Local villages becoming ‘rat runs’ during the construction period may also give rise to severance of communities living in these villages. Where impacts are likely to arise, these can be managed through construction management processes such as the implementation of a Construction Environmental Management Plan (CEMP).

12.10.7. The Scheme could also cause severance during operation due to the dualling somewhat cutting off villages and facilities from one another. This is likely to cause severance for WCH (especially congregants of churches and children attending local schools).

12.10.8. 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 economic benefits arising from the overall programme of work scheduled for the A47 of which the Scheme is a part.

12.10.9. As the Scheme is considered likely to result in some significant effects on social and community receptors, it is recommended that community severance, community land and community facilities, development land, demolition of private property and associated land take, and local economy are scoped in for assessment of both the construction and operational stages.

### Agricultural land and individual farm businesses

12.10.10. Overall, the Proposed Scheme is likely to impact on agricultural land and individual farm businesses during construction.

12.10.11. In particular, during the construction and operation phases of the Proposed Scheme, permanent and temporary land-take will be required from the BMV (Grade 2), Grade 3 and Grade 4 agricultural land, and two areas of non-agricultural land, which shall also impact on the individual farm businesses. It should be noted that the maps provided by 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. The land-take of BMV Grade 2 agricultural land shall require further assessment in the forms of ALC and SRS survey working informing the SMP and Farm viability assessment. Work shall be undertaken in accordance with the DMRB Volume 11, Section 3, Part 6 (amendment number 1): ‘Land Use’.

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

## Summary of assessment requirements

12.10.13. Table 12-21 outlines the level of assessment required for each sub-topic of People and Communities.

Table 12-20 : Level of assessment required

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

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

# 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, demolition 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 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 down-gradient 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. This chapter has been completed based on the information contained from previous stages of design development and assessment, plus the following sources of information:

- British Geological Survey 1:50,000 and 1:625,000 superficial and bedrock geological map and available borehole logs (BGS, 2017)
- British Geological Survey Sheet 161 Memoir ‘Geology of the country around Norwich’ (BGS, 1989)
- British Geological Survey ‘The physical properties of major aquifers in England and Wales’ (BGS, 1997)
- Defra Magic map (Defra, 2017)
- Environment Agency (EA) data (EA 2017; 2017a; 2017b; 2017c; 2017d; 2017e and 2017f)
- Highways Agency Drainage Data Management System (HADDMS), Drainage Data Management System v5.12.0 (HE, 2011)
- Highways England (2017), A47 Corridor Improvement Programme. Stage 2 Buildability Summary Report

13.3.2. The information in Table 13-1 summarises the relevant waterbodies within the study area for the Proposed Scheme as well as any water dependent designated conservation sites. Figure 13.1 shows the surface water features and flood zones within the study area, Figure 13.2 shows the groundwater bodies, Figure 13.3 shows the surface water flood risk and Figure 13.4 shows groundwater flooding in the vicinity of the Proposed Scheme (see Appendix E).

Table 13-1 : Level of assessment required

| Item | Summary of existing baseline |
|---|---|
| Surface Water | • The River Tud, is the only main watercourse located within the study area, and flows for approximately 9.3km in an easterly direction south of the A47, crossing under the carriageway at Honingham where it continues in an easterly direction to the north of the A47 before its confluence with the River Wensum (see Figure 13.1). The study area has an elevation of between 32 to 52 metres above Ordnance Datum (mAOD). The majority of the catchment within the Proposed Scheme boundary is rural with the villages of Easton, Honingham and Hockering located along the existing A47.<br>• The River Tud (Water Framework Directive (WFD) WBID: GB105034051000) is designated as a heavily modified water body and lies within the Anglian River Basin District, the Broadland Rivers management catchment and the Wensum operational catchment. It is partially protected under the Habitats and Species Directive (Norfolk Valley Fens and River Wensum) and the Nitrates Directive. The Proposed Scheme lies within the River Tud Nitrate Vulnerable Zone (NVZ) for surface water.<br>• The River Tud is a tributary of the River Wensum with the confluence approximately 7.3km downstream of the study area at approximately TG1971010828. The downstream water body, the River Wensum (Wensum DS Norwich (WBID:GB105034055882)) is designated as a heavily modified water body under the WFD and lies within the Anglian River Basin District, the Broadland Rivers management catchment and the Wensum operational catchment. It is partially protected as a Drinking Water Protected Area (DrWPA; Wensum DS Norwich) at risk from metaldehyde, Habitats and Species Directive (River Wensum), Nitrates Directive (203, 397, 400) and the Urban Waste Water Treatment Directive (River Wensum). Although the study area does not impinge on this water body it has been identified as an indirect receptor.<br>• A small area of the River Wensum (Wensum US Norwich (WBID: GB105034055881)) water body catchment lies within the north western extent of the study area. It is designated as a heavily modified water body and is protected as a surface water DrWPA at risk from metaldehyde.<br>• A small section of the River Yare (Yare (Tiffey to Wensum) (WBID: GB105034051281)) catchment lies within the study area at Easton. However, there are no identified water bodies or watercourses linked to this catchment within the study area.<br>• Numerous small ponds and drains are identified within the Proposed Scheme area (see Figure 13.1), with a large number of these being located around the existing A47, within the Tud catchment<br>• A cluster of four drainage ponds lie to the north east of Hockering at approximately TG0804713236. All four ponds lie within arable farmland and drain into the River Tud approximately 700m to the south. The ponds make up part of Park Farm |

| Item | Summary of existing baseline |
|---|---|
| | Lakes which is a local commercial fishery. The ponds do not hold an overall classification.<br>• To the south east of Hockering a large water body is identified, which is used recreationally for fishing, this holds an abstraction licence for domestic and agriculture purposes.<br>• A drainage pond and a cluster of drains are located to the north east of Honingham near where the Proposed Scheme will cross the River Tud. These drain into the River Tud. Clusters of drains and small ponds are also identified to the west of Honingham. |
| Groundwater | • The bedrock and superficial geology within the study area is described in detail in Section 9 (Geology and Soils) and is summarised below.<br>• The superficial geology mainly comprises Lowestoft Formation (Diamicton), which is classified by the EA as a Secondary (Undifferentiated) aquifer. Secondary (Undifferentiated) classifications are given to geological formations with variable characteristics and are therefore considered both secondary and unproductive in different locations (Figure 13.2).<br>• The Proposed Scheme is also underlain by Secondary A aquifers of Alluvium, Lowestoft Formation Sand and Gravels and Sheringham Cliffs Formation Sand and Gravels. Within the study area, Secondary A aquifers of Leet Hill Sand and Gravel Member, Happisburgh Glacigenic Formation and Lowestoft Formation (Undifferentiated) and River Terrace Deposits 1 are also present. Secondary A classifications are given to geological formations that provide water supply and baseflow at a local scale.<br>• The bedrock geology underlying the study area comprises undifferentiated formations within the White Chalk Subgroup across its full extent. This aquifer is designated a Principal Aquifer and mainly has a Major Aquifer Intermediate vulnerability classification, with zones of Major Aquifer High vulnerability to the eastern extent of the study area. There is no clear correlation between the higher vulnerability zones and separate superficial formations from the available maps.<br>• The groundwater within the study area is part of the Broadland Rivers Chalk and Crag WFD groundwater body (GB40501G400300).<br>• The Proposed Scheme crosses a source protection zone (SPZ) 3 (Total Catchment) at the eastern extents which is associated with major groundwater abstractions to the northeast, south and southeast of the scheme.<br>• A further area of SPZ 3 is present within the 1km study area boundary, located approximately 250m to 1000m north of the Proposed Scheme. These SPZs are associated with public water supply abstractions beyond the 1km study area.<br>• Shallow groundwater levels are recorded in the SPZ and where close to the River Tud, with existing borehole logs available from the British Geological Survey's GeoIndex showing a standing water level of 0.91m below ground level.<br>• The study area is partially within the Norwich Crag and Gravels groundwater NVZ (G79). |
| Water Quality | • The current Anglian River Basin Management Plan (RBMP), as shown by the EA's Catchment Data Explorer website (EA, 2017a) shows that the River Tud (GB105034051000) and the Wensum DS Norwich (GB105034055882) are classified as having an overall 'Moderate' status.<br>• The EA's Catchment Data Explorer website (EA, 2017a) specifies the breakdown of the water quality elements of the River Tud WFD water body as follows: |

| Item | Summary of existing baseline |
|---|---|
| | ○ Ecological classification is at 'Moderate' potential and is not expected to obtain 'Good' potential due to it being disproportionately expensive<br>○ Chemical classification is at 'Good' status<br>• The River Tud ecological potential is limited by physio-chemical quality elements (phosphate) not achieving 'Good' potential.<br>• The EA's Catchment Data Explorer website (EA, 2017a) specifies the breakdown of the water quality elements of the River Wensum WFD water body as follows:<br>○ Ecological classification is at 'Moderate' potential with an objective of being 'Good' by 2027<br>○ Chemical classification is at 'Good' status<br>• The River Wensum ecological potential is limited by biological quality elements (macrophytes and phytobenthos combined) and surface water supporting elements (mitigation measures assessment) not achieving 'Good' potential.<br>• The surface water WFD water bodies are linked to DrWPAs, at risk from metaldehyde pollution. The Drinking Water Safeguard Zones SWSGZ1016 and SWSGZ1017 have been established with measures in place to protect water quality upstream of the DrWPAs.<br>• No assessment of pollution impacts from routine run-off to surface water has been undertaken using the Highways Agency Water Risk Assessment Tool (HAWRAT) within the draft Stage 2 Interim Environmental Assessment Report (2012).<br>• The Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) has 'Poor' chemical and quantitative status (2016 cycle 2). The quantitative status is limited by the Groundwater Dependent Terrestrial Ecosystems (GWDTE) test which scored poorly due to agricultural abstractions lowering the natural flow and levels of the groundwater. The objective is to achieve 'Good' quantitative status by 2021. The chemical status is limited by the Chemical DrWPA criteria, which scored poorly due to suspect data. Objectives are to achieve 'Good' chemical Status by 2027 by natural recovery. The water body is protected under the Nitrates Directive and is linked to a DrWPA. |
| Licenced abstractions and private water supply | • The Envirocheck report (2017) identifies 17 surface water abstraction licences located within the Proposed Scheme area. The majority of these abstractions are taken from the River Tud and its tributaries, other abstractions are taken from the River Wensum and its tributaries and unknown sources. These surface water abstractions consist of:<br>○ 11 for general agriculture (spray and irrigation)<br>○ Four for general farming and domestic purposes<br>○ One for frost protection purposes<br>○ One for mineral washing and processing purposes<br>• It is noted the Envirocheck report covers only the main carriageway with a 1km buffer corridor around it and does not extend to the area covered by a 1km buffer corridor around the Scoping Boundary. The number of abstractions within the study area will be confirmed as part of the assessment.<br>• There are 38 licensed groundwater abstractions within the Proposed Scheme area. These consist of:<br>○ 19 for general farming and domestic purposes<br>○ Three general agriculture |

