highways england

A47 North Tuddenham to Easton Dualling

Scheme Number: TR010038

Volume 6
6.1 Environmental Statement
Chapter 15 – Cumulative Effects Assessment

APFP Regulation 5(2)(a)

Planning Act 2008

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

December 2021

Infrastructure Planning

Planning Act 2008

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

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

ENVIRONMENTAL STATEMENT CHAPTER 15 CUMULATIVE EFFECTS ASSESSMENT

Regulation Number:	5(2)(a)
Planning Inspectorate Scheme Reference	TR010038
Application Document Reference	TR010038/APP/6.1
BIM Document Reference	HE551489-GTY-EGN-000-RP-LX-30006
Author:	A47 North Tuddenham to Easton Dualling Project Team, Highways England

Version	Date	Status of Version
Rev 0	March 2021	Application Issue
Rev 1	December 2021	Deadline 6 Update

Table of contents

15. Cumulative effects assessment

15.1. Introduction

15.1.1. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter presents the cumulative effects assessment (CEA) for the Proposed Scheme. EIAs must include cumulative effects in accordance with the requirements of the EIA Directive (2014/52/EU).

15.1.2. Cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the Proposed Scheme.

15.1.3. The assessment has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring (2020) (Revision 1) and the Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects Assessment' (2019).

15.1.4. In line with DMRB LA 104, this CEA includes effects from:

- a single project (the Proposed Scheme), which considers numerous different effects impacting a single receptor
- different projects, in combination with the Proposed Scheme.

15.1.5. The study areas for each of the environmental topics, defined in the preceding chapters of this ES, inform the Zone of Influence (ZOI) of the CEA for other developments or approved developments and this ranges from 400m to 4km depending on the topic and potential effects.

15.2. Competent expert evidence

15.2.1. The technical lead for this assessment is an environmental impact assessment specialist with 8 years' experience with numerous highways projects and a relevant MSc.

15.2.2. Recent experience includes technical lead for cumulative on the A63 Castle Street Improvement, Hull (2018), another development consent order application and EIA road project.

15.3. Assessment methodology

15.3.1. Since the publication of the EIA Scoping Report (September 2019) (**TR010038/APP/6.5**) and Scoping Opinion (**TR010038/APP/6.6**) of the Proposed Scheme (November 2019), the DMRB for cumulative effects has been updated.

DMRB LA 104 Environmental Assessment and Monitoring (2020) includes standards for cumulative effects.

15.3.2. The approach to the assessment remains the same other than a change in terminology, changing from 'combined' and 'cumulative' to 'single project' and 'different projects' respectively. The methodology for the assessment follows the DMRB LA 104 and Planning Inspectorate Advice Note Seventeen.

15.3.3. The assessment includes the following:

- review of the preceding chapters of this ES to identify potential multiple different effects impacting a single receptor
- establish the ZOI of the project together with other projects (using a combination of the traffic model uncertainty log, consultation and desk study)
- establish a list of projects which have the potential to result in cumulative impacts (following the stages 1 and 2 set out in Planning Inspectorate Advice Note Seventeen)
- obtain further information and detail on the list of identified projects to support further assessment

Study area

Single project

15.3.4. The study area for the assessment of single project effects, for both construction and operation, are defined by the study areas identified within the relevant environment topics set out in the preceding chapters of this ES.

Different projects

15.3.5. The study area for different projects is a ZOI based on the study areas defined for the topic assessments in Chapters 5 to 14.

15.3.6. Where a topic has identified a study area for potential significant effects e.g. 1km from the DCO boundary for landscape and visual effects, this distance is doubled for the ZOI (2km) as it assumes that sensitive receptors at the furthest extent of the Proposed Scheme study areas could be at the furthest extent of a theoretical study area for other development. For most topics the study area is 2km or less, which meant a ZOI of 4km was a suitable 'catch all' buffer to identify other developments.

15.3.7. This is summarised in Table 15-1 (Study area extents) and presented in Figure 15.1 (**TR010038/APP/6.2**). The table orders the environmental topics by size of ZOI for CEA.

Table 15-1: Study area extents

Discipline topic	Study area from preceding topic chapters	CEA ZOI
Biodiversity	Statutory designated for bats: 30km Designated sites: 2km Phase 1 habitat survey: 50m Great crested newts (GCN) *Triturus cristatus*: 500m Surveys for breeding birds and wintering birds: 500m Water vole: 250m Phase 1 habitat survey: 50m Bats – flight paths, foraging areas or roosts in trees and buildings: 50m Aquatic and terrestrial invertebrates: 50m Reptile: 50m Surveys for other ecological receptors, including badger *Meles meles* and reptiles: 50m Botanical survey: All areas within the DCO boundary Barn owl: Targeted areas within DCO boundary White-clawed crayfish: Targeted survey along River Tud	4km from the DCO boundary
Cultural heritage	Archaeological potential and history context: 1km from the DCO boundary. Zone of Visual Influence: approx. 1.8km	3.6km from the DCO boundary
Landscape and visual effects	1km from the DCO boundary	2km from the DCO boundary
Geology and soils	1km from DCO boundary	2km from the DCO boundary
Road drainage and the water environment	1km from the DCO boundary Assessment for road runoff and accidental spillages includes traffic associated with other developments and is therefore inherently cumulative. This aspect is not included in the different projects assessment to avoid double counting.	2km from the DCO boundary
Noise and vibration	The vibration study area is a maximum of 100m from the construction works although typically 30m has been assessed. The noise study area is a maximum of 300m from the closest construction activity. The operational study area for this assessment has been defined as the area within 600m of new road links or road links physically changed or bypassed by the project.	1.2km from the DCO boundary
Population and human health	500m from the DCO boundary	1km from the DCO boundary
Air quality	200m from construction activities for dust and vehicle emissions. As the construction and operational phase traffic data includes traffic associated with other developments, the air quality impact assessment reported within the air quality chapter is inherently cumulative. Not included in the different projects assessment to avoid double counting.	400m from construction activities
Material assets and waste	The estimated materials availability and waste capacity data used in the material assets and waste chapter are based on future regional demand. Not included in the different projects assessment to avoid double counting.	Not applicable

Discipline topic	Study area from preceding topic chapters	CEA ZOI
Climate	As the construction and operational phase traffic data includes traffic associated with other developments, the emissions assessment reported within the climate chapter is inherently cumulative. Not included in the CEA to avoid double counting. The study area for climate resilience is informed by other environmental topic assessments study areas. Therefore, no additional ZOI extents are required beyond that identified within the topics included in this table.	Not applicable

15.3.8. Further information on the study areas for the technical assessments are found within each of the technical Chapters 5 to 14 in the ES.

Single project

15.3.9. Single receptors or resources are identified where the combined action of a number of different environmental topic-specific activities have a residual effect. Professional judgement is used to assess temporal combination effects such as permanent construction impacts and operational phase impacts.

15.3.10. Effects that are moderate adverse or beneficial and above are considered significant. However, the CEA has considered residual effects (that is those that are predicted to remain after mitigation) that are identified as minor slight and above. These are considered further to determine whether multiple smaller effects in combination could result in a significant single project cumulative effect.

15.3.11. Receptors identified and considered in relation to the single project combined effects are:

- human receptors (residential and community facilities, all travellers)
- ecological receptors
- the water environment
- landscape and visual receptors
- geology and soils
- heritage assets

15.3.12. Where multiple receptors have been identified in the preceding chapters as being impacted by the Proposed Scheme and are in close proximity to one another, this assessment has grouped them together to assess potential cumulative effects in that area.

15.3.13. Potential interactions across receptors or receptor groups were identified by reviewing the impacts identified within each environmental topic assessed in the preceding chapters of this ES and using professional judgement and experience.

15.3.14. The cultural heritage, biodiversity, climate and population and human health ES chapters cumulatively assess impacts on certain receptors as part of their

assessment. The cumulatively assessed aspects within these chapters are detailed in Table 15-2. Therefore, to avoid duplication of information of assessment within the ES, these specific aspects are not considered further in this chapter.

Table 15-2: Topics not included within the cumulative assessment

Topic	Cumulative aspects assessed within ES chapter
Cultural heritage	The Cultural Heritage (Chapter 6) **(TR010038/APP/6.1)** assessment considers the potential interactions of effects relating to construction and operational noise and air quality, and construction dust on receptors. Therefore, heritage assets are not considered against noise and air quality in Table 15-6 and 15-7.
Biodiversity	Biodiversity (Chapter 8) **(TR010038/APP/6.1)** assessment considers the potential interactions of effects relating to construction and operational noise and air quality, and construction dust on receptors. Therefore, biodiversity is not considered against noise and air quality in Table 15-6 and 15-7. Biodiversity (Chapter 8) **(TR010038/APP/6.1)** includes consideration of effects on the water environment in relation to ecological receptors. Therefore, biodiversity is not considered against water environment in Table 15-6 and 15-7.
Population and human health	Population and Human Health (Chapter 12) **(TR010038/APP/6.1)**, considers identified health effects from other relevant environmental topics (air quality, landscape and visual, noise and access) to assess health outcomes. Therefore, human health is not considered against the topics stated in Table 15-6 and 15-7.
Climate	Climate (Chapter 14) **(TR010038/APP/6.1)** includes specific consideration of interrelated climate impacts informed by other environmental topics (Road drainage and water environment, material assets and waste). Therefore, climate is not considered against the topics stated in Table 15-6 and 15-7.