| Item | Summary of existing baseline |
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| | ○ Four spray irrigation (direct)<br>○ Four private water supplies<br>○ One public water supply<br>○ One for industrial (mineral washing) purposes<br>○ One for top up water supply<br>○ Two for unspecified purposes<br>○ One for domestic use<br>○ One for domestic and agriculture purposes<br>○ One for frost protection purposes<br>• Twenty-eight of these abstractions are taken from the Chalk Principal aquifer, four are taken from Glacial Sands and Gravels, and six are from unspecified geology.<br>• There may be unlicensed surface water and groundwater abstractions of less than 20m$^3$/day within the study area. |
| Consented discharges | • There are 25 active consented discharges in the Proposed Scheme area to water within the study area (EA, 2017). These consist of:<br>○ 13 from a domestic property (single) (including farm house)<br>○ Ten from WwTW (not water company) (not STP at private premises)<br>○ One from a pumping station on sewerage network (water company)<br>○ One from a WwTW (water company)<br>• There are five active consented discharges in the Proposed Scheme area to groundwater within the study area (EA, 2017).<br>○ Two discharges to land of sewage final effluent (not water company);<br>○ One discharge to groundwater via infiltration of sewage final effluent (not water company);<br>○ One discharge to groundwater via soakaway of sewage final effluent (not water company); and<br>○ One trade discharge (cooling water) to groundwater via borehole. |
| Road drainage | • HADDMS identified 14 priority outfalls located within the Proposed Scheme extent. Seven of these were identified as Category D Priority Outfalls (low pollution risk), six were identified as Category C Priority Outfalls (moderate pollution risk) and one was identified as a Category B Priority Outfall (high pollution risk). These outfalls discharge into the tributaries/drains which supply the River Tud. However, the HADDMS asset details register notes that the baseline assessment for eight of the outfalls has suggested these assets are in catchments with soakaways, and may not be outfalls.<br>• HADDMS and other available information on the existing highway drainage outfalls is relatively limited. Existing drainage arrangements indicate the eastern and western section discharges to the River Tud; however, the central section is unconfirmed but could potentially discharge to a combined/surface water sewer. Surface water at the northern junction of Sandy Lane is directed to a catchpit via a gully pot. It is assumed almost all of the existing drainage will not be used, barring the furthest eastern and western section where the Proposed Scheme joins the existing A47. |

| Item | Summary of existing baseline |
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| | • The Proposed Scheme lies within the boundary of the Norfolk Rivers Internal Drainage Board (IDB). The IDB drainage district does not cover its full watershed catchment area, and the boundary is based on the principles of the 1933 Medway Letter which sought to set boundaries for low lying areas which requires close attention to manage and reduce the risk of flooding (Broads, 2006).<br>• Nine soakaways are identified by HADDMS on the hard-shoulder of the existing A47 route between North Tuddenham and Easton. All of the soakaways were identified as Category D (Low) pollution risk to groundwater. |
| Flood Risk | • The EA's indicative Flood Map for Planning (EA, 2017b) shows that the majority of the Proposed Scheme is located within Flood Zone 1 (see Figure 13.1) which is associated with a low risk of flooding from fluvial and coastal sources (an annual probability of less than 1 in 1,000 of river and sea flooding).<br>• The land immediately surrounding the River Tud is primarily designated as Flood Zone 2 and Flood Zone 3.<br>  ○ Flood Zone 2 consists of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.<br>  ○ Flood Zone 3 is split into two separate zones; 3a and 3b.<br>  ▪ Flood Zone 3a comprises of land assessed as having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding.<br>  ▪ Flood Zone 3b comprises as land where water has to flow or be stored in times of flood.<br>• The Proposed Scheme would cross two areas of Flood Zone 3; Flood Zone 3b east of Honingham where the Proposed Scheme crosses the River Tud and Flood Zone 3a south east of Hockering where the Proposed Scheme crosses a drain to the Tud.<br>• As the Proposed Scheme is classed as 'essential infrastructure' and passes through Flood Zone 3 then the 'upper end' climate change allowance category is applied for a time frame up to the 2080s. The climate change allowance of the Anglian river basin district for peak river flow is 65% (EA, 2019).<br>• The EA's indicative long-term flood risk map (EA, 2017c) shows that the Proposed Scheme is at very low risk of surface water flooding (see Figure 13.3).<br>• The Proposed Scheme crosses isolated areas of low and medium flood risk originating from local land drains.<br>• The Proposed Scheme crosses three areas of high surface water flood risk; south east of Hockering originating from a drain running adjacent to the River Tud, east of Hockering (near the Sandy Lane Junction) due to a depression in the land which would collect overland flow and, north and east of Honingham originating from the cluster of drains and the River Tud.<br>• The EA's indicative flood risk map (EA, 2017c) also shows that there is risk of flooding from reservoirs where the Proposed Scheme crosses the River Tud. However, it is unclear which reservoir this risk originates from.<br>• The Proposed Scheme is not within an 'Area Benefitting from Flood Defences' (EA, 2017b).<br>• The EA's Historic Flood Map (EA, 2017d) indicates there has been no historical flooding from rivers, seas or groundwater springs within the Proposed Scheme. |

| Item | Summary of existing baseline |
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| | • The Highways Agency Drainage Data Management System (HADDMS) identified 16 instances of historic flooding within the Proposed Scheme area. HADDMS identified 12 of these flooding instances to be between Hockering and Honingham, mainly around the Wood Land junction and Sandy Lane junction. The majority of these events were due to blocked gully pot covers, and once the gullies were cleared the water drained away. Four instances of historical flooding were identified between Easton and Honingham, however, there was no further information provided.<br>• Currently there is no information from Anglian Water regarding sewer flooding. |
| Groundwater Flood Risk | • The proposed route crosses zones of potential for groundwater flooding to above ground structures between Ch. 5950 – 6050 and Ch. 2200 – 2600, at a ground level of approximately 30mAOD along the route of the River Tud (Figure 13.4).<br>• The proposed route crosses zones of potential for groundwater flooding to subsurface structures at Ch. 2000 – 4000, Ch. 5900 – 6100 and at Ch, 6900, which corresponds to a ground level of approximately 40mAOD along the route of the River Tud (Figure 13.4). |
| Aquatic Ecology | • The study area is ecologically diverse and contains a range of wildlife species which are likely dependant on the water environment. The River Tud is classified as having moderate ecological potential, yet it is ecologically connected to the River Wensum which as discussed, is designated as a SAC and SSSI due to the observed presence of species such as White-clawed crayfish Austropotamobius pallipes, Desmoulin's whorl snail Vertigo moulinsiana and the potential presence of Brook lamprey Lamptera planeri, and Bullhead Cottus gobio.<br>• The River Wensum SSSI and SAC (UK0012647, Defra, 2017) is located, at its closest, 1.6km north east of the Proposed Scheme extent but approximately 7.3km downstream of the study area. Although this lies out with the study area, it has been considered as a potentially sensitive receptor due to the contribution of flow or changes in water quality from the River Tud to the River Wensum, and it potentially receives baseflow from the underlying Principal Chalk and Secondary Superficial aquifers.<br>• Seven Priority Habitat Lowland Fens are present within the study area. The Lowland Fens receive water and nutrients from the soil, rock and groundwater. A Priority Habitat Coastal and Floodplain Grazing Marsh is present at the location where the proposed river crossing is planned.<br>• Further information on sensitive species and aquatic ecology is available in Chapter 8, Biodiversity. |
| Recreation and Human Health | • There are a number of water abstractions from surface water and groundwater within the wider catchment. These are predominantly for agricultural and environment applications, although there are also public and private water supplies from groundwater.<br>• It is understood that the River Tud and Wensum are used recreationally, for example, for angling. Angling is mostly private on the River Tud but Dereham and District Angling Club and Norwich Union Angling Club has waters on the River Wensum. |
| Climate Change | • The Met Office regional climate summary for Eastern England indicates the current climate baseline to be:<br>  ○ Mean annual temperatures ranges from 9.5 to 10.5°C with daily maxima ranging from 6 to 8°C in winter to 20 to 23°C in summer; |

| Item | Summary of existing baseline |
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| | ○ Average sunshine hours range up to 1600 hours per annum in Norfolk, Suffolk and Essex;<br>○ On average, the region experiences 30 rain days in winter and less than 25 days in summer;<br>○ The average number of days per year with snow fall is between 20-30;<br>○ Eastern England is one of the most sheltered parts of the UK in terms of wind.<br>• The associated online climate change allowance (EA, 2019) states that to allow for residual uncertainty in assessing the impacts of climate change on future flood risk, fluvial flow rates should be increased by 65% which refers to the 'Upper End'' categories for the Anglian Region and a time horizon of 2080s (2070 to 2115), as the Site is classed as 'essential infrastructure' partly lying in Flood Zone 3b. |
| Major Accidents and/or Disasters (Events) | • Norfolk County Council Local Flood Risk Management Strategy (Norfolk County Council, 2015) identified historic flooding events in Norwich with the largest in 1912 with an estimated return period of 800 years. Fifteen flooding events were reported between 2001 and 2009 with the most significant in 2008.<br>• No further information was available on major accidents, disasters or pollution events and spills within the study area.<br>• Further consultation will be required with Norfolk County Council, South Norfolk District Council, Broadland District Council, Breckland District Council and Anglian Water to fully understand the extent of historical flooding in the study area. |

## 13.4. Assumptions and limitations

13.4.1. This scoping exercise has been prepared using publicly available information and with reference to previous assessments carried out and through the use of:

- Highways Agency Geotechnical Data Management System (HAGDMS)
- Highways Agency Drainage Data Management System (HADDMS)

The assessment presented is based on a desk study and no site visit was carried out as part of the preparation of this Scoping Report. Considering the nature of the Proposed Scheme, it is not considered that the data limitations introduce any significant uncertainties with respect to surface water, groundwater and flood risks.

13.4.2. 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.

13.4.3. 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.

13.4.4. It is assumed that significant in-channel works and potential river diversions will be necessary on the River Tud, east of Honingham, where a proposed bridge is required as part of the realignment, and also at a crossing over a smaller Ordinary Watercourse to the south of Hockering.

13.4.5. It is assumed that temporary watercourse crossings will be required as part of the Proposed Scheme.

## 13.5. Guidance and best practice

13.5.1. The methodologies listed in Sections 13.7 to 13.9 represent the approach required to meet the following statutory and non-statutory requirements:

- National Planning Policy Framework (DCLG, 2019) and its associated Technical Guidance (DCLG, 2014)
- 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 (2000), more commonly known as the Water Framework Directive
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2000
- The Groundwater (Water Framework Directive) (England) Direction 2016
- Groundwater protection guides covering: requirements, permissions, risk assessments and controls (EA, 2017d), 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, Highways Agency, 2009).

## 13.6. Consultation

13.6.1. Consultation with the following organisations will be required throughout the ES process:

- Environment Agency
- Norfolk County Council as Lead Local Flood Authority (LLFA)

- Norfolk Rivers Internal Drainage Board (IDB)
- South Norfolk District Council,
- Broadland District Council
- Breckland District Council
- Anglian Water

13.6.2. It is proposed to initiate consultations with the organisations listed in Section 13.6.1 regarding clarifications on approach and other issues relating to water quality and WFD status, flooding, drainage and groundwater for the ES. The outcomes of the relevant consultation will be detailed in the ES.