Different projects

15.3.15. The assessment methodology for cumulative effects involves identification of incremental changes likely to be caused by potential 'other developments' together with the Proposed Scheme.

15.3.16. The assessment of cumulative effects follows Planning Inspectorate Advice Note Seventeen: Cumulative Effects Assessment with the four stages of assessment:

- Stage 1: Establish the ZOI and identify a long list of 'other developments'. This is available in Appendix 15.1 (Long list) (**TR010038/APP/6.3**)
- Stage 2: Identify shortlist of 'other developments' for the cumulative effects assessment. This is available in Appendix 15.2 (Short list) (**TR010038/APP/6.3**).
- Stage 3: Information gathering

- Stage 4: Assessment

15.3.17. The ZOI is based on the study areas of the environmental topics detailed in the preceding chapters of this ES and summarised in Table 15-1 (Study area extents). Figure 15.1 (**TR010038/APP/6.2**) shows the developments from the short list and study area.

15.3.18. Following consultation with Norfolk County Council, Broadland District Council, Breckland Council and South Norfolk Council, additional projects were added to the scope. The additions included Sheringham and Dudgeon Extension Offshore Wind Farm and Norwich Western Link (NWL).

15.3.19. Other A47 road projects A47 between Peterborough and Great Yarmouth were initially considered following scoping opinion feedback. However, none are within the ZOI and therefore not progressed further in this assessment.

Environmental topics

15.3.20. Some environmental topics in the preceding chapters of this ES, have relied wholly, or in part, on the forecasts derived from the traffic model. As the traffic model includes future other developments, the assessments of the Proposed Scheme's effects within these topics have included cumulative impacts by default and therefore the effects are already reported within their assessments.

15.3.21. The topics and the intrinsically cumulative aspect of the operational assessment, noted in Table 15-1, are included in the following chapters:

- Chapter 5 (Air quality) (**TR010038/APP/6.1)**
- Chapter 11 (Noise and vibration) (**TR010038/APP/6.1)**
- Chapter 13 (Road drainage and the water environment) for road runoff and accidental spillages (**TR010038/APP/6.1)**

15.3.22. In line with the DMRB LA 104 good practice principles, these are not included in the scope of operational effects for the CEA to avoid duplication of information and/or assessment of effect.

15.3.23. The air quality chapter did not identify any significant effects on human or ecological receptors as a result of the Proposed Scheme, as detailed in ES Chapter 5 (Air quality) (**TR010038/APP/6.1**).

15.3.24. The noise and vibration chapter has identified significant effects (moderate adverse) at one human receptor during construction due to vibration (Acorn Barn, Lyng Road). During operation, significant adverse effects have been identified at a number of human receptors: receptors on Lyng Road, Church Lane/ Rotten Row, Mattishall Lane, Hall Farm, Hall Farm Cottages, St Andrew's Church, Newgate, Gypsy Lane, Hockering Nursery and 7 Public rights of way (PRoWs). Significant effects have not been identified at ecological receptors.

The assessment of effects at these receptors is detailed in ES Chapter 11 (Noise and vibration) (**TR010038/APP/6.1**).

15.3.25. The road drainage and the water environment (RDWE) chapter did not identify any significant effects on human receptors as a result of the Proposed Scheme, as detailed in Chapter 13 (Road drainage and the water environment) (**TR010038/APP/6.1**).

Other developments

15.3.26. A search for developments in the east of England was carried out using the Planning Inspectorate website. Developments within the ZOI were included in the long list of developments as shown in Table 1 of Appendix 15.1 (**TR010038/APP/6.3**).

15.3.27. As part of the transport forecasting, a list of potential developments, with varying degree of certainty that the development will occur, informs the future traffic scenarios. This list is referred to as an uncertainty log, as discussed in Section 4.3 of the Case for the Scheme (**TR010038/APP/7.1**). The forecast for developments is up to 2036. Only those developments that are considered as being 'Near Certain' and 'More Than Likely' are used in the traffic model (Table 15-3 (Certainty of developments)).

15.3.28. Developments from the Planning Inspectorate Nationally Significant Infrastructure Projects (NSIP) website and traffic uncertainty log were used to inform the cumulative effects in combination with consultation, publicly available information and professional judgement.

Table 15-3: Certainty of developments

Certainty of outcome	Development Status
Near Certain: The outcome will happen or there is a high probability of it occurring.	Intent announced by proponent to regulatory agencies. Approved development proposals. Projects under construction.
More Than Likely: The outcome is likely to happen but some uncertainty.	Development application within the consent process and in accordance with the development plan.
Reasonably Foreseeable: The outcome may happen but significant uncertainty.	Identified within a development plan and, although not directly associated with the project, may occur if the project is implemented.
Hypothetical: There is considerable uncertainty whether the outcome would ever happen.	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs in an initial consultation process.

Source: A47 North Tuddenham to Easton Chapter 4 Transport Assessment in the Case for the Scheme (**TR010038/APP/7.1**)

15.3.29. The developments are grouped into tiers, reflecting the likely degree of certainty attached to each development, with Tier 1 being the most certain as shown in Table 15-4 (Assigning certainty to 'other existing development and/or approved development'). Tier 3 developments are least certain, and most likely to have limited publicly available information to inform assessments.

15.3.30. Rather than reporting every interaction, the assessment of cumulative effects focuses on the main significant effects and aims to differentiate between permanent or temporary, positive or negative and other existing or more than likely / near certain major developments.

Table 15- 4: Assigning certainty to 'other existing development and/or approved development

Tier	Likely degree of certainty	
Tier 1	Under construction* Permitted Application(s), whether under the Planning Act 2008 or other regimes, but not yet implemented. Submitted application(s) whether under the Planning Act 2008 or other regimes but not yet determined.	Decreasing level of detail likely to be available 
Tier 2	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted.	
Tier 3	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted. Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given as the move closer to adoption) recognising that much information on any relevant proposals will be limited. Identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.	

Source: Planning Inspectorate: Advice note seventeen.

* where other projects are expected to be completed before construction of the proposed Nationally Significant Infrastructure Project and the effects of those projects are fully determined, effects arising from them should be considered as part of the baseline and may be considered as part of both the construction and operational assessment.

15.3.31. Where significant cumulative effects, beyond those identified as residual effects from the Proposed Scheme in isolation, have been identified, additional mitigation would be recommended.

Significance criteria

15.3.32. The assessment of significance of the cumulative effects has been determined in accordance with the significance criteria contained in DMRB LA 104. Typically, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the greater the effect. Consequently, a

highly valued resource suffering a major detrimental impact would result in a very large adverse effect.

15.3.33. For the purpose of the cumulative effects assessment, the value of a resource and magnitude of impact is determined according to the criteria set within the preceding chapters of the ES.

15.3.34. The significance of effect is then carried forward from preceding environmental chapters to enable an assessment of single project significance, as well as to identify the significance of different project effects with other developments. Typical descriptors of cumulative significance are included in Table 15-5 (Significance criteria) which reflects the approach. The overall significance is determined with mitigation included. Where an effect is moderate or above (adverse or beneficial), it is deemed to be significant.

Table 15- 5: Significance criteria

Significance category	Typical descriptors of effect
Very large (adverse or beneficial)	Where the balance of the effects of the Proposed Scheme or single project 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 very highly significant (positive or negative). Effects would be permanent and far reaching for receptors of very high value.
Large (adverse or beneficial)	Where the balance of the effects of the Proposed Scheme or single project 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 (positive or negative). Effects would be: • Permanent and far reaching for receptors of high value. • Localised for a receptor of very high value. • Temporary for receptor of very high value.
Moderate (adverse or beneficial)	Where the balance of the effects of the Proposed Scheme or single project 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 significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of medium value. • Localised for receptors of high value. • Temporary for a receptor of high value.
Slight (adverse or beneficial)	Where the balance of the effects of the Proposed Scheme or single project 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 noteworthy but not significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of low value. • Localised for receptors of medium value. • Temporary for a receptor of medium value.
Neutral	Where the positive or negative effects of the Proposed Scheme or the single project effects of the Proposed Scheme in association with other existing or more than likely / near certain future major developments would balance.

Source: Adapted from table 3.7, DMRB LA 104

15.3.35. Significance descriptors have also been aligned with the considerations included within Planning Inspectorate Advice Note Seventeen: Cumulative Effects Assessment. Consideration is given to the following:

- The duration of effect, for example, will it be temporary or permanent
- The extent of effect, for example, the geographical area of an effect
- The type of effect, for example, whether additive (loss of 2 pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (2 discharges combine to have an effect on a species not affected by discharges in isolation)
- The frequency of the effect
- The value and resilience of the receptor affected
- The likely success of mitigation

Consultation

15.3.36. The proposed assessment methodology for cumulative effects was described in the EIA Scoping Report (**TR010038/APP/6.5**) issued to the Planning Inspectorate in September 2019.