## 13.7. Potential effects including monitoring and mitigation measures

### Construction and demolition

13.7.1. The main compound is proposed to be approximately located at the west end of the Proposed Scheme to the south of the existing A47 in fields behind Old Oak farm. A satellite compound would also be required approximately at the east end to the north of the existing A47 with access off Church Lane (Highways England, 2017). These areas are currently used as agricultural land.

13.7.2. There is the potential for mobilisation of sediment and contaminants from surface water run-off to the watercourses (including groundwater) as a consequence of road construction activities such as earthworks, construction dewatering, plant and vehicle washing and alterations to ground levels, although this would be managed by best practice construction measures to be included within the Construction Environmental Management Plan (CEMP) in accordance with CIRIA Guidelines (CIRIA C532, 2002; CIRIA C648, 2006; and CIRIA C741, 2015a).

13.7.3. The River Tud is designated as a NVZ for surface water and for groundwater. Where construction activities have the potential to mobilise nitrate during, for example, earthworks in areas of agriculture, there is a potential to increase nitrate concentrations within the Tud or to groundwater. The risk of nitrate mobilisation will be managed by the implementation of best practice construction measures through the CEMP and, if appropriate, would include surface water quality monitoring, prior to, and during the construction period. Indirect receptors, such as groundwater abstractions for potable water supply or surface water features, are considered to be sufficiently far enough away that any resultant increase in nitrate loading within the groundwater body would not be measurable.

13.7.4. The River Tud is designated as a Drinking Water Safeguard Zone by Anglian Water for metaldehyde. A small proportion of the study area at the western

extent lies within the Wensum US Norwich DrWPA. Metaldehyde is used as a molluscicide on arable crops such as potatoes and in parks and gardens. It is highly unlikely that any construction activity, such as earthworks, has the potential to introduce or mobilise metaldehyde, due to its rapid degradation (DT90 of 18 days) in soil (University of Hertfordshire, 2017). The potential impact on the DrWPA is therefore considered negligible.

13.7.5. Any permeable horizons present within the superficial deposits may act as pathways for the migration of near-surface groundwater or contaminants. This is of particular concern where the route crosses a SPZ for a public water supply, and where base flow to surface waters occurs.

13.7.6. The hydraulic continuity between the Chalk and overlying superficial deposits is unknown and may be either in full hydraulic continuity or hydraulically separated by low permeability putty chalk and clay layers (BGS, 1997). The superficial deposits may provide some protection to the Principal Chalk aquifer but there is still the potential for leaching of existing and unknown contaminants through more permeable horizons. This is of particular concern where close to potential contaminant sources, or within the NVZ where soil disturbances may result in increased leaching of nitrates. Full details of potential sources of contamination can be found within Chapter 9 Geology and Soils.

13.7.7. Any foundations could create preferential pathways for the migration of pollutants to the underlying aquifers and groundwater dependent surface waters during construction. This is of particular concern where piles may be constructed into the top of the Chalk. Best practice construction methods would be included in the CEMP to mitigate these potential impacts.

13.7.8. Areas susceptible to groundwater flooding at surface and below ground correspond to alluvium within the Tud floodplain and indicate that groundwater levels are likely to be close to ground level in these areas. This is of particular concern where these areas correspond to cuttings along the Proposed Scheme, as seepage may occur and reduce slope stability during construction.

13.7.9. Construction activities for the Proposed Scheme could increase the risk of a pollution incident, associated with accidental spillages/or leaks of fuels, oil, chemicals, wastewater, concrete and cement and admixture. This could adversely impact on the Principal Aquifer, SPZ, local abstractions and the River Wensum SSSI and SAC downstream of the River Tud. However, due to the temporary nature of these impacts, and with appropriate mitigation and monitoring measures and best practice working measures implemented through the CEMP, the risk is considered to be minimal.

13.7.10. Where works will lead to temporary changes in the surface water run-off regime by the alteration of ground elevations and overland flow pathways for example, by earthworks or proposed structures, a temporary surface water drainage strategy would be developed for the Proposed Scheme and incorporated into the CEMP to ensure that there will be no increase in run-off and flood risk during the construction phase. Sustainable Drainage Systems (SuDS) would be implemented where appropriate.

13.7.11. The proposed bridge structure across the River Tud or the proposed drain crossing, south of Hockering, may require temporary construction works within the floodplain and river channel. This has the potential to mobilise sediment and contaminants, impacting on the water quality and aquatic ecology downstream. Construction works could alter flood flow pathways due to earthwork activities leading to an increase in flood risk. Any impact and mitigation of these activities will be considered as the preliminary design progresses and the requirements are confirmed. Appropriate mitigation measures would be implemented through the CEMP and, if appropriate, would include water quality monitoring, prior to, and during the construction period.

13.7.12. The construction phase has the potential to effect recreational users of, and the aquatic ecology within, the watercourses due to increased pollution during construction. Due to the temporary nature of these impacts, and with appropriate best practice measures implemented through the CEMP, these risks are likely to be mitigated. Aquatic ecology may also be affected by the impact of changes in groundwater levels, flow and quality on groundwater-dependent habitats.

13.7.13. Any construction activities on or near an Ordinary watercourse or IDB watercourse would require consent from the Lead Local Flood Authority or the IDB as appropriate. 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.

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

13.7.15. Potential demolition activities include the removal of the existing bridge across the River Tud, east of Honingham, the removal of side roads that are to be severed and the removal of the main carriageway where it is no longer required.

### Operation

13.7.16. The Proposed Scheme would result in a new road drainage design, which is yet to be completed, and it is assumed that only a small section of the existing A47 drainage would be utilised where it ties in. The location of the proposed outfalls

is currently not known although it is assumed that they would be in locations similar to the existing outfalls.

13.7.17. The proposed sections of dualling along with the potential associated increase in the volume of traffic may result in an increase in pollutant loads in highway run-off, resulting in long term increase in diffuse pollution and subsequent deterioration in water quality of surface water and groundwater. This may, in turn, result in impacts on the aquatic ecology of the downstream designated site and human health. Mitigation may be required, in the form of SuDS treatment, to ensure that there is no deterioration in water quality downstream of the proposed outfalls (CIRIA, 2015b).

13.7.18. The proposed main carriageway and side roads would cross two areas of Flood Zones 2 and 3 although the majority of the study area itself is within Flood Zone 1. The effect of an assumed net increase in impermeable area would result in an increase in peak flow rates and volumes which could increase flood risk in the areas of existing flood risk adjacent to the Proposed Scheme (i.e. Flood Zones 2 and 3). Appropriate attenuation would be required in the drainage design to ensure there is no increase in surface water run-off peak flow rate or volume as compared to the existing condition, including a 40% allowance for climate change. Attenuation would be provided by SuDS features which should be designed in accordance with the SuDS Manual (CIRIA, 2015b).

13.7.19. The proposed river crossing structure and the floodplain crossing within Flood Zone 3 would result in a reduction of floodplain storage and could potentially increase fluvial flood risk upstream and downstream. Compensatory flood storage would be required to mitigate this impact.

13.7.20. Any underground structures, such as foundations or underpasses, have the potential to act as groundwater dams, potentially resulting in mounding of groundwater up-gradient of the structure and a reduction of groundwater availability down-gradient of the structure.

13.7.21. Any cuttings transecting permeable strata may result in seepage through the cutting face, resulting in additional flows to the drainage system. This is a particular concern in areas where the potential for groundwater flooding to ground and below ground has been identified. Seepage volumes will be calculated to inform the drainage design, however.

13.7.22. The increase in impermeable surface area is unlikely to significantly reduce recharge to underlying groundwater bodies, due to the area of new hardstanding compared to the overall aquifer surface area.

13.7.23. Any resultant variations in groundwater levels, flows and quality have the potential to impact on groundwater-dependent habitats and aquatic ecology.

13.7.24. It is considered that the operation on the Proposed Scheme will not increase nitrate loading to the groundwater and surface water NVZs. Similarly, the operation on the Proposed Scheme will not increase the risk of metaldehyde within the Wensum US Norwich and Wensum DS Norwich DrWPAs.

13.7.25. Appropriate mitigation/attenuation would be required to ensure no increased surface water run-off peak flow rate or volume and/or reduction in flood plain storage results from 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, 2015b).

13.7.26. The Proposed Scheme requires a new crossing over the River Tud and an Ordinary watercourse south of Hockering, which has the potential to adversely affect the WFD status of the watercourse including the hydrological and geomorphological regime, flood risk and the quality of in-stream and riparian habitat. Detailed assessment will be required to ensure the design of the temporary channel diversion and structures do not cause an adverse impact and aim to improve the overall status of the River Tud, where possible.

13.7.27. Although appropriate measures will be implemented to mitigate impacts, monitoring the baseline and the impacts of the Proposed Scheme operation in the water environment is considered necessary due to the proposed new river crossing and the presence of designated sites of importance as potential receptors.

## 13.8. Proposed level and scope of assessment

### Surface water and water quality

13.8.1. The River Tud and its affected tributaries, and the River Wensum will be considered as part of the environmental assessment as the water bodies are hydrologically connected to the Proposed Scheme.

13.8.2. There are a number of ponds located within the River Tud floodplain north and south of the Proposed Scheme. These will be reported in the ES.

### Groundwater

13.8.3. The environmental assessment will consider both groundwater level and quality impacts in accordance with the requirements of the WFD. Consideration will be given to the potential changes to water flow, volumes and quality during both construction and operation phases. Potential groundwater contaminants which may be present as a result of land contamination will also be considered. Consideration of conveyance of flow and potential water quality impacts to indirect receptors such as the abstractions associated with the SPZ, other local

abstractions, the Lowland Fens (Priority Habitat) and the River Wensum SSSI/SAC will also be made. Additional information collected as part of the ground investigation, including groundwater level monitoring, will be used to inform the assessment.

13.8.4. The Proposed Scheme may include discharges to groundwater, although this has not been confirmed at this stage. If discharges to groundwater are incorporated as part of the Proposed Scheme, a detailed assessment will be required.

### WFD and water quality

13.8.5. As noted previously, the Proposed Scheme has the potential to impact on surface waters due to polluted run-off or spills during the construction, operation and demolition phases, as well as groundwater by the creation of new contaminant pathways and leakage to the underlying aquifers. This could damage aquatic ecosystems and human health.

13.8.6. It is proposed to assess the impact of routine run-off and spillages on water quality on the receiving water bodies through a Simple assessment, and if required, a Detailed assessment. A HAWRAT assessment has not been undertaken to date, this will be undertaken at as part of the ES.

13.8.7. The study area lies within surface water and groundwater NVZs and a surface water DrWPA. It is anticipated the Proposed Scheme will not impact upon these protected areas during construction, demolition and operation due to mitigation within the design and through the implementation of best practice construction measures described in the CEMP.