15.3.37. The scope of this assessment reflects comments received within the Scoping Opinion for the Proposed Scheme (November 2019) (**TR010038/APP/6.6**).

15.3.38. Consultation was undertaken with Norfolk County Council in 2018 and it was agreed that the uncertainty log developed for the traffic model was suitable for the environmental assessment.

15.3.39. Further consultation to confirm the approach was undertaken in 2020 and 2021 with Norfolk County Council, Broadland District Council, Breckland Council and South Norfolk Council.

15.3.40. This ES chapter reflects the study areas and assessment approach agreed with the consultees.

Limitations and assumptions

15.3.41. Limitations to the assessment and uncertainty are in relation to the diminishing certainty of future developments and for the developments where only limited information is publicly available. This limitation has been addressed as far as possible through professional judgement and adopting a worst case approach i.e. when the construction start and finish dates are not available for the other developments, it has been assumed that either part or all of the construction phase will fall within the same period as the Proposed Scheme construction activities, reflecting a worst case scenario approach.

15.3.42. For developments with 'more than likely' uncertainty or above are absent from the local planning authority and the Planning Inspectorate portal (i.e. Tier 3 defined in

Planning Inspectorate Advice Note Seventeen) it is assumed that the development(s) are not likely to have significant effects on the environment, therefore Neutral effects have been assigned for these projects.

15.4. Assessment of single project effects

15.4.1. The predicted environmental effects for both construction and operational phases of the Proposed Scheme are taken into consideration with the inclusion of any proposed mitigation from the preceding chapters of the ES. The topics outlined in Table 15-2 are not considered in the table below as already considered in the individual assessments.

15.4.2. A summary of the reported construction effects are described in Table 15-6.

Table 15- 6: Potential single project effects between topics on receptors during construction of the Proposed Scheme

Receptor	Air quality	Biodiversity	Cultural heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment (RDWE)	Significance of combined effects
Human receptors residents, including community and private assets, sensitive receptors and vulnerable groups	Not included in scope of air quality assessment	Not included in scope of biodiversity assessment	**Moderate adverse** The proposed carriageway will be slightly closer than the current A47, resulting in potential effects from road traffic noise and urbanising effects.	Visual construction impacts are expected at the following private properties: **Large adverse** Effects on representative viewpoint Low Road, West of Hockering. Clearance of vegetation beside the existing road would open up views of construction operations and a soil storage area in close proximity to residential receptors. Oak Farm properties and Ash Lodge properties Hill View properties and Caravan Park on Mattishall Lane Newgate House Ringland Road Sycamore Farm properties Properties beside Sandy Lane Church Lane is located directly south of the existing A47, where the clearance of vegetation would open up views of construction operations. **Moderate adverse** Berry Hall properties and Merrywood House	Not included in scope of geology and soils assessment.	**Moderate adverse** Journey length increase to/ from the A47 for private properties on Church Lane, Ringland Road, Dog Lane, Low Road, Rotten Row, Hillcrest, Oak Farm, Hall Farm and residents of Berry Lane. **Moderate adverse** Journey length increase to Merrywood House on Berrys Lane **Moderate adverse** Permanent land-take from an area of consecrated land owned by St Peters Church. **Moderate adverse** Journey length increase to Riverside Farm holiday apartment rental	**Moderate adverse** Effects are expected at Acorn Barn on Lyng Road, when mitigated by temporary noise barriers. **Major adverse/ moderate** Noise effects expected at Hill View **Significant beneficial** Effects on 36 receptors within Noise Important Area (NIA) 5200. **Significant beneficial** Three receptors in Hockering outside of NIA 5200 **Significant beneficial** 51 receptors on Ringland Road **Significant beneficial** • 1 Receptor on Park Lane, Hockering **Significant adverse** for the following receptors: • 33 receptors on Lyng Road • 2 receptors on Church Lane/ Rotten Row • 6 receptors on Mattishall Lane • 5 receptors in Honingham including Hall Farm Cottages • Church of St Andrew • Newgate, Gypsy Lane and Hockering Nursery	Not included in scope of road drainage and the water environment assessment.	**Moderate adverse** For the receptors St Peter's Church, St Andrew's Church, Oak Farm, Hall Farm, receptors at Hill View, receptors at Church Lane, receptors at Ringland Road, and for receptors on Low Road, the assessments within the preceding chapters have identified multiple potentially significant adverse effects for construction. Effects on receptors have been classified as **Moderate adverse** for this receptor group, due to the significance of the individual effects and the temporary nature of the effect. Mitigation and enhancement measures have been considered in Table 15-9 (CEA design, mitigation and enhancement measures).

Receptor	Air quality	Biodiversity	Cultural heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment (RDWE)	Significance of combined effects
				Property at western extent of Honingham Hall Farm Hall Fam cottages Properties opposite Church Plantation Caravan site, Mattishall Lane **Slight adverse** Construction phase visual effects on St Peters Church Construction phase visual effects on St Andrews Church			**Slight adverse** • Light and noise effects from traffic due to replacement of the existing roundabout with a new tie-in to the existing dualled section of the A47 at Easton. **Minor adverse** • Residential properties at Sandy Lane		
Human- all travellers (vehicle, walkers, cyclists and horse riders)	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment.	Not included in scope of cultural heritage assessment.	**Moderate adverse** Footpaths to the south of Hockering and the Proposed Scheme in proximity of the River Tud, views north of the footpaths would comprise intermittent views of proposed construction operations.	Not included in scope of geology and soils assessment.	**Moderate adverse** Severance of Hockering FP7 footpath. **Moderate adverse** Stopping up of Honingham RB1. **Moderate adverse** Closure of uncontrolled crossing at Ringland Lane/ Dog Lane in Easton.	**Significant beneficial effects:** • Noise effects on public right of ways Hockering FP11, FP3 and FP10 **Significant adverse** • Noise effects on public right of ways Hockering FP8, FP7, East Tuddenham FP9, Honingham RB1, Lyng RB1, RB12 and FP17	Not included in scope of road drainage and the water environment assessment.	**Moderate adverse** Effects on receptors have been classified as **Moderate adverse** for this receptor group, due to the significance of the individual effects and the temporary nature of the effect. Mitigation and enhancement measures have been considered in Table 15-8 (CEA design, mitigation and enhancement measures).
Ecological receptors (designated sites, protected species and existing habitats)	Not included in scope of air quality assessment.	**Moderate adverse** Permanent loss of hedgerows, ponds, deciduous woodland, good quality semi-improved grassland and coastal and floodplain grazing marsh (adjacent to Mattishall Lane and the River Tud)	Not included in scope of cultural heritage assessment.	Not included in scope of landscape assessment.	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise and vibration assessment.	**Slight adverse** Loss or deterioration of aquatic environment	**Neutral** Significant cumulative effects on ecological receptors during construction are not expected as a result of the Proposed Scheme.

Receptor	Air quality	Biodiversity	Cultural heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment (RDWE)	Significance of combined effects
The water environment	Not included in scope of air quality assessment.	No significant effects	Not included in scope of cultural heritage assessment.	No significant effects.	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise and vibration assessment.	**Negligible adverse to Moderate beneficial** Effects on the conveyance of flow of unnamed ordinary watercourses within the Tud WFD water body catchment	**Neutral** Significant cumulative effects on water environment receptors during construction are not expected as a result of the Proposed Scheme.
Landscape and visual	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment.	**Large adverse** The proposed Norwich Road junction to the east and new carriageway to the south and west of the churchyard introduce new urbanising elements into the setting of the Church.	**Large adverse** Effects on representative viewpoint Mattishall Lane, Hockering. **Moderate adverse** Effects on representative viewpoint: Path near Newgate House, south of Hockering. **Large adverse** Effects on representative viewpoint: Sandy Lane properties beside A47. **Moderate adverse** Effects on representative viewpoint: Taverham Road. **Moderate adverse** Effects on representative viewpoint: River Tud footpath **Large adverse** Effects on representative viewpoint Church Lane **Moderate adverse** Effect on representative	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise and vibration assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on landscape and visual receptors during construction are not expected as a result of the Proposed Scheme.

Receptor	Air quality	Biodiversity	Cultural heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment (RDWE)	Significance of combined effects
				viewpoint: Path to east of Wood Lane.					
Geology and soils	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment.	Not included in scope of geology and soils assessment.	Not included in scope of landscape assessment.	**Moderate adverse and large adverse** effects expected on Grade 2 agricultural soils. **Very large adverse** effects on Garde 3a soils	Not included in scope of population and human health assessment. Potential pollution pathways already cumulatively assessed under human health.	Not included in scope of noise assessment.	Not included in scope of RDWE assessment.	**Neutral** Significant cumulative effects on geology and soils during construction are not expected as a result of the Proposed Scheme.
Heritage assets	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment.	**Moderate adverse** St Peter's Church Grade I listed building. The footbridge would have a moderate effect on the assets setting. There is some loss of the original setting but it does not adversely affect the integrity of the setting. **Large adverse** St Andrew's Church Grade II* listed building. Permanent construction effects on the setting of the church and churchyard from construction of the new carriageway immediately adjacent. **Moderate beneficial** Milestone (MNF62796). The asset is vulnerable to accidental damage from construction works in its vicinity. **Moderate beneficial** Milestone (MNF62797). The asset is vulnerable to accidental damage from construction works in its vicinity.	**Slight adverse** Construction phase visual effects on St Peters Church Construction phase visual effects on St Andrews Church	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on heritage assets during construction are not expected as a result of the Proposed Scheme.
Overall single project effect for the Proposed Scheme on construction								**Moderate adverse**	

Table 15-7: Potential single project effects between topics on receptors during operation of the Proposed Scheme

Receptor	Air quality	Biodiversity	Cultural Heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment	Significance of combined effects
Human receptors (residents, including community and private assets, sensitive receptors and vulnerable groups	No significant effects. 25 of the 49 human receptors identified are expected to show a decrease in air quality, 24 show an improvement in air quality with the Proposed Scheme in place.	Not included in scope of biodiversity assessment	Not included in scope of cultural heritage assessment.	During year 15 of operation: **Moderate adverse** • Visual effects on residential properties located on Sandy Lane **Moderate adverse** • Visual effects on residential properties located on Church Lane **Slight adverse** • Operational phase visual effects on Ringland Road	Not included in scope of geology and soils assessment.	**Slight beneficial** • The proposed combined footway / cycleway along the realigned section of Mattishall Lane that would pass under the new A47 alignment would provide a safe crossing for walkers, cyclists and horse-riders and would maintain connectivity between communities. **Slight beneficial** • The proposed combined footway / cycleway along the new side road between Church Lane and the Wood Lane roundabout would improve connectivity and safety. • The proposed combined footway / cycleway to the north of the new A47 alignment between Taverham Road and Ringland Road would improve connectivity and safety.	Significant adverse • Properties at northern extents of Mattishall Lane **Minor adverse** • Properties at Sandy Lane **Major adverse/** • Noise effects at St Andrew's Church **Major to minor adverse** • Adverse noise due to the Proposed Scheme during the short-term and long-term for multiple properties on Ringland Road	Not included in scope of road drainage and the water environment assessment.	**Moderate adverse** For receptors at Mattishall Lane, Church Lane, Sandy Lane, Ringland Road and St Andrew's Church Honingham, the assessments within the preceding chapters have identified multiple potentially adverse effects. Effects on receptors have been classified as **Moderate adverse** for this receptor group, due to the significance of the individual effects and the temporary nature of the effect. Mitigation and enhancement measures have been considered in Table 15-9. (CEA design, mitigation and enhancement measures).
Human- all travellers (vehicle, walkers, cyclists and horse riders)	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment	Not included in scope of cultural heritage assessment.	No significant effects during year 15 of operation.	Not included in scope of geology and soils assessment.		No significant effects are expected.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on human receptors (all travellers) during operation are not expected as a result of the Proposed Scheme.
Ecological receptors (designated sites, protected species and existing habitats)	No significant effects identified. Bawburgh County Wildlife Site (CWS) (one of 12 ecological sites modelled) shows a predicted annual mean NOx concentration which is	**Moderate adverse** Permanent (habitat loss) and temporary (pollution and surface water run-off) **Large adverse** Bats- unknown whether mitigation at	Not included in scope of cultural heritage assessment.	**Moderate adverse** (significant) 256 of the existing 605 individual trees have potential to be impacted Notable areas of tree loss would be:	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise and vibration assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on ecological receptors during operation are not expected as a result of the Proposed Scheme.

Receptor	Air quality	Biodiversity	Cultural Heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment	Significance of combined effects
	greater than the annual mean NOx objective of 30 µg/m3 in the Baseline, Do-Minimum and Do-Something scenarios. There is a tree line (approximately 20m from the road) along the verge followed by marshy grassland. It is unlikely that species sensitive to nitrogen will be present in the 20m prior to the treeline due to the proximity to the A47.	underpasses, overpasses and the River Tud bridge to enable bats to fly safely across the new road will work until monitoring surveys complete. No published data available. As such, on a precautionary basis the impact has been concluded to be major adverse due to the potential for permanent damage to populations. **Large adverse** Bats- mortality through traffic collisions is predicted to be less likely once remediated roadside trees mature.		• existing A47 roadside tree cover at the western extent of the Proposed Scheme; • scattered trees to the east of Mattishall Lane; • woodland beside the existing A47 between Sandy Lane and Wood Lane; • linear belts of planting beside Wood Lane (at the proposed junction location); • linear belts of planting beside the existing A47, to the north of Honingham; • mature tree cover beside the River Tud as the Proposed Scheme crosses it, just to the east of Honingham (although this has been minimised to avoid losses directly beside the river); • linear belts of planting beside the existing A47 between Honingham and Easton (including and beside the proposed junction location) • tree cover on the northern boundary of St Peter's Church, Easton.					
The water environment	Not included in scope of air quality assessment.	No significant effects	Not included in scope of cultural heritage assessment.	No significant effects	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment. Potential pollution pathways already cumulatively assessed under human health.	Not included in scope of noise and vibration assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on the water environment during operation is not expected as a result of the Proposed Scheme.

Receptor	Air quality	Biodiversity	Cultural Heritage	Landscape and visual effects	Geology and soils	Population and human health	Noise and vibration	Road drainage and the water environment	Significance of combined effects
Landscape and visual	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment	Not included in scope of cultural heritage assessment.	Effects at Year 15 of operation: **Moderate adverse** Effects on representative viewpoint Sandy lane properties Effects on representative viewpoint Church Lane. **Moderate adverse** • Effects on representative viewpoints: Newgate House • Sycamore Farm properties • Properties beside Sandy Lane	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	Not included in scope of noise and vibration assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on landscape and visual receptors during construction are not expected as a result of the Proposed Scheme.
Geology and soils	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment	Not included in scope of cultural heritage assessment.	Not included in scope of landscape and visual assessment.	No significant effects are anticipated.	Not included in scope of population and human health assessment. Potential pollution pathways already cumulatively assessed under human health.	Not included in scope of noise and vibration assessment.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on geology and soils receptors during construction are not expected as a result of the Proposed Scheme.
Heritage assets	Not included in scope of air quality assessment.	Not included in scope of biodiversity assessment	**Large adverse** St Andrew's Church Grade II* listed building. Impacts from traffic noise and light on the setting of the church and churchyard.	**Slight adverse** • Operational phase visual effects on St Andrew Church	Not included in scope of geology and soils assessment.	Not included in scope of population and human health assessment.	No significant effects are anticipated.	Not included in scope of road drainage and the water environment assessment.	**Neutral** Significant cumulative effects on heritage assets during operation are not expected as a result of the Proposed Scheme.
Overall single project effect for operation								**Moderate adverse**	

Summary of single project effects

15.4.3. Mitigation measures to reduce the significant combined effects identified in Table 15-6 and Table 15-7 are outlined in Table 15-8.

Construction

15.4.4. During construction, additive cumulative effects are expected on some human receptors. **Moderate adverse** cumulative effects are expected at St Peter's Church, St Andrew's Church, Oak Farm, Hall Farm, receptors at Hill View, receptors at Church Lane, receptors at Ringland Road, receptors on Low Road. Effects are due to temporary visual intrusion, construction noise and increased journey lengths as a result of construction of the Proposed Scheme.

Operation

15.4.5. During operation, cumulative effects are expected on some human receptors. **Moderate adverse** cumulative effects are expected at Mattishall Lane, Church Lane, Sandy Lane, Ringland Road and St Andrew's Church due to visual disturbance, light and noise from traffic on the Proposed A47. There are also some beneficial effects due to the proposed walking and cycling routes.

15.4.6. The below table (15-8) identifies the residual effect of each receptor identified in tables 15-6 and 15-7 which are anticipated to experience cumulative effects as a result of construction and operation of the Proposed Scheme.

Table 15-8: Residual effects and design, mitigation and enhancement measures

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
Human receptors (residents, including community and private assets, sensitive receptors and vulnerable groups	St Peter's Church, Easton	Visual effects during construction.	Construction operations would be temporary and the residual effect on landscape character due to tree removal is factored into the assessment of operational phase effects.
		Urbanising effects during construction on a cultural heritage asset as a result of the carriageway moving slightly closer.	A precautionary approach has already been prescribed as part of the heritage mitigation and will be undertaken during construction activities to monitor the building for vibration during construction. The proposed green noise barrier and landscape planting on the north boundary of the churchyard will soften effects from road traffic noise. The landscape screening planting on the east and west sides of the churchyard will soften the urbanising effect of the new footbridge structures.
		Visual effects during operation.	A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**). By year 15 of operation, new planting as part of the environmental masterplan would have reduced

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
			the visual effect at this receptor to not significant.
		Light and noise effects from traffic during operation.	Installation of a temporary noise barrier and sympathetic landscape planting design along the north boundary of the churchyard will soften the effects of light and noise from traffic.
	Low Road, west of Hockering	Visual effects during construction due to vegetation clearance.	Construction operations would be temporary and the residual effect on landscape character due to tree removal is factored into the assessment of operational phase effects. A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**). At Year 15, effects would be reduced to neutral.
		Increased journey length for residents of private properties and businesses.	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised for those travelling between communities and those travelling to facilities and businesses. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
	Hill View	Visual effects due to construction operations including nearby soil storage area and compound.	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**).
		Noise effects during construction and operation	Proposed mitigation includes the use of low-noise surface and an acoustic barrier however, not all significant adverse noise effects will be avoided. Best practice noise and vibration mitigation techniques shall be employed as outlined in the EMP (**TR010038/APP/7.4**).
	Properties at northern extent of Mattishall Lane	Visual effects due to proximity to construction area including material storage and compound.	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**).