13.8.8. The preliminary design of the Proposed Scheme is ongoing; however, it is anticipated that the Proposed Scheme will require new crossings on the River Tud and an Ordinary watercourse to the south of Hockering in addition to the proposed discharge of highway run-off. Therefore, it is likely that a detailed WFD compliance assessment will be required.

13.8.9. A preliminary WFD compliance assessment will be carried out as part of the environmental assessment, in consultation with the EA, to screen if the Proposed Scheme has the potential to have an effect on the WFD status of the water bodies within the study area. Any potential significant adverse impacts on these water bodies will trigger a standalone detailed WFD compliance assessment report.

13.8.10. It is anticipated that a detailed WFD compliance assessment report will be required to assess the impacts of the proposed bridge and culvert structures in the river channel and floodplain on the geomorphology and river scour potential

of the Tud. A geomorphological survey and impact assessment will be required to support the assessment. The WFD assessment will identify opportunities for enhancement measures where possible.

### Licensed abstractions and private water supplies

13.8.11. Further information on licensed and unlicensed private water supplies will be identified in consultation with the EA and the local authority.

13.8.12. It is anticipated that the Proposed Scheme will not result in an impact on the ability of licence holders to abstract surface water as any additional run-off from the Proposed Scheme, in terms of volume is unlikely to change through mitigation. However, this assumption will be reviewed once further information has been received.

13.8.13. The proposed route crosses the SPZ of a public water supply abstraction to the east of the study area, and consideration will be given to this, and other licensed groundwater abstractions in the groundwater assessment.

### Consented discharges

13.8.14. It is considered that the construction, demolition and operation of the Proposed Scheme is unlikely to result in an impact on the dilution of existing consented discharges as any change in run-off from the Proposed Scheme, in terms of volume and pollutant load, is likely to be minimised through the CEMP or in-design mitigation. This will be assessed following the confirmation of the proposed drainage discharge rates and volume, outfall locations and type (groundwater or surface water).

### Road drainage

13.8.15. A drainage strategy will be developed 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 hydraulic drainage model.

### Flood risk

13.8.16. A Flood Risk Assessment (FRA) will be undertaken to assess the risk of all forms of flooding and the potential impacts. The FRA will be undertaken in accordance with the requirements of the NPPF (CLG, 2019) and its associated Planning Practice Guidance (CLG, 2019). This will incorporate the findings of the drainage strategy.

13.8.17. The FRA will assess the impact of the proposed design of the river and floodplain crossings on the flood risk, utilising either an existing EA hydraulic

model for the River Tud, or developing a new model, and will include the impacts of climate change using the 2019 guidance (EA, 2019). This will determine the need for flood risk mitigation measures, such as compensatory storage, inform the design of the crossings and the potential for increase in river erosion.

### Groundwater flooding

13.8.18. There is potential for groundwater flooding to occur to above and below ground structures within the study area. The dataset is for use as guidance, and risk of groundwater flooding will need to be confirmed by ground investigations. If identified as an issue, the potential for groundwater flooding will be included in the FRA.

### Aquatic ecology

13.8.19. The environmental assessment will review potential impacts of water availability, water quality and status of the receiving surface water bodies within the study area as well as indirect groundwater-dependent receptors (i.e. the Lowland Fens and downstream River Wensum SSSI/SAC). Any consequential impact on the aquatic ecology will be considered under Chapter 8 Biodiversity.

### Recreation and human health

13.8.20. It is considered that impacts of the Proposed Scheme on human health will be considered indirectly through the water quality impact assessment and the impacts of the proposed drainage strategy on receiving watercourses and groundwater bodies.

### Climate change

13.8.21. To account for climate change, a 65% increase in peak river flow (corresponding to the Upper End allowance in the 2080s for the Anglian region (EA, 2019)) will be considered for the River Tud when assessing the fluvial flood risk impacts, and informing the design, of the Proposed Scheme.

13.8.22. In addition to this, the current DMRB guidance will be adopted when considering climate change within the drainage design; this is a 20% allowance for an increase in peak rainfall intensity. A sensitivity assessment will be undertaken using the climate change allowance, from the 2019 guidance (EA, 2019) which can be up to a 40% increase in peak rainfall intensity depending on the Flood Zone it drains to.

### Events

13.8.23. The impact of Climate Change and the occurrence of a Major Event or Disaster will be considered as part of the FRA. It is considered that the occurrence of an extreme flooding event is the primary major natural event to impact the Proposed Scheme.

## 13.9. Proposed methodology including significance

13.9.1. The proposed methodology will follow the guidance provided in DMRB Volume 11, Section 3, Part 10 (HD 45/09) (HA, 2009) for assessing the significance of effects of proposed road schemes on the 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 (HA, 2009).

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 Tud 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 River Tud 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 results of the drainage strategy will be used to inform the environment assessment and the FRA.

13.9.4. The FRA will be undertaken in accordance with the requirements of the NPPF (DCLG, 2019; 2014), and the EA's climate change allowances (EA, 2019).

13.9.5. The extent of the work involved in the FRA will be discussed and confirmed in consultation with the EA, Norfolk County Council as LLFA, Anglian Water and Highways England. The proposed scope of work required for the FRA is as follows:

- Undertake a desk-based review of existing flood risk information available from the consultees including output from any existing hydraulic model for the River Tud.
- Using information from consultees, surface water flood risk will be investigated to assess whether surface water overland flow will impact on the Proposed Scheme.
- The requirement for compensatory storage will be assessed where the Proposed Scheme lies within Flood Zone 3.
- If an existing EA model is not available or suitable for use, then a hydraulic model will need to be developed for the River Tud. This will require undertaking a topographical survey of the existing river channel and structures to an extent agreed with the EA.
- The hydraulic model, together with the 2016 guidance on climate change allowances for fluvial flood risk, will be used to assess the fluvial flood risk impacts of the proposed structures and assess the performance of flood risk mitigation measures such as compensatory storage.
- The FRA will incorporate the findings and any mitigation proposed as part of the drainage strategy in line with DMRB guidance (HA, 2009).

13.9.6. The construction, operation and demolition stages could result in potential adverse direct effects on water bodies classified under the WFD and therefore a preliminary WFD compliance assessment will be required to inform the requirement for more detailed assessments. It is anticipated that a detailed WFD compliance assessment report will be required to assess the impacts of the proposed bridge and culvert structures in the river channel and floodplain on the geomorphology and river scour potential of the Tud. A geomorphological survey and impact assessment will be required to support the assessment. The WFD assessment will be undertaken, as part of the environmental assessment, in consultation with the EA and in accordance with Planning Inspectorate Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017).

## Assessment of magnitude of impacts and significance of effects

13.9.7. The conservation value of water resources is in part defined by legislation which protects all controlled waters in England and Wales and, in effect, protects all water bodies (surface water or groundwater). Thus, there cannot be any water feature which has a negligible value. The value of controlled waters can be defined by taking into account the use and conservation importance of the water body. The criteria used in this assessment to determine the value/importance of each water feature and its attributes are set out in Table 13-1, based on the definitions provided in Table A4.3 of Annex IV in the DMRB guidance HD 45/09 (HA, 2009).

13.9.8. The value/importance of water environment attributes within the study area are defined in Table 13-2.

13.9.9. Definitions for the magnitude of impact are given in Table 13-3 and are based on values set out in Table A4.4 of Annex IV of DMRB HD 45/09 (HA, 2009). The overall significance of effect is determined using the matrix presented as Table 2-4 in HA 205/08 (HA, 2008) and the definitions provided in Table 13-4. 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.

13.9.10. These tables are based on the guidance given in DMRB HD 45/09 (HA, 2009), although additional criteria have been added, where appropriate to Table 13-2 to meet the requirements of WFD, for which guidance on the assessment of compliance became available after the publication of HD45/09 (HA, 2009).

Table 13-2 : Criteria or 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.<br>**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.<br>**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.<br>**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 industrial properties, which may be affected by changes to the groundwater regime. |

| Value | Criteria | Typical Examples |
|---|---|---|
| | | **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.<br>**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.<br>**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 water body is not classified under the WFD.<br>**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.<br>**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 13-3 : 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).<br>Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex 1).<br>Loss of, or extensive change to, a designated site or aquifer.<br>Potential high risk of groundwater pollution from routine run-off – risk score >250 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'high' or 'good' status or potential water body<br>Increase in peak flood level (1% annual probability) of >100mm. |
| 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).<br>Calculated risk of pollution from a spillage >1 and <2% annually (Spillage Risk Assessment, Method D, Annex 1).<br>Partial loss of, or change to, a designated site or aquifer.<br>Potential medium risk of groundwater pollution from routine run-off – risk score 150-250 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'moderate' status or potential water body<br>Increase in peak flood level (1% annual probability) of >50mm. |
| Minor adverse | Results in some measurable change in | Failure of either soluble or sediment bound pollutants in HAWRAT (Method A, Annex A).<br>Partial change to an aquifer. |

| Magnitude | Criteria | Example |
|---|---|---|
| | attribute's quality or vulnerability | Calculated risk of pollution from a spillage >0.5 and <1% annually (Spillage Risk Assessment, Method D, Annex 1).<br>Potential medium risk of groundwater pollution from routine run-off – risk score <150 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'poor' status or potential water body<br>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.<br>Risk of pollution from spillages <0.5%.<br>No impact on aquifer and risk of groundwater pollution from spillages <0.5%.<br>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.<br>Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is <1% or more).<br>Increase in status of a WFD 'poor' status or potential water body<br>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.<br>Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is >1% or more).<br>Increase in status of a WFD 'moderate' status or potential water body<br>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.<br>Recharge of an aquifer.<br>Increase in status of a WFD 'good' status or potential water body<br>Reduction in peak flood level (1% annual probability) of >100mm. |

Table 13-4 : Estimating the magnitude of an impact on an attribute

| Significance | Examples |
|---|---|
| Very large adverse | Surface water: Potential failure of both soluble and sediment bound pollutants in a High or Good watercourse.<br>Groundwater: Potential high risk (score >250) of pollution in the Groundwater Assessment (Method C, Annex 1) to a principal aquifer providing a regionally important resource or supporting a site protected under habitat legislation.<br>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. |

| Significance | Examples |
|---|---|
| | 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.<br>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.<br>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.<br>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.<br>Groundwater: Potential low risk of pollution (score <150) to a secondary aquifer with limited agricultural use and connectivity to surface waters and local ecology.<br>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.<br>Groundwater: No predicted change in quality of any type of aquifer and/or its use as a resource.<br>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.<br>Groundwater: Reduction by 50% or more in existing pollution risk from spillages into an aquifer (when existing spillage risk is <1%).<br>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.<br>Groundwater: Recharge of aquifer through provision of treated discharges to ground resulting in measurable improvements to a connected site/habitat (LNR).<br>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. |

| Significance | Examples |
|---|---|
| | Groundwater: Removal of an existing polluting discharge within SPZ 1 or 2 and/or a principal aquifer.<br>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 following water receptors have been identified that could be impacted by the Proposed Scheme:

- River Tud (GB105034051000).
- River Wensum DS Norwich (GB105034055882).
- Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) and associated groundwater abstractions.
- The Secondary superficial aquifer and associated groundwater abstractions.
- Indirect receptors via groundwater, on aquatic ecology features associated with the WFD surface water body (River Tud GB105034051000) and the associated designated features in the River Wensum SSSI and SAC (UK0012647).

13.10.2. The potential for the Proposed Scheme to affect these water receptors will be assessed using the appropriate methodologies outlined in DMRB Volume 11, Section 3, part 10 (HD45/09).

13.10.3. A preliminary WFD assessment will be undertaken alongside the above assessments to establish the potential for effects on WFD water body status and to establish the need for a detailed WFD compliance assessment. The WFD assessment will be carried out in accordance with Planning Inspectorate Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017).

13.10.4. The majority of the Proposed Scheme is within Flood Zone 1; however, it does cross Flood Zone 2 and 3. An FRA will assess the impact to, and of, the Proposed Scheme on flood risk with a focus on Flood Zones 2 and 3. This will include any mitigation proposed as part of the drainage strategy. Mitigation will be designed in accordance with relevant DMRB guidance (Highways England, 2016a; 2016b) and the SuDS Manual (CIRIA, 2015b).

13.10.5. There will be a requirement for detailed hydrological and hydraulic modelling of the River Tud for any proposed river or watercourse crossings as part of the FRA.

13.10.6. The above assessments will be presented within the ES.

# 14. Climate

## 14.1. Introduction

14.1.1. This assessment will consider the impact of the Proposed Scheme on climate change and the potential impacts of climate change upon the Proposed Scheme. It will be divided into two separate aspects:

- *Effects on climate*: i.e. impacts on climate from carbon emissions arising from the Proposed Scheme, including how the Proposed Scheme may affect the ability of the UK government to meet its carbon reduction targets (in accordance with the National Networks National Policy Statement (NN NPS) (Department for Transport, 2014))
- *Vulnerability of the Proposed Scheme to climate change*: i.e. the resilience of the Proposed Scheme to climate change impacts, including how the Proposed Scheme will take account of the projected climate change (in accordance with NN NPS and the Infrastructure Planning EIA Regulations 2017)

14.1.2. The term 'carbon' will be used as shorthand to refer to all relevant greenhouse gas (GHG) emissions.

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

## 14.2. Study area

**Effects on climate**

14.2.1. The assessment of effects on climate will consider the extent to which carbon emissions resulting from the Proposed Scheme may impact the global climate and contribute towards climate change.

14.2.2. The study area to be considered for the construction phase will include the embodied carbon of Proposed Scheme materials and emissions associated with construction activities. These are defined in terms of lifecycle stages, as detailed in Section 7 of the PAS 2080:2016 Carbon Management in Infrastructure standard:

- Products and materials (A1-3) – use of materials for temporary and permanent construction activities
- Construction / installation processes (A5) – construction plant use

14.2.3. The study area to be considered for the operational phase will include the operational energy requirements of the Proposed Scheme (i.e. road lighting), and the Affected Road Network (ARN) for end-user carbon (vehicle emissions). Assessment of end-user carbon will be undertaken in line with HA207/07. These

elements are defined in terms of life cycle stages, as detailed in Section 7 of PAS 2080:2016 and as follows:

- Operational energy use (B6) – operational energy
- User utilisation of infrastructure (B9) – end-user traffic flows

**Vulnerability of the Proposed Scheme to climate change**

14.2.4. For the purposes of the climate change vulnerability assessment, the study area is considered to be the physical infrastructure assets associated with the Proposed Scheme. The Proposed Scheme lifetime is taken to be 60 years in line with WebTAG and Highways England guidance.

14.2.5. The vulnerability assessment will consider climate change effects on the Proposed Scheme assets such as pavements, drainage and geotechnical receptors. In addition, environmental receptors identified within respective disciplines' scope will be considered where climate change has the potential to impact upon them as an in-combination effect.

14.2.6. The assessment of vulnerability to climate change will consider construction and operational effects. Climate change effects 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 Projections.

## 14.3. Existing baseline knowledge

**Effects on climate**

14.3.1. Existing carbon emissions will be considered from a variety of sources in the Local Authority area relevant to the Proposed Scheme (e.g. Norwich City Council and Norfolk County Council), including those from transport infrastructure.

14.3.2. Norwich City Council reported a carbon footprint of approximately 6,000 tCO2e in 2016, measured in accordance with national indicator NI185 (Norwich City Council, 2017), although it is noted that this figure reflects emissions specifically associated with the Council's operations (e.g. owned and contractor-operated buildings, vehicle fleet, etc.) rather than the wider local authority region. In 2015, total end-user CO2 emissions from transport in Norwich were reported as approximately 135,600 tonnes (Department for Business, Energy & Industrial Strategy, 2017b).

14.3.3. Norfolk County Council reported total emissions for the 2015-16 year to be approximately 99,147 tCO2e for Local Authority operations (Norfolk County Council, 2016), and the Council has committed to reducing emissions by 50% by

2020, relative to 2009-10 levels. Most recent figures released in 2015 indicated total transport emissions for the wider Norfolk County area (including all relevant Districts) to be approximately 1,953,000 tCO2 (Department for Business, Energy & Industrial Strategy, 2017b).

14.3.4. In 2015, UK net $CO_2$ emissions were estimated at 403.8 million tonnes, a decrease of 3.8% in comparison to 2014 levels (Department for Business, Energy & Industrial Strategy, 2017a). Furthermore, 24% of UK carbon emissions in 2015 originated from the transport sector with emissions of 120mt$CO_2$e.

### Vulnerability of the Proposed Scheme to climate change

14.3.5. A current climate baseline for the wider region has been compiled through the use of Met Office (2016) regional climate data for the Eastern England region, which comprises the counties of Bedfordshire, Cambridgeshire, Norfolk, Suffolk, Lincolnshire, the East Riding of Yorkshire and parts of Essex and Hertfordshire. High-level climate observations for the region over a 30-year averaging period (1981-2010) are presented in 14-**Error! Reference source not found.**1 below.

Table 14-1: Historic climate baseline for the Eastern England region

| Climate Variables | 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 | Eastern England includes some of the driest areas in the country, with the majority of the region receiving less than 700mm of rainfall annually, distributed fairly evenly throughout the year. On average, the region experiences approximately 30 rain days during the winter months (December – February) and under 25 days during the summer period (June – August). Despite generally low levels of precipitation, the area has encountered a number of severe storms which can contribute significantly to total annual rainfall and may also result in the occurrence of hail. |
| Wind | Eastern England is one of the more sheltered parts of the UK, however the winter months are when the strongest winds are experienced. Wind direction is fairly consistent across the region; however, speeds are generally greater in coastal locations than inland, and gusts exceeding 90 knots have been recorded in East Anglia. The frequency of tornadoes is greatest in eastern England relative to other parts of the UK, nevertheless, the intensity of these events remains minor. |
| Sunshine | Average annual sunshine in the wider region ranges from approximately 1,450 hours over Lincolnshire and East Yorkshire, to over 1,600 hours in east Norfolk, Suffolk and Essex |
| Air Frost | The average number of days with air frost ranges from less than 30 (coastal) to 55 (inland) per year. |

Source: Met Office (2016) Regional Climate Data

### Future Projections

14.3.6. The UK Climate Projections provide regional climate information, for which the project area is included within the East of England Administrative Region,

forecasted for the 2080s horizon. The East of England region is predicted to experience changes in temperature, rainfall, and frequency of extreme weather events as a consequence of climate change. These changes are predicted to occur under all three emissions scenarios (i.e. low, medium, and high carbon emissions), which are incorporated into the climate change models used by the Inter-governmental Panel on Climate Change (IPCC). The general trend for the region is warmer, drier summers and milder, wetter winters.

14.3.7. Under the high emissions scenario for the 2080s, estimated changes in climatic conditions are as outlined in Table 14-2.

Table 14.2: Future climate projection data for the 2080s

| Climatic Conditions | Climate Observations |
|---|---|
| Temperature | The average summer temperature is estimated to increase by 5-6°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 3-4°C (50th percentile). |
| Rainfall | The average summer rainfall rate is estimated to decrease by 40-50%, whereas the average winter rainfall rate is estimated to increase by 20-30% (in the 50th 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: UKCP18 Climate Projections

14.3.8. Climate projection data corresponding to the 2080s under a high emissions scenario have been selected in line with NPS paragraph 4.41, which states:

*14.3.9.* *"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."*

14.3.10. For the purposes of this assessment, the latest available projections, published in November 2018 (UKCP18), have been used in place of the UKCP09 projections referred to above.

## 14.4. Assumptions and limitations

14.4.1. Information on the climate baseline and future projections are based on available information from third parties, including the historical meteorological variables recorded by the Met Office and the UK Climate Projections (UKCP18) developed by the Met Office.

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. Therefore, climate modelling results cannot be treated as exact or factual, but projection options, and their reliability differs between climate variables. Generally, global projections are more certain than regional, and temperature projections are more certain than those for precipitation. Furthermore, the degree of uncertainty associated with all climate change projections increases for projections further into the future.

## 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-57-052017, Rev 1) and in accordance with the National Networks National Policy Statement (2014). 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 scheme-wide consultation refer to Chapter 4.

## 14.7. Potential effects including monitoring and mitigation measures

**Effects on Climate**

***Construction***

14.7.1. The duration of Proposed Scheme construction works is anticipated to be approximately 26 months. Embodied carbon emissions from the use of construction materials are the main contributor to climate change, with additional carbon emissions arising from the transportation of these materials and the use of construction plant.

14.7.2. As outlined in Sections 5.7 and 10.7, mitigation measures to be included in the Construction Environmental Management Plan (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.

14.7.3. Assessment appraising the carbon emissions of the Proposed Scheme will be carried out and presented within the ES in accordance with TAG Unit A3 Chapter 4.

***Operation***

14.7.4. Over the design life of the Proposed Scheme, its operation has the potential to result in an increase in end-user carbon emissions due to changes in vehicle distributions and speeds. An appraisal of carbon emissions for the Proposed Scheme during opening year and design year will be undertaken within the ES in accordance with TAG Unit A3 Chapter 4.

**Vulnerability of the Proposed Scheme to Climate Change**

***Construction***

14.7.5. Due to the relatively short-term nature of the construction period, climate change is not expected to impact Proposed Scheme construction. Furthermore, adaptation measures included in the CEMP such as ensuring construction materials are covered when stored and pro-active planning would minimise adverse effects associated with potential weather extremes.

***Operation***

14.7.6. Changes in climate as outlined in **Table 14-2** are anticipated in the Study area over the design life of the Proposed Scheme which have the potential to pose a risk to Proposed Scheme assets and other environmental receptors. Further assessment, as outlined in Section 14.10, will therefore be undertaken and presented within the ES.

**Summary**

14.7.7. A summary of the potential effects related to climate is presented in **Table 14-3**.

Table 14-3: Summary of potential climate effects

| | Potential Construction Effects | Potential Operation Effects |
|---|---|---|
| **Effects on climate** | Potential for increased CO2 emissions. | Potential for increased CO2 emissions. |
| **Vulnerability of the Proposed Scheme to Climate Change** | Changes in climate are not expected to impact Proposed Scheme construction, however the construction site may be vulnerable to extreme weather. | 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 climate change over its lifetime. Therefore, further assessment is required to inform relevant mitigation and adaptation measures.