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
		Increased journey length for residents during construction.	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
		Significant adverse noise effects during construction and operation.	Two noise barriers at the south and north of Mattishall Lane are required to reduce noise levels and low-noise surface is included in design. Significant adverse effects are predicted at these locations despite the inclusion of noise barriers between the receptor(s) and the Proposed Scheme. In addition to the above mitigation measures, best practice noise and vibration mitigation techniques shall be employed as outlined in the EMP (**TR010038/APP/7.4**).
		Beneficial effects for users of new combined footway / cycleway along the new Mattishall Lane Link Road	The effect is beneficial therefore no further design, mitigation or enhancement measures are considered practical above the measures outlined in the preceding chapters.
	Sandy Lane	Visual effects during construction and operation	Construction activities and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**). A residual significant effect would remain due to the remaining visibility of the Proposed Scheme and the fundamental change to the view that would occur at close proximity, including introduction of new planting.
		Noise effects during construction and operation.	Mitigation has not been proposed at off-line locations as these are under the control of the local highways authority and acoustic barriers are impractical because they would obstruct access to driveways.

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
	St Andrew's Church, Honingham	Visual effects during construction and operation.	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**).
		Increase in journey length to access the church and private properties during construction.	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
		Urbanising elements of the churchyard and effects on a cultural heritage asset.	As the church is very close to construction works, it would be prudent to take a precautionary approach and monitor the building for vibration during construction. Noise reducing tarmac will be laid along this section of the new carriageway to reduce noise impacts. The landscape screening planting on the south west of the churchyard will soften the urbanising effect of the Proposed Scheme. This impact will be softened by sympathetic landscape planting design along the carriageway. An underpass will maintain pedestrian links to the village of Honingham.
		Noise and vibration	A noise barrier is not proposed at this location. Mitigation in the form of a low-noise surface along the length of the Proposed Scheme has been included, however, this is not sufficient to avoid significant adverse noise effects at this location.
	Church Lane, east Tuddenham to the south of the A47	Visual effects during construction and operation	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
			and is presented in the Environmental Masterplan (**TR010038/APP/6.8**). The proposed mitigation would reduce the effect from year one however a residual significant effect would remain due to the remaining visibility of the Proposed Scheme and the fundamental change to the view that would occur at close proximity including the introduction of new planting.
		Increased journey length for residents of private property on Church Lane during construction.	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
		Noise effects	Proposed mitigation includes the use of low-noise surface and an acoustic barrier. Best practice noise and vibration mitigation techniques shall be employed as outlined in the EMP (**TR010038/APP/7.4**).
		Beneficial effects of new combined footway / cycleway along the new side road between Church Lane and the Wood Lane roundabout.	The effect is beneficial therefore no further design, mitigation or enhancement measures are considered practical above the measures outlined in the preceding chapters.
	Ringland Road, between Lower Easton and Easton	Visual effects of the Proposed Scheme during construction and operation.	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8**). At Year 15, effects would be reduced to neutral due to the screening provided by tree planting beside the Proposed Scheme, proposed as part of the environmental masterplan.
		Increase in journey length for private properties along	Traffic management measures will be put in place as part of the outline Traffic

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
		Ringland Road during construction.	Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The Principal Contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
		Beneficial noise effects for five dwellings along Ringland Road.	Effects will be beneficial therefore no further design, mitigation or enhancement measures are considered practical above the measures outlined in the preceding chapters.
		Beneficial effects of new combined footway / cycleway to the north of the new A47 alignment between Taverham Road and Ringland Road.	Effects will be beneficial therefore no further design, mitigation or enhancement measures are considered practical above the measures outlined in the preceding chapters.
	Oak Farm	Visual effects during construction and operation at residential receptors	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (**TR010038/APP/6.8).** By year 15 of operation new planting proposed as part of the environmental masterplan would have reduced the visual effect at most residential receptors to not significant.
		Increase in journey length for residents of Oak Farm as a result of the permanent stopping up of Low Road	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage

Overarching receptors	Receptors	Residual effect	Design, mitigation and enhancement measures
			for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
	Hall Farm	Increase in journey length for residents of Hall Farm	Traffic management measures will be put in place as part of the outline Traffic Management Plan (**TR010038/APP/7.5**) to ensure disruption is minimised on those travelling to facilities, businesses and between communities. Communication with local residents will take place during construction to highlight potential periods of disruption. Where a closure of a WCH route is required, safe and appropriate alternative routes would be provided to ensure access is maintained during construction. The principal contractor would agree all temporary diversion routes with the local authority. Appropriate signage for all closures or diversions would be used to provide sufficient notice of such closures or diversions.
		Visual effects during construction	Construction operations and associated effects would be temporary. Mitigation for visual effects from compounds and storage areas during consutruction is outlined in the EMP (**TR010038/APP/7.4**). A planting design to mitigate visual impacts was identified in the preceding topic chapters and is presented in the Environmental Masterplan (TR010038/APP/6.8).
		Noise impacts during construction and operation	A noise barrier is considered not suitable at this location due to the effectiveness and cost. That is, due to the length of barrier required to reduce road traffic noise levels, the relatively small number of receptors predicted to have a perceptible benefit in terms of noise reduction, the inability of a 3 metre high barrier to prevent significant adverse effects. Best practice noise and vibration mitigation techniques shall be employed as outlined in the EMP (**TR010038/APP/7.4**).

Construction

15.4.7. During construction, cumulative effects identified on St Peter's Church are not expected result in a significant adverse residual effect.

15.4.8. A **moderate adverse**, temporary construction visual effect is expected at receptors on Low Road, Hill View, the northern extent of Mattishall Lane, Sandy Lane, St Andrew's Church, Church Lane (east Tuddenham), Ringland Road, Oak Farm and Hall Farm. However, these effects will be short lived and temporary. A slight adverse effect as a result of longer journey times may result on receptors

located on Low Road, the northern extent of Mattishall Lane, St Andrew's Church, Church Lane and Hall Farm. Liaison with owners and occupiers of properties to provide updates on programme of works would help those impacted to understand the likely implications and plan accordingly. Best standard practice construction approaches in combination with additional liaison would likely help to mitigate the cumulative impact of the effects.

15.4.9. Noise and visual impacts are inherently part of the heritage assessment in this instance. To avoid duplication of assessment, in line with DMRB LA 104, this is not considered further in the CEA.

15.4.10. The significant adverse noise effect and remaining significant visual effect on receptors at Church Lane following mitigation would likely result in a **Moderate adverse** significant cumulative effect. Mitigation measures such as temporary noise barriers will be considered in this location to reduce the adverse effects.

15.4.11. The other potential adverse effects identified are not considered to result in a significant cumulative effect. No further mitigation is proposed as part of the CEA.

Operation

15.4.12. During operation, the noise and visual impacts are inherently part of the heritage assessment in this instance. To avoid duplication of assessment, in line with DMRB LA 104, this is not considered further in the CEA.

15.4.13. During operation, proposed mitigation will reduce visual effects at Ringland Road to neutral by year 15. Prior to year 15 there would be **Moderate adverse** significant residual effects. There are anticipated slight beneficial effects for noise and as a result of the proposed combined footway / cycleway. Therefore, these effects are unlikely to give rise to a significant cumulative effect during operation. No further mitigation is proposed as part of the CEA.

15.4.14. Operational **moderate adverse** residual effects have been identified for receptors Mattishall Lane, Church Lane, Sandy Lane, Ringland Road and St Andrew's Church Honingham, due to the cumulative visual and noise effects on human receptors.

15.4.15. Following the measures presented in Table 15-8 (residual effects design, mitigation and enhancement measures), there is potential significant cumulative effects as a result of the Proposed Scheme.

15.4.16. No additional mitigation for cumulative is proposed in addition to the design and mitigation prescribed.

15.5. Assessment of different project effects

15.5.1. Only those developments that have been included in the shortlist have been brought through to the assessment of different project effects.

15.5.2. Consultation was undertaken with Norfolk County Council, Broadland District Council, Breckland Council and South Norfolk Council to identify any additional projects to be considered in the CEA.

15.5.3. The developments listed below have been included in the assessment of different project effects as the Broadland District Council, Breckland Council and South Norfolk Council Planning Portal shows them to have had an environmental statement produced, therefore they have been classified as Tier 1 developments.

15.5.4. The remainder of the shortlist developments are Tier 3 as explained in Table 15-3. A search was undertaken for scoping reports for the shortlisted developments and none were identified. Therefore, a 'very high level' assessment is appropriate as per the Stage 4 of the methodology outlined by Planning Inspectorate Advice Note Seventeen.