## 14.9. Proposed methodology including significance

14.9.1. No single prescribed methodology exists for assessing climate-related impacts; however, the assessment will follow best practice and be undertaken in accordance with Highways England guidance, as set out in Section 14.5.

### Effects on climate

14.9.2. The assessment of the effects of the Proposed Scheme on climate will include:

- Estimation of the carbon emissions associated with Proposed Scheme construction using the Highways England Carbon Tool v1.03.
- Estimation of the carbon emissions associated with Proposed Scheme operational energy using the Highways England Carbon Tool v1.03 (and 2019 UK GHG conversion factors, where required[2])
- Estimation of the carbon emissions associated with Proposed Scheme user utilisation in line with Chapter 5 Air Quality
- Assessment of significance of effects through comparing estimated carbon emissions arising from the Proposed Scheme with UK carbon budgets and the associated reduction targets (in accordance with the National Policy Statement for National Networks (2014))
- Opportunities for mitigation in the Proposed Scheme design

[2] As provided by the Department for Business, Energy & Industrial Strategy (2019)

### Vulnerability of the Proposed Scheme to climate change

14.9.3. A qualitative methodology for assessing the vulnerability of Proposed Scheme assets to climate change has been produced in line with DMRB Volume 11 Section 2 Part 5 and Highways England guidance. The assessment will include the following:

- Impacts (hazards and opportunities) for each receptor will be identified using Met Office climate projection data. The vulnerability of the Proposed Scheme to both normal weather and extreme weather-related disaster scenarios throughout the project lifecycle will be identified and reported.
- Following identification of climate change impacts (hazards and opportunities), a risk assessment of those impacts on the Proposed Scheme will be undertaken and significance of effects reported using the required framework, outlined in Highways England MPI-57-052017 (Rev 1).

## 14.10. Conclusion

14.10.1. Construction and operation of the Proposed Scheme are likely to result in increased carbon emissions which may contribute to climate change.

14.10.2. Climate change is not expected to impact Proposed Scheme construction, however projected changes in climate have the potential to affect Proposed Scheme assets and environmental receptors during operation.

14.10.3. Further assessment of construction and operational effects, both on the climate and as a result of climate change, is therefore required for the Proposed Scheme. This assessment will be presented within the ES.

# 15. Combined and cumulative effects

## 15.1. Introduction

15.1.1. Combined and Cumulative effects derive 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 within this Environmental Scoping Report have identified that further assessment is required for a number of environmental topics, which would be undertaken during the EIA and beyond. As a result, no assessment of cumulative effects has currently been made within this Scoping Report. Instead, this chapter provides an overview of the baseline 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.

### Cumulative effects

15.2.2. The study 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. 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. On this basis, given the scope and scale of the proposed works, the study area for the assessment of cumulative effects of the Proposed Scheme would be 2km.

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 model Uncertainty Log and committed developments to be confirmed with Broadland District Council.

## 15.4. Assumptions and limitations

15.4.1. At this stage of assessment, the major 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 effect 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 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 effect 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 effect 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 combined and cumulative 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.<br>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. | 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.<br>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 effect 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.

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:<br>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:<br>• Permanent and far reaching for receptors of high value, or<br>• Localised for a receptor of very high value, or<br>• 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:<br>• Permanent and far reaching for receptors of medium value, or<br>• Localised for receptors of high value, or |

| Significance Category | Definition |
|---|---|
| | • 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:<br>• Permanent and far reaching for receptors of low value, or<br>• Localised for receptors of medium value, or<br>• 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. This 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 Environmental 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 provide a summary of the level of assessment required for each EIA topic scoping into the EIA.

Table 16-1 : Summary of scoping for A47 North Tuddenham to Easton dualling

| Topic | Environmental Statement – Level of Assessment | Scope |
|---|---|---|
| Air Quality | Simple | Scoped in |
| Cultural Heritage | Detailed | Scoped in |
| Landscape | Detailed | Scoped in |
| Biodiversity | Detailed | Scoped in |
| Geology & Soils | Simple | Scoped in |
| Materials | Simple | Scoped in |
| Noise & Vibration | Detailed | Scoped in |
| People and Communities | Various across all sub-topics | Scoped in |
| Road Drainage and the Water Environment | Simple | Scoped in |
| Climate | Further Assessment | Scoped in |
| Combined and Cumulative Effects | -- | Scoped in |

16.1.3. Table 16-2 provides a summary of the potential effects of the Proposed Scheme and identifies whether further Environmental Assessment is required on a topic-by-topic basis.

Table 16-2 : Summary of potential effects and further environmental 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 a Simple level. | No further topic specific consultation is required. |
| | Operation | Impacts on ambient concentrations of Nitrogen Oxides ($NO_x$) including $NO_2$ and fine particulates ($PM_{10}$) as a result of changes to traffic. | Assessment required to a Simple level. | |
| Cultural heritage | Construction | The Proposed Scheme has the potential to adversely affect designated and non-designated heritage assets during construction<br>The southern edge of a historic park (not registered) would be slightly affected.<br>The close proximity of listed buildings to the Proposed Scheme presents the potential for temporary significant effects upon the setting of heritage assets. | Assessment required to detailed level required.<br>Further archaeological investigations may be undertaken, dependent upon the results of the detailed assessment. | Further consultation will be undertaken specifically with Historic England and Council Conservation and Historic Environment Officers. |
| | 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 a Detailed Level. | |
| Landscape | Construction | The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting, will potentially result in (large/moderate) adverse visual effects on residential properties, PRoW users, local community facilities and road users.<br>The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting will potentially result in a (moderate) adverse impact on | Assessment required to a Detailed Level. | Consultation required with Local Planning Authority to agree representative viewpoints to inform the |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | local landscape elements and character during construction. In particular there will be loss of highway boundary trees, shrubs and hedgerow along the existing A47 corridor, loss of agricultural land (notably south-east of Hockering and east of Honingham) and loss of areas of woodland (notably north of Honingham). | | assessment of visual effects. |
| | Operation | Year 1 – Potential adverse effects associated with a reduction in extent of tree cover and increased prominence of highway infrastructure.<br>Year 15 – Potential adverse effects associated with incursion of the influence of the A47 highway on the rural landscape to the east of the Proposed Scheme. | | |
| Visual | Construction | The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting<br>Receptors with potential to be adversely affected by the Proposed Scheme during construction include residential properties on the southern edge of Hockering, the northern edge of Honingham and a number of residential properties dispersed across the area located to either side of the Proposed Scheme route corridor. | Assessment required to a Detailed Level. | - |
| | Operation | At year 1 of operation, prior to the establishment of Proposed Scheme landscape mitigation, there is potential for adverse visual effects associated with views of the road/highway infrastructure, including highway overbridges, and vehicles<br>By year 15 of operation, the establishment of Proposed Scheme landscape mitigation will contribute to a reduction in the extent and significance of visual effects.<br>There is also potential for adverse night time visual effects as a result of the influence of vehicle headlights on residential properties | | |
| Biodiversity | Construction | The River Tud is ecologically and hydrologically connected to the River Wensum SAC and construction may alter the flow, quality and quantity of surface water. | | Detailed consultation to be undertaking with |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | Vegetation clearance may fragment reduce available habitat for protected species.<br>Construction will result in direct loss of woodland and scrub habitat that is used by a variety of common and widespread breeding species.<br>Removal of trees will result in the loss of at least four identified bat roosts.<br>Development adjacent to the River Tud and other watercourses has the potential to impact water voles, otter, breeding and wintering birds, aquatic and terrestrial invertebrates and fish.<br>Increased risk of a pollution incident, such as contaminated land run off or spills/leaks of oils and fuels, and increased airborne pollutants from construction activities may affect adjacent habitats which support protected species;<br>Changes in drainage condition may affect protected species;<br>Night-time works may disturb nocturnal species (bats and badgers) due to lighting, noise and vibration. | Assessment required to a Detailed Level. | Natural England, Environmental Agency, Local Planning Authority, The Wildlife Trust for Bedfordshire and Northamptonshire and RSPB. |
| | Operation | Impacts on the qualifying species of sites of International importance during operations are possible. This may include white-clawed crayfish and water vole impacted by any potential pollution run off.<br>Operation may impact on the hydrology of the River Tud by altering the flow, quantity and quality of surface water entering the river.<br>Potential significant direct and indirect impacts to protected species, designated sites and sensitive habitats.<br>The permanent loss and potential severance of habitats of biodiversity value such as broad-leaved semi-natural woodland, marshy grassland, lowland fen, arable and hedgerows. The permanent loss of habitat suitable for protected species has the potential to adversely affect individual species and their conservation status. | | |
| Geology and soils | Construction | Excavation works associated with the Proposed Scheme have the potential to directly damage any underlying geological features.<br>The potential impact on groundwater resources by the Proposed Scheme. | Assessment required to a Simple level. | Consultation with the Environment Agency will be necessary to discuss the impact |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | The proposed alignment is indicated to pass close to two grave yards and a sewage works. It also traverses land occupied by a timber yard and Mooney's plant hire and building material reclamation yard located in proximity to the River Tud. | | of the Proposed Scheme |
| | Operation | No significant adverse effects anticipated. | No further assessment required. | - |
| Materials | Construction | Potential effect during construction due to the use of materials and generation of waste. However, given the size of the Proposed Scheme and estimated land take, the overall potential effects generate during construction is minor. | Assessment required to a Simple level. | Consultation with the Environmental Agency will be ongoing, where relevant. |
| | Operation | No significant effects anticipated. | - | - |
| Noise and Vibration | Construction | Potential to directly alter the noise and vibration baseline for sensitive receptors for a temporary period. Construction noise would be managed with adherence to mitigation measures and is therefore not anticipated to have significant direct effects. | Assessment required to a Detailed Level. | Consultation with Environmental Health Officers of Local Planning Authority will be progressed following any consultation undertaken to date |
| | Operation | Potential for changes to traffic flows and road alignment to result in noise changes at noise sensitive receptors. Potential adverse effects can be minimised following appropriate mitigation measures. | | |
| People and communities | Construction | **WCH**<br>The Proposed Scheme would have a direct impact upon users of PRoW 4 and 5 since it would sever these routes. This would result in increased journey times and lengths during the temporary construction period.<br>WCH 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**<br>Amenity is likely to be temporarily impacted.<br>Construction activities may cause indirect effects for WCH, 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**<br>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**<br>Affected community facilities include Hockering nursery, while affected businesses could include Mooney Demolition, Reclaimed Building Materials and Plant Hire.<br><br>It is also possible that local villages will become 'rat-runs' for vehicle traffic, potentially resulting in further severance arising from congestion and increased traffic volumes.<br><br>The Scheme could cut off Saint Andrew's Church from the village of Honingham, therefore causing severance for congregants (of whom many are elderly) with regards to attending Church services. | Assessment is required to a Simple Level in the first instance. | |
| | | **Community Land and Community Facilities**<br>No impacts are anticipated to arise effecting community land or community facilities with the study area. | Assessment is required to a Simple Level in the first instance. | |
| | | **Development Land**<br>No impacts on development land are anticipated during the construction phase. | Assessment is required to a Simple Level in the first instance. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | **Demolition of Private Property and Associated Land Take**<br>There is likely to be both temporary and permanent land take as a result of the Proposed Scheme. | Assessment is required to a Simple Level in the first instance. | |
| | | **Local Economy**<br>If the Proposed Scheme results in new employment in the area, this could have a slight beneficial impact on employment rates. | Assessment is required to a Simple Level in the first instance. | |
| | | **Agricultural Land and Individual Farm Business**<br>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. | No further assessment required. | |
| | Operation | **WCH**<br>The Proposed Scheme would have a direct impact upon PRoW 4 and PRoW 5 since it would sever both routes. At this stage, it is not clear if these alignments would be maintained or be permanently diverted. The magnitude of the effect would be either moderate beneficial or major adverse depending upon the strategy to be adopted. | Assessment is required to a Simple Level in the first instance. | |
| | | **Amenity**<br>The Proposed Scheme would result in a moderate adverse effect for users of PRoW4 and PRoW 5 since the new alignment of the A47 would sever these routes and move traffic closer to users. This would lead to increased noise levels and pollution. Much of both routes would remain usable due to their connections with other PRoW and highways in the area. | Assessment is required to a Simple Level in the first instance. | |
| | | **MTs Driver Stress**<br>A reduction in the number of side roads with access to the carriageway and the upgrading of the road to a dual carriageway would reduce driver stress on the A47. Despite this, the severance of many of the side roads may potentially increase driver stress. | Assessment is required to a Simple Level in the first instance. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | **MTs View from the Road (Operation only)**<br>Prior to the establishment of Proposed Scheme mitigation planting, there would be 'open' of A47 and new link roads of the Proposed Scheme.<br>By year 15 of operation the nature of views from the Proposed Scheme and other roads in the vicinity will typically revert to a state comparable to that of the existing baseline and thereby associate with 'restricted' views from the road. | Assessment is required to a Simple Level in the first instance. | |
| | | **Community Severance**<br>The Proposed Scheme could cause permanent severance for local communities due to some villages and facilities being cut off from one another. The dualling of the A47 could make the road difficult and complicated to cross, both as an WCH or in a vehicle. | Assessment is required to a Simple Level in the first instance. | |
| | | **Community Land and Community Facilities**<br>No effects on community land and community facilities are expected to arise during the operation of the Proposed Scheme. | Assessment is required to a Simple Level in the first instance. | |
| | | **Development Land**<br>Beneficial impacts are likely to arise due to the unlocking of development sites such as the FEZ. The Scheme is likely to improve access to new developments for both employees and members of the public. | Assessment is required to a Simple Level in the first instance. | |
| | | **Demolition of Private Property and Associated Land Take**<br>There will be permanent land and property effects with compulsory purchase of land and residences along the route. To avoid double counting of potential effects, these have been captured at the construction stage where these effects will arise. | Assessment is required to a Simple Level in the first instance. | |
| | | **Local Economy**<br>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. | Assessment is required to a Simple Level in the first instance. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| Road Drainage and the Water Environment | Construction | Mobilisation of sediment and contaminants from surface water run-off to the watercourses (including groundwater) as a consequence of road construction activities such as earthworks, construction dewatering, plant and vehicle washing and alterations to ground levels<br>The Rover Tud is designated as NVZ for surface water and construction activities have the potential to mobilise nitrate during earthworks in areas of agriculture;<br>Potential to create pathways for the migration of pollutants to the underlying aquifers<br>An increase in Construction activities for the Proposed Scheme could increase risk of a pollution incident, associated with contaminated land or spills/leaks of chemicals. This could adversely impact on the principle aquifer, local abstractions and the River Wensum SSSI and SAC downstream of the River Tud near to the Proposed Scheme.<br>The construction phase has the potential to affect recreational users of, and the aquatic ecology within, the local surface water features due to increased pollution during construction | Assessment required to a Simple level. | Consultations will be an ongoing process with<br>EA<br>Lead Local Flood Authority (LLFA)<br>Anglian Water. |
| | Operation | Potentially significant direct effects of an increase in long term diffuse pollution and an increase in surface water runoff leading to an increased flood risk without mitigation.<br>The proposed river crossing structure and the floodplain crossing within Flood Zone 3 would result in a reduction of floodplain storage.<br>Any resultant variations in groundwater levels, flows and quality have the potential to impact on groundwater-dependent habitats and aquatic ecology. | Assessment required to a Simple level. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | The Proposed Scheme requires a new crossing over the River Tud and an Ordinary watercourse south of Hockering, which has the potential to adversely affect the WFD status of the watercourse including the hydrological and geomorphological regime, flood risk and the quality of in-stream and riparian habitat | | |
| Climate | Construction | Potential for increased $CO_2$ emissions.<br>The construction site has the potential to be vulnerable to extremes of weather, although significant climate change is not expected during the construction period. | Further assessment required. | No further topic specific consultation is required. |
| | Operation | Potential for increased $CO_2$ emissions.<br>Changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors. | | |
| Combined and cumulative effects | Construction | No assessment has been made. | The assessment for combined and cumulative effects will be undertaken and presented within an ES. | Consultation with the Local Planning Authority will be undertaken to agree a list of proposed developments to include within the cumulative effect assessments. |
| | Operation | | | |