15.5.5. For the other developments, all are absent from the local planning authority and National Infrastructure Planning website. It is therefore reasonable to assume that these developments are unlikely to have significant effects on the environment.

Wind Farm Projects

15.5.6. Four offshore wind farm projects are found within the zone of influence for the CEA, the project descriptions are shown in Table 15-9.

Table 15-9: Project Descriptions of wind farm projects within the CEA ZOI

Project information	Ørsted Hornsea Project Three	Vattenfall Norfolk Vanguard	Vattenfall Norfolk Boreas	Sheringham and Dudgeon Extension**
Stage in the planning process	Consent granted January 2021	Consent granted July 2020	Consent granted July 2019	Pre-application scoping opinion received November 2019
Construction date	Commencing 2023 with onshore cables to be laid in year 2 to year 4	2022 to 2025 with peak construction period expected in 2022	Main construction year 2023 (scenario 1 – vanguard complete) and 2026 (scenario 2 – vanguard not completed)	Unknown
Construction period in one area	3 months	Unkown*	Unknown*	Unknown*
Onshore cable within ZOI	Yes – intersects with the Proposed Scheme to the west of Easton	Yes – approximately 3km north west of the western scheme extent	Yes – approximately 3km north west of the western scheme extent	Yes – intersects with the proposed A47 scheme to the west of Easton and to the west of the Ørsted Horsea Project Three project

Project information	Ørsted Hornsea Project Three	Vattenfall Norfolk Vanguard	Vattenfall Norfolk Boreas	Sheringham and Dudgeon Extension**
Offshore cable within ZOI	No	No	No	No
Non-infrastructure asset (coverter / substation) within ZOI	No	No	No	No

* For the purposes of this assessment construction period is assumed to be the same as Hornsea Three

** For the purpose of the assessment it is recognised that consent has not been granted for this project with the expectation being the Proposed Scheme is consented first.

15.5.7. The reported residual effects of the wind farm projects were considered in combination with the Proposed Scheme and other developments. Relevant topics with overlapping receptors included:

- Cultural Heritage
- Landscape and visual effects
- Agriculture
- Traffic and transport

15.5.8. Traffic and transport also creates air quality, noise and vibration, water pollution and climate emissions risks. The wind farm projects would not lead to a significant effect to these topics as construction controls won't impact the assessed thresholds.

15.5.9. These are considered in turn below.

Construction

Cultural Heritage

15.5.10. Potential residual effects identified from the wind farm developments include direct effects on buried archaeology and indirect effects on setting of heritage assets.

15.5.11. Vattenfall Norfolk Vanguard and Vattenfall Norfolk Boreas are located approximately 3km north of the Proposed Scheme. There are no potential direct or indirect impacts identified between these developments and the Proposed Scheme and therefore not considered to have the potential to result in significant cumulative effects.

15.5.12. Ørsted Hornsea Project Three and Sheringham and Dudgeon intersect the proposed A47 route and are within the DCO boundary. The ES for Ørsted Hornsea Project Three concludes that the residual effects on buried archaeological remains are negligible and worst case effects on heritage assets are minor adverse.

15.5.13. Due to the similar scale, type and timings of Sheringham and Dudgeon and that no other detailed information is available, it is assumed that the conclusions of Ørsted Hornsea Project Three applies.

15.5.14. In addition, the scale of the cable works are not considered significant in relation to the anticipated construction works for the Proposed Scheme.

Landscape and Visual

15.5.15. For Vattenfall Norfolk Boreas and Vattenfall Norfolk Vanguard, the schemes are beyond the 2km ZOI identified for landscape and visual effects.

15.5.16. For Ørsted Hornsea Project Three, the published environmental assessment[1] considers the sensitivity of visual receptors within settlements is considered to be high and the magnitude of the impact is deemed to range from moderate to no change. The effects on settlements would range from moderate adverse significance, at the most affected settlements, to negligible significance, which is not significant.

15.5.17. Easton is the closest settlement to the cable corridors for Ørsted Hornsea Project Three and Sheringham and Dudgeon within the A47 Proposed Scheme study area. This settlement is screened by vegetation and has very limited or non-existent views of the works area. The Ørsted Hornsea Project Three LVIA concludes that for these conditions the impacts would be negligible for these receptors.

15.5.18. It is not considered that there would be cumulative significant effects.

Agriculture

15.5.19. The construction of onshore cable corridors has the potential to result in the permanent loss of the “best and most versatile” land and to impact Agricultural Land Classification by reducing the soil quality. For Ørsted Hornsea Project Three, during construction, a Soil Management Strategy is to be implemented and temporarily affected land would be restored to its former agricultural use, as far as possible, following the completion of the construction phase.

15.5.20. Similarly, for Vattenfall Norfolk Vanguard and Vattenfall Norfolk Boreas, with mitigation measures in place, the project is predicted to have no greater than minor impacts in relation to land use and agriculture. It has been concluded in the ES’s for these developments that there will be no operational effects in relation to agricultural land.

[1] Available online at: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/hornsea-project-three-offshore-wind-farm/?ipcsection=docs&stage=app&filter1=Environmental+Statement

15.5.21. Due to the similar scale, type and timings of Sheringham and Dudgeon to these developments and that no other detailed information is available, it is assumed that the same conclusions apply.

15.5.22. It is not considered that there would be cumulative significant effects.

Traffic and Transport

15.5.23. Onshore construction of Ørsted Hornsea Project Three is anticipated to commence in 2023 with cables to be installed between year 2 and year 4. Two construction compounds and material storage areas are proposed near to the A47 and will potentially increase construction traffic in this area on the same routes that construction traffic will use for the A47 North Tuddenham to Easton Dualling.

15.5.24. The proposed compounds are both located to the west of Easton roundabout, one is located to the north of the existing A47 with access from Church Lane and one is located to the south. The proposed haul routes for the Ørsted Hornsea Project Three will be impacted by the removal of Easton roundabout and closure of direct vehicle access to Church Lane, north of the A47.

15.5.25. The Proposed Scheme and Ørsted's Hornsea Project Three will have construction compounds in a similar location, for the northern compound of Ørsted's Hornsea Project Three. The Proposed Scheme has accommodated the construction requirements for Ørsted's Hornsea Project Three. As the Proposed Scheme has considered the works required for the Ørsted's Hornsea Project Three in this location, it is expected that the same construction mitigation measures outlined in the Hornsea Project Three DCO will be adopted if the Proposed Scheme is to carry out the works.

15.5.26. Construction for Vattenfall Norfolk Vanguard is expected to take place from 2022 to 2025 with peak construction year for traffic in 2022. Peak traffic flows for Vattenfall Norfolk Boreas are expected to occur in 2023 for scenario 1 in which Vattenfall Norfolk Vanguard is completed and in 2026 for scenario 2 where only Vattenfall Norfolk Boreas is constructed.

15.5.27. Due to the temporary nature of the construction impacts and implementation of traffic management for both the Proposed Scheme and different projects, the potential cumulative effects identified on traffic and transport are not considered to be significant.

Operational

15.5.28. No above ground structures such as converter stations or booster stations associated with the other windfarm developments are proposed to be located within the ZOI of the Proposed Scheme. Therefore, operational effects associated with the underground windfarm cables are limited to minor or

negligible. It is not anticipated that there would be cumulative operational effects as a result of the proposed windfarm developments and the Proposed Scheme.

Norwich Western Link Road

15.5.29. The Norwich Western Link (NWL) road development would be a new 6.1km dual carriageway road proposed to connect the western end of Broadland Northway (formerly the Northern Distributor Road (NDR)) to the A47 trunk road west of Norwich. The Proposed Scheme includes a tie in option at the proposed Wood Lane junction for the future NWL. The interaction of the Proposed Scheme with the NWL is outlined in Section 9 of the Scheme Design Report (**TR010038/APP/7.3**).

15.5.30. Whilst no planning application has been submitted as yet for the proposed NWL road scheme, there was public consultation in May 2020 on the proposals. Construction is indicatively planned to commence in 2023 until late 2025.

15.5.31. An assessment of inter-project cumulative effects has been undertaken for noise and vibration and air quality, considering the impact from both the Proposed Scheme and the proposed NWL. The conclusions of these assessments are outlined in the sections below.

15.5.32. An assessment of inter-project cumulative effects has not been undertaken for other environmental topics as no scoping report has been submitted for the proposed NWL development. This is considered a Tier 3 development under Advice Note Seventeen guidance and it is assumed that the NWL will assess the Proposed Scheme in their coming EIA.

Construction

Noise

15.5.33. The assessment of cumulative effects includes the embedded mitigation measures for the Proposed Scheme but does not include any mitigation for the NWL. Noise and vibration due to the NWL will need to be considered, and mitigated where necessary, as part of the EIA for that scheme.

15.5.34. No significant cumulative effects are anticipated during construction provided that the mitigation measures stated in the EMP (**TR010038/APP/7.4**) are implemented for the Proposed Scheme, and provided that construction noise and vibration due to the NWL is considered as part of the NWL EIA.

Air Quality

15.5.35. During construction, it was concluded the impact of construction dust would be highly unlikely to trigger a significant air quality effect. As construction activities are programmed to last less than two years it is unlikely there would be a significant effect on air quality or affect the UK's ability to comply with the Air Quality Directive.