# 17. References

## 17.1. Introduction


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- PINS (2017) Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping


## 17.2. Air Quality


- Department for Environment, Food and Rural Affairs (2016): Local Air Quality Management Technical Guidance
- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1 Air Quality (HA 207/07)
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- 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
- Highways Agency (2015) Interim Advice Note (IAN) 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


## 17.3. Cultural Heritage


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- Historic England (2008) Conservation Principles: Policies and Guidance
- Historic England (2015) Historic Environment Good Practice Advice in Planning
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- Standard and Guidance from the Chartered Institute of Archaeologists

## 17.4. Landscape

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- Highways Agency (2010) Interim Advice Note 135/10: Landscape and Visual Effects Assessment
- Landscape Institute & the Institute of Environmental Management and Association (IEMA) (2013): Guidelines for Landscape and Visual Impact Assessment
- Natural England and Defra (2014) Landscape Character Assessment

## 17.5. Biodiversity

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## 17.6. Geology and soils

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- Highways Agency (1993) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 11 Geology and Soils
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- CL:AIRE Definition of Waste: Development Industry Code of Practice Version 2, 2011

- DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites
- DEFRA (2011) Guidance on applying the Waste Hierarchy
- Environment Agency (EA) (Standard Rules SR2015 No39: use of waste in a deposit for recovery operation
- Environment Permitting (England and Wales) Regulations 2010 (as amended 2011 and 2012)
- Environmental Protection Act 1990, Part II, Section 34
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- Hazardous Waste (England and Wales) Regulations 2005 (as amended, 2009)
- Highways Agency (2001) Interim Advice Note 153/11: Guidance on the Environmental Assessment of Materials Resources
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## 17.8. Noise and Vibration

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- Institute of Environmental Management & Assessment (IEMA) (2014) Guidelines for Noise Impact Assessment
- Sections 60 and 61 of The Control of Pollution Act 1974
- The Environmental Protection Act 1990
- The Land Compensation Act 1973 Part 1
- The National Planning Policy Framework 2019
- The National Policy Statement for National Networks 2014
- The Noise Insulation Regulations 1975 (amended 1988)
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## 17.9. People and communities


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## 17.12. Combined and cumulative effects

- The Planning Inspectorate's 'Advice Note Seventeen: Cumulative Effects Assessment'
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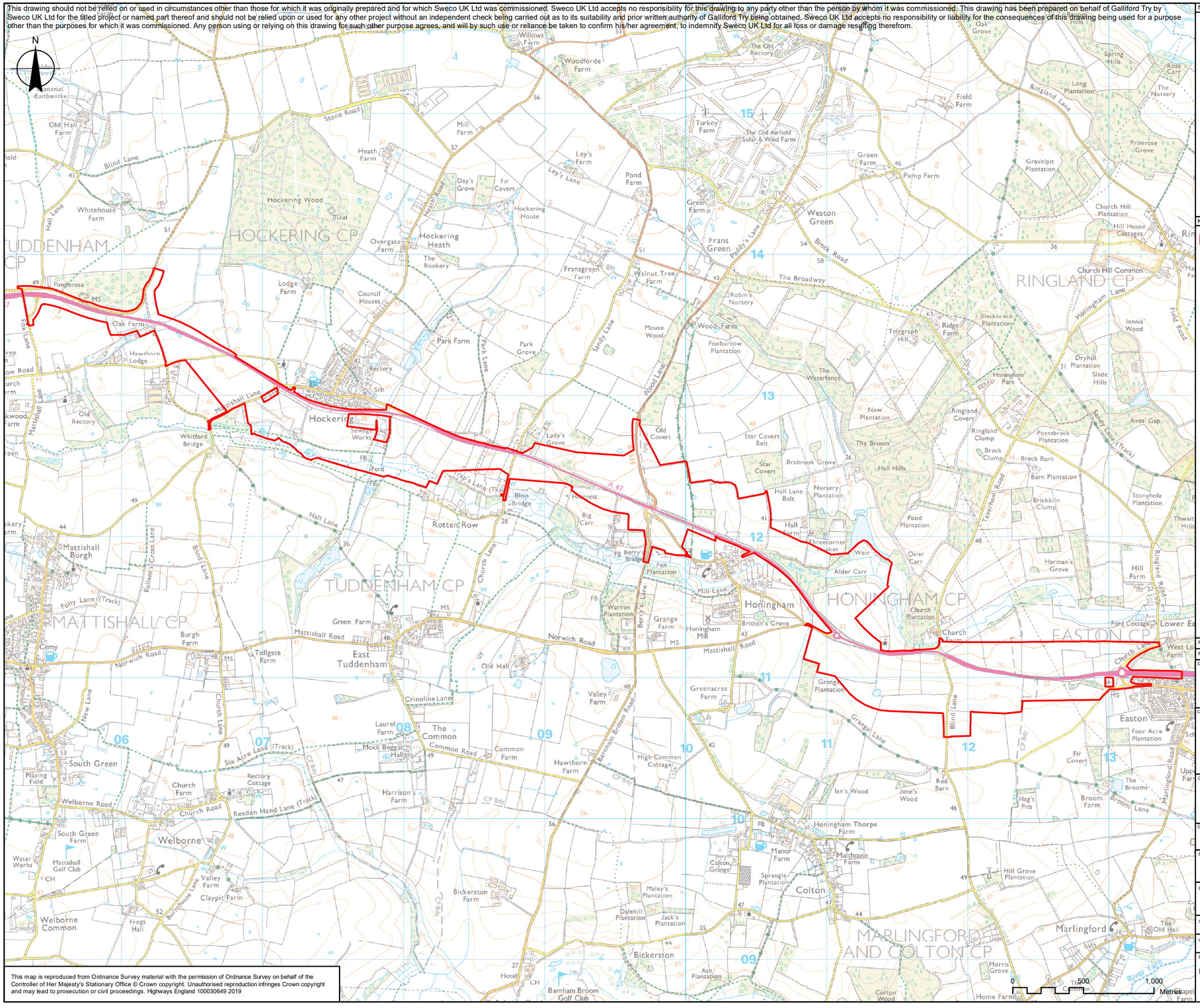
# Appendix A. Scoping boundary






Notes

Key to symbols

Scoping boundary

| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Report produced | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

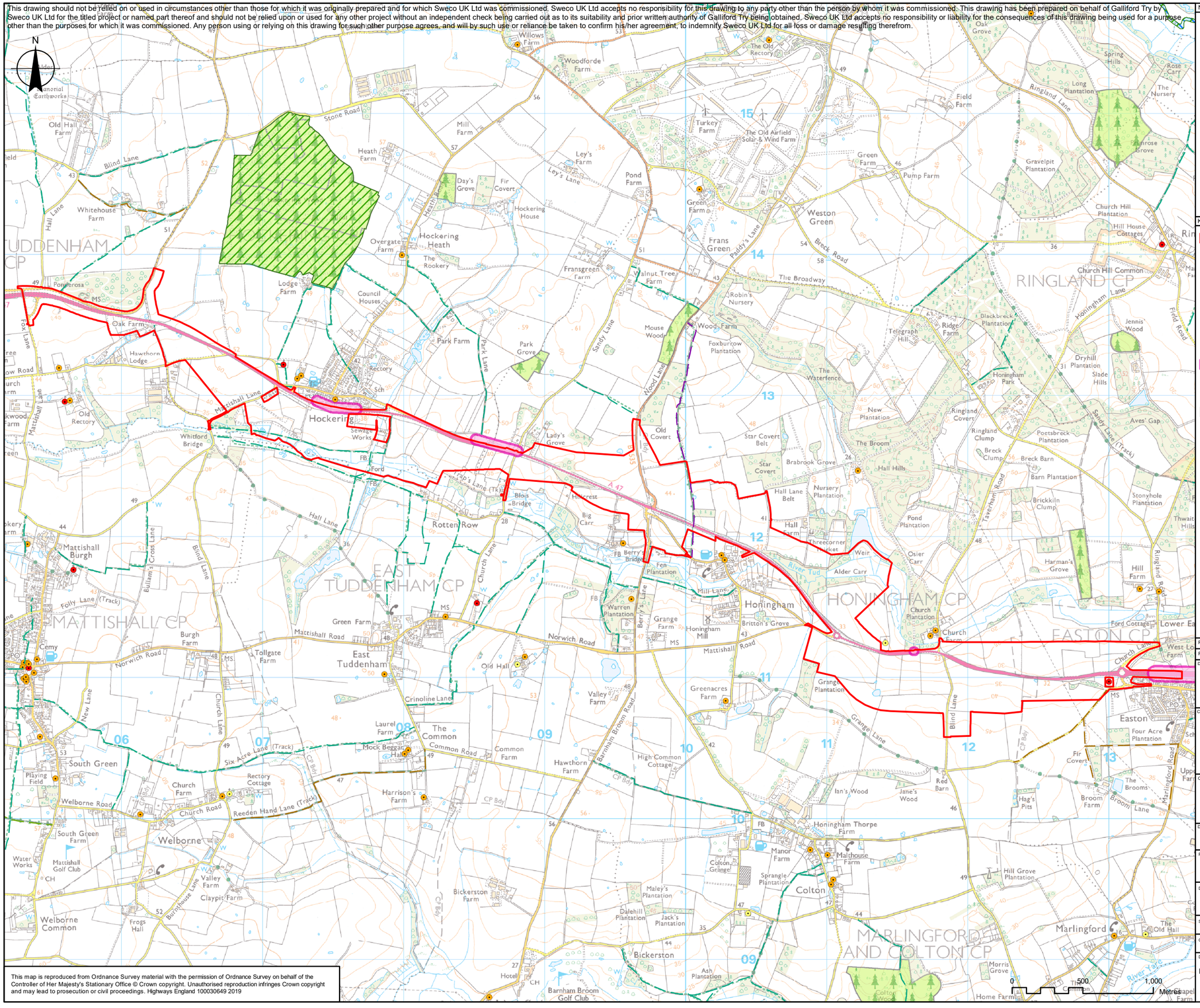
Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure A - Scoping boundary overview

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:25,000 | Bell, Francesca | Corcoran, Ant | Mark, Murphy | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

| Drawing Number HE PIN | Originator | Volume | | Project Ref. No. |
|---|---|---|---|---|
| HE551489 | GTY | EGN | | HE551489 |
| 000 | RP | LE | 0001 | Revision P01 |
| Location | Type | Role | Number | |

# Appendix B. Environmental constraints figures






Notes

Key to symbols

- Scoping boundary
- Bridleway
- Byway open to all traffic
- Footpath
- Restricted byway
- Grade I - listed building
- Grade II - listed building
- Grade II* - listed building
- Noise action planning important areas
- Site of special scientific interest
- Special area of conservation
- Ancient woodland



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Report produced | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure B.1 - Environmental Constraints Site Level

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:25,000 | Bell, Francesca | Corcoran, Ant | Bell, Francesca | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

| Drawing Number HE PIN | Originator | Volume | | Location | Type | Role | Number | Project Ref. No. | Revision |
|---|---|---|---|---|---|---|---|---|---|
| HE551489 | GTY | EGN | - | 000 | RP | LE | 0002 | HE551489 | P01 |

Notes

Key to symbols

- Indicative 5km buffer
- Scoping boundary
- Bridleway
- Byway open to all traffic
- Footpath
- Restricted byway
- Grade I - listed building
- Grade II - listed building
- Grade II* - listed building
- Scheduled monuments
- Authorised landfill site
- Noise action planning important areas
- Site of special scientific interest
- Special area of conservation
- Ancient woodland



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Report Produced | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure B.2 - Environmental Constraints Wider Context

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:59,000 | Bell, Francesca | Corcoran, Ant | Bell, Francesca | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

| Drawing Number | Originator | Volume | | Project Ref. No. |
|---|---|---|---|---|
| HE PIN | | | | |
| HE551489 | GTY | EGN | | HE551489 |
| 000 | RP | LE | 0003 | Revision |
| Location | Type | Role | Number | P01 |





0 1 2 Kilometres

# Appendix C. Lighting impact assessment methodology

## Introduction and study area

A Lighting Impact Assessment will be included as part of the ES 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 assess possible impacts on potential bat roosts or foraging routes, nearby residential properties and listed buildings.

## Guidance and Best Practice 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): 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 'Lighting Professionals (ILP): 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 any 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 site and further assessed by the proposed use of the Zone. Mitigation measures will also take into account the findings of the landscape / biodiversity assessment and any such mitigation which is proposed in the associated reporting.

# Appendix D. People and communities – WCH figure

Hockering Post Office and shop
St. Michael's Church and Cemetery
Hockering Village Hall
Hockering Church of England Academy
Victoria Inn PH
Hockering Nursery
Merrywood House Residential Care
Childrens Play Area
Honingham Village Hall
The Honingham Buck
St Paul's Chapel of Ease
St Andrew's Church - Honingham
St Peter's Church - Easton
Easton Post Office
Easton Village Hall
Allotment Gardens
Diocese of Norwich
St Peter's Church of England Primary Academy



0 500 1,000 Metres

Notes

Key to symbols

- Scoping boundary
- Local impact area
- Community facilities
- Community facilities area

**Public rights of way (PRoW)**

- Bridleway
- Byway open to all traffic
- Footpath
- Restricted byway



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Figure produced | AC | MD | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

Drawing Status: FOR INFORMATION

Suitability: S0

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure 12.1 - People and Communities

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:26,500 | Duckworth, Mark | Corcoran, Ant | Duckworth, Mark | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

Drawing Number: HE PIN HE551489 - Originator GTY - Volume EGN - Location 000 - Type RP - Role LE - Number 0004

Project Ref. No.: HE551489

Revision: P01

# Appendix E. Road drainage and water environment figures

Notes

Key to symbols

- Scoping Boundary
- Indicative 1km Buffer
- River
- Flood Zone 3
- Flood Zone 2
- Water Framework Directive - Surface Water Operational Catchments



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | First Edition | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

Drawing Status: FOR INFORMATION

Suitability: S0

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure 13.1 - Surface water features

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:33,500 | Bell, Fran | Corcoran, Ant | Bell, Fran | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

Drawing Number: HE PIN | Originator | Volume
HE551489 - GTY - EGN -
000 - RP - LE - 0005
Location | Type | Role | Number

Project Ref. No.: HE551489

Revision: P01



0 500 1,000 Metres

N

0 500 1,000 Metres

Notes

Key to symbols

- Scoping boundary
- Indicative 1km buffer

**Source protection zone**

- Zone I - Inner protection zone
- Zone II - Outer protection zone
- Zone III - Total catchment

**Aquifer - Superficial deposits designation**

- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unproductive



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Report produced | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure 13.2 - Groundwater Bodies

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:33,500 | Bell, Francesca | Corcoran, Ant | Bell, Francesca | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

Drawing Number: HE PIN | Originator | Volume | Location | Type | Role | Number
HE551489 - GTY - EGN - 000 - RP - LE - 0006

Project Ref. No.: HE551489

Revision: P01

Notes

Key to symbols

- Scoping boundary
- Indicative 1km buffer
- Risk of flooding from surface water - 1 in 30 years
- Risk of flooding from surface water - 1 in 100 years
- Risk of flooding from surface water - 1 in 1000 years



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | First Edition | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure 13.3 - Surface water flood risk

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:33,500 | Bell, Francesca | Corcoran, Ant | Bell, Francesca | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 11/07/2019 | 11/07/2019 |

| Drawing Number HE PIN | Originator | Volume | | Project Ref. No. |
|---|---|---|---|---|
| HE551489 | GTY | EGN | | HE551489 |
| **Location** | **Type** | **Role** | **Number** | **Revision** |
| 000 | RP | LE | 0007 | P01 |



0 500 1,000 Metres

Notes

Key to symbols

Scoping boundary

Indicative 1km buffer

**Flood Type**

Limited potential for groundwater flooding to occur

Potential for groundwater flooding of property situated below ground level

Potential for groundwater flooding to occur at surface



| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P01 | 30/07/2019 | Report produced | AC | FB | BJ |

Designer: SWECO

Contractor: GallifordTry

Client: highways england

| Drawing Status | Suitability |
|---|---|
| FOR INFORMATION | S0 |

Project Title: A47 - NORTH TUDDENHAM TO EASTON

Drawing Title: Figure 13.4 - Groundwater flooding

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:33,500 | Bell, Francesca | Corcoran, Ant | Bell, Francesca | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 30/07/2019 | 30/07/2019 | 30/07/2019 | 30/07/2019 |

Drawing Number: HE PIN HE551489 - Originator GTY - Volume EGN - Location 000 - Type RP - Role LE - Number 0008

Project Ref. No.: HE551489

Revision: P01



0 500 1,000 Metres