Operational

Noise

15.5.36. Anticipated cumulative operational residual effects as a result of the Proposed Scheme and NWL on significantly affected receptors can be found in Chapter 11 (Noise and Vibration) (**TR010038/APP/6.1**).

15.5.37. An assessment of different project cumulative noise and vibration effects has also been undertaken, considering the impact from both the Proposed Scheme and the proposed NWL.

15.5.38. Both significant beneficial and adverse cumulative operational noise effects are anticipated due to the alignment of the Proposed Scheme and the NWL, along with the expected change in road users' behaviour brought about by both schemes.

15.5.39. The conclusions of the different project assessment are as follows:

- No significant effects are expected due to the cumulative level of construction noise and vibration provided that the mitigation identified in Chapter 11 (Noise and Vibration) (**TR010038/APP/6.1**) is implemented, and provided that construction effects are considered as part of the NWL EIA.
- No significant cumulative operational effects are predicted at the NIAs.
- The majority of the significant cumulative operational effects in the core study area for the cumulative assessment are also present in the core assessment.

15.5.40. The additional significant cumulative operational effects with the core study area are:

- Five fewer significant beneficial noise effects.
- Six additional significant beneficial noise effects; and
- Thirteen additional significant adverse noise effects

15.5.41. The additional significant cumulative operational effects within the extended study area.

- Significant beneficial noise effects at four dwellings along Dereham Road/Mill Street (B1147) due to traffic re-routing.
- Significant adverse noise effects at six dwellings at Swanton Morley along Greengate (B1147) due to traffic re-routing.
- Significant adverse noise effects at the SSSI River Wensum, PROW Ringland FP1, PROW Attlebridge FP5 and PROW Attlebridge RB4 due to direct impact from the proposed NWL.

Air Quality

15.5.42. A detailed air quality assessment has been undertaken to assess the air quality effects during the operational phase of the Proposed Scheme. As part of the cumulative air quality assessment, the proposed NWL was included in the do minimum and do something scenarios.

15.5.43. The air quality assessment predicted concentrations at all human health receptors to be well below the Air Quality Objective (AQO) of 40 µg/m3. Overall, 33 of the 56 receptors are expected to show a slight deterioration in air quality, with 23 showing an improvement in air quality with the Proposed Scheme in place. Although 33 receptors are showing a slight deterioration, the predicted air quality concentrations are well below the AQO with the majority of receptors indicating a small or imperceptible change.

15.5.44. The greatest increase in annual mean NO_2 concentration is expected to occur at receptor 34, located on Main Road in North Tuddenham, with an increase in an annual mean NO_2 concentration from 12.7 µg/m^3 to 13.9 µg/m^3, resulting in an increase of 1.2 µg/m^3. This receptor is located on a road which triggers higher level of traffic flow changes (an increase of over 1000 vehicles per day) due to the Proposed Scheme in place. However, the predicted annual mean concentration is well below the AQO of 40 µg/m^3 in both the DM and DS scenarios.

15.5.45. Baseline results have shown annual mean PM_{10} concentrations to be well below the AQO. As a result, PM_{10} was not included in the opening year modelling scenarios.

15.5.46. There were no exceedances of the one-hour mean NO2 AQO.

15.5.47. The air quality assessment that included the proposed NWL concluded there would be no significant effects on air quality at human and ecological receptors as a result of the Proposed Scheme.

Easton Village Growth: Land North and South of Dereham Road

15.5.48. An outline planning application was approved by South Norfolk Council in 2015 for the erection of 890 dwellings. The plans include an extended primary school, a new village hall, a retail store, areas of public open space, the relocation and increased capacity of allotments and associated infrastructure including public open space and highways work. The proposed construction start date is 2016. A Reserved Matters application was submitted in June 2020 and is currently pending decision.

15.5.49. The reported residual effects for the Easton Village Growth development were considered in combination with the Proposed Scheme. Relevant topics with overlapping receptors are considered below.

Construction

15.5.50. The construction phase has the potential to impact on non-designated below ground archaeological assets. A programme of mitigation will be implemented prior to construction that would reduce residual effects to neutral.

Operational

15.5.51. The traffic and transport assessment indicated that the proposed development may have moderate and major adverse impacts in terms of severance at two links along Dereham Road and one link on Bawburgh Road. The proposed development has been incorporated into the traffic modelling for the Proposed Scheme and the assessments in the preceding chapters have not identified any adverse effects at receptors on Dereham Road or Bawburgh Road.

15.5.52. It is not considered that there would be cumulative significant effects.

Food Enterprise Park

15.5.53. The Food Enterprise Park is a commercial development located to the west of Norwich at Honingham and immediately adjoining the existing A47. Broadland District Council adopted the Local Development Order (LDO) in 2017 to help facilitate the Food Enterprise Park. An LDO grants planning permission, subject to certain conditions, for specific developments described within the order. Therefore, it is not necessary for investors or occupiers to submit planning applications for their proposals.

15.5.54. This development was screened out of the EIA process in agreement with Broadland District Council and is therefore considered not to have significant environmental effects. With no scoping report submitted this is considered a Tier 3 development under advice note seventeen guidance. This development is therefore not shortlisted for the cumulative assessment of the Proposed Scheme.

Other Shortlisted Developments

15.5.55. The remainder of the shortlist developments are Tier 3. Tier 3 developments are defined as least certain to be developed, and most likely to have limited publicly available information to inform assessments. A search was undertaken for scoping reports for the shortlisted developments and none were identified. Therefore, a 'very high level' assessment is appropriate as per the Stage 4 of the methodology outlined by Planning Inspectorate Advice Note Seventeen. All are absent from the local planning authority and National Infrastructure Planning website. It is therefore reasonable to assume that these developments are unlikely to have significant effects on the environment.

15.6. Monitoring

12.1.1 Once built and operational, significant effects reported in Section 15.5 would be permanent and unchanging, therefore no monitoring would be required in addition to monitoring proposed in the individual ES chapters. Monitoring will take place for receptors in which significant effects have been identified due to changes in noise and vibration, during construction and operation of the

Proposed Scheme. For further detail please Chapter 11 (Noise and vibration) (**TR010038/APP/6.1**).

12.1.2 Monitoring requirements for landscape visual effects will be determined as an outcome of the DCO process. The maintenance of mitigation such as planting and seeding will continue for a period of five years before being managed as part of on-going highway maintenance.

15.7. Summary

15.7.1. The assessment for single project effects involved the identification of impact interactions associated with the Proposed Scheme upon separate receptors / resources. The methodology for the assessment of single and different project effects followed DMRB LA 104.

15.7.2. In summary, as a result of the residual effects of the Proposed Scheme, as a single project there is potential for significant cumulative effects for some receptors. During construction, significant (moderate) adverse effects are proposed at Low Road, Hill View, the northern extent of Mattishall Lane, Sandy Lane, St Andrew's Church, Church Lane, Ringland Road, Oak Farm and Hall Farm due to visual effects experienced by the receptors. However, these effects will be short lived and temporary.

15.7.3. Operational **moderate adverse** residual single project effects have been identified for receptors Mattishall Lane, Church Lane, Sandy Lane, Ringland Road and St Andrew's Church Honingham, due to the cumulative visual and noise effects on human receptors.

15.7.4. Best standard practice construction approaches in combination with community liaison would likely help to mitigate the cumulative impact of the effects. A planting design to mitigate visual impacts by screening the property views is presented in the Environmental Masterplan (**TR010038/APP/6.8**).

15.7.5. The assessment for cumulative effects has involved the identification of incremental changes likely to be caused by a shortlist of other developments and the Proposed Scheme itself. This assessment has followed the methodology Advice Note Seventeen.

15.7.6. The different project assessment of noise and vibration with the NWL project has identified additional (beneficial and adverse) significant effects.

15.7.7. The residual different project effects during the construction and operational phases of the Proposed Scheme with of all of the other developments are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters.

15.8. References

Highways England (2020) Design Manual for Roads and Bridges DMRB LA 104 - Environmental assessment and monitoring (Revision 1). Available online at: [redacted]

The Planning Inspectorate (2019) Advice Note Seventeen: Cumulative Effects Assessment Version 2. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf

Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available online at: [redacted]

Department for Transport (2014) National Policy Statement for National Networks: Presented to Parliament pursuant to Section 9 (8). Available online at [redacted]

Environmental Impact Assessment (EIA) Directive (85/337/EEC) (2011) as amended by the Council Directives 97/11/EC and 2003/31/EC and codified by 2011/92/EU. Available online at: [redacted]

15.9. Post-Submission Amendment

15.9.1. In the Applicant's Response to the Relevant Representations (REP1-013), under response RR-037.29, the Applicant acknowledges NCC's comment that ES Chapter 15 Cumulative Effects (**TR010038/APP/6.1**) needed the assessment of cumulative effects with the NWL updating to the information presented in the Scoping Report available on the NCC Planning Portal (reference SCO/2020/0001).

15.9.2. In relevant representation response RR-037.29, The Applicant acknowledges NCC's comment that ES Chapter 15 Cumulative Effects (**TR010038/APP/6.1**) needed the assessment of cumulative effects with the NWL updating to the information presented in the Scoping Report available on the NCC Planning Portal (reference SCO/2020/0001).

15.9.3. Therefore, this Addendum presents the proposed changes to the cumulative effects assessment with of the Scheme with the NWL presented in paragraphs 15.5.29 to 15.5.47 of the original ES Chapter 15.

15.9.4. In light of the below addendum conclusion, the conclusions in Sections 15.6 'Monitoring' and 15.7 'Summary' do not need updating. The conclusions of the residual different project effects of the Proposed Scheme in combination with NWL have not changed and no additional mitigation or monitoring measures are required.

Norwich Western Link Road

15.9.5. The Norwich Western Link (NWL) road development would be a new 6.1km dual carriageway road proposed to connect the western end of Broadland Northway (formerly the Northern Distributor Road (NDR)) to the A47 trunk road west of Norwich. The Proposed Scheme includes a tie in option at the proposed Wood Lane junction for the future NWL. The interaction of the Proposed Scheme with the NWL is outlined in Section 9 of the Scheme Design Report (**TR010038/APP/7.3**).

15.9.6. A Scoping Report has been produced for the NWL (May 2020) and is available through Norfolk County Council Planning Portal website (planning reference SCO/2020/0001). A Scoping Opinion was received on 16 October 2020.

15.9.7. The NWL is considered a Tier 2 development under Advice Note Seventeen guidance. An assessment of inter-project cumulative effects has been undertaken between the Proposed Scheme and the NWL.

15.9.8. To undertake a cumulative effects assessment of the Proposed Scheme and NWL, study areas for each topic within the relevant ES chapters and the NWL scoping report were combined. Receptors situated within overlapping study areas were assessed for cumulative effects as a result of the NWL. These study areas are shown in Table 15-10.

Table 15-10: Study areas for the Proposed Scheme and Norwich Western Link (NWL)

Topic	A47 North Tuddenham to Easton ES Study Area (km)	NWL Scoping Report Study Area (km)
Biodiversity (all ZOI for both construction and operation)	Within Scheme only: botanical survey, terrestrial invertebrate survey	Within Scheme only – important hedgerows, national vegation classication (NVC) of important habitats, terrestrial invertebrate survey
	Within Scheme only: barn owl survey	0.025 – barn owl survey (incidential records)
		0.1 – barn owl survey of structures
	Within Scheme only: bat crossing point surveys	Within Scheme only – foraging and commuting bats
	0.05 – bat roost survey (all species)	0.025 – tree roosting bats
		0.1 – structure roosting bats
		0.5 – hibernating bats (structures only)

Topic	A47 North Tuddenham to Easton ES Study Area (km)	NWL Scoping Report Study Area (km)
	1.0 – bat activity surveys (foraging and commuting)	6 – radio-tracking surveys of bats (construction and operational)
	0.05 – aquatic invertebrate survey, reptile survey, fungi survey	0.05 – macrophyte survey of River Wensum and ordinary watercourses with the scheme and electric fishing (50m either side of crossing point)
		0.1 – other aquatic invertebrates survey – 200m section of the River Wensum (100m either side of the viaduct crossing location)
		0.25 – river habitat survey – 500m section of the River Wensum (250m either side of the viaduct crossing location)
	7km stretch of the River Tud adjacent to the potential works – white-clawed crayfish	0.1 – white-clawed crayfish
	0.05 – breeding bird surveys, wintering bird surveys	0.1 – wintering and breeding birds
	0.05 – reptile survey and fungi survey	-
	0.1 – phase 1 habitat survey	0.05 – phase 1 habitat survey
		0.2 – Habitats of principal importance (HOPI), ancient woodland (Construction & Operational)
	0.25 – otter and watervole surveys	0.3 – otter and water vole survey along all watercourses and associated riparian habitat upstream and downstream
	0.05 – all great crested newt surveys	0.25 – incidental common toad survey and great crested newt population estimate surveys (where presence is confirmed) within and up to 250m from the scheme
		0.5 – great crested newt habitat suitability index and environmental DNA presence/absence surveys, (construction & operational)
	2 – biological records search for protected/notable flora and fauna (desk study), SACs, possible SACs (pSAC), Special Protection Areas (SPAs), potential SPAs (pSPA), Wetlands of international Importance (Ramsar sites), Natural Nature Reserved (NNRs) and Sites of Special Scientific Interest (SSSIs)	2 – biological records search for protected/notable flora and fauna (desk study), SACs designated for less mobile species, County Wildlife Sites and Roadside Nature Reserves, statutory designated sites for amphibians
		5 – nationally designated sites, SSSIs, NNRs and LNRs
	-	6 – off-site creation / enhancement for biodiversity net-gain considered (operational)
	10 – desk study for bat records	10 – internationally designated sites (Ramsar sites, SACs and SPAs) and functionally linked land

Topic	A47 North Tuddenham to Easton ES Study Area (km)	NWL Scoping Report Study Area (km)
	30 – SACs designated for bats	30 – SACs designated for bats
Cultural Heritage	ZVI (see Figure 6.1 TR010038/APP/6.2) (Construction & Operational)	1 (Construction an Operational)
Landscape and Visual	1 (Construction & Operational)	2 (Construction & Operational)
Geology and Soils	1 (Construction & Operational)	0.5 - Surface water features (Construction & Operational) 1 - Groundwater resources
Road Drainage and the Water Environment		
Noise and Vibration	0.3 (Construction Noise) 0.6 (Operational Noise) 0.1 (Construction Vibration)	0.3 (Construction Noise) 0.6 (Operational Noise) 0.1 (Construction Vibration)
Air Quality	0.2 (Construction & Operational)	0.2 (Construction & Operational)
Population and Human Health	0.5 - Land use and accessability (Construction and Operational)	0.5 - Land use and accessability (Construction and Operational)

15.9.9. The conclusions of the cumulative effects assessments for each topic are outlined in the sections below.

Construction

Ecology and Biodiversity

15.9.10. Considering the potential for cumulative ecological effects during the construction phase, zones of influence and their associated study areas are compared between the two schemes. Study areas for a number of less mobile ecological features are removed from further consideration because they are outside any overlap of study areas between the two schemes. These include aquatic invertebrates (including white-clawed crayfish), water voles and otters.

15.9.11. Where study areas overlap, but are discrete so ecological features are not present in the area where cumulative effects may occur, these ecological features are also removed from further consideration. This is the case for habitats of principal importance (including ancient woodland), terrestrial invertebrates, great crested newts, breeding birds (including barn owls), wintering birds and badgers.

15.9.12. Cumulative effects on statutory sites are not expected. Since no significant effects from either scheme are anticipated on designated sites they are removed from further consideration.

15.9.13. Cumulative impacts on foraging and commuting bats are possible during the construction phase. When considering cumulative impacts, the worst case scenario that the Proposed Scheme and NWL are constructed simultaneously is considered. No cumulative impacts as a result of loss of roosting habitat is anticipated, since for both schemes this will be mitigated for under the terms of a Natural England licence and require habitat creation in the form of artificial roosting habitat to ensure the favourable conversation status of local bat species is maintained.

15.9.14. Construction phase impacts for both schemes include accidental killing/injury, habitat loss, severance of commuting routes, reduction in habitat and increasing in lighting impacts. Habitat loss and severance from the larger footprint of the Proposed Scheme and the NWL cannot be mitigated for at the start of construction, but mitigation for both schemes will likely include compensation of habitat as each phase of the road is completed. The significance of the residual effect for the Proposed Scheme is large adverse, primarily due to the time lag between loss and the remediated habitats reaching maturity. No residual effects from pollution are predicted for either scheme.

15.9.15. When considering the habitat loss and fragmentation from the Proposed Scheme and the NWL together, the significance of the residual cumulative effect would be no greater than the residual effect of the Proposed Scheme, characterised as large adverse. The level of cumulative impact is estimated to be major adverse on foraging and commuting bats in the area, which includes a significant population of barbastelle bats that are a national resource. Consequently, the potential cumulative impact considering the NWL does not elevate the level of impact already estimated for the Proposed Scheme.

Landscape and Visual

15.9.16. Considering the potential for cumulative landscape effects during the construction phase, the worst case scenario is that the Proposed Scheme and NWL are constructed simultaneously will give rise to some adverse effects on landscape character within the study area. The Proposed Scheme and NWL are both located within LCA D2 and the assessment of landscape effects due to the Proposed Scheme identified a significant landscape effect during construction on this character area. The construction of NWL could give rise to adverse cumulative landscape effects in conjunction with the Proposed Scheme and there would be an adverse cumulative landscape effect on LCA D2 during the construction period. However, given the visual containment provided by surrounding woodland cover and the limited visual connection between the

Proposed Scheme and NWL, cumulative landscape effects would be relatively localised.

15.9.17. Considering the potential for cumulative visual effects during the construction phase, there is potential for adverse visual cumulative effects on Viewpoint H which is located on a restricted byway within open arable fields. A significant effect was assessed on Viewpoint H during the construction of the Proposed Scheme and an adverse cumulative effect would occur when the NWL is also considered. However, the adverse cumulative effect would be largely due to the NWL. While users of the very southern extent of the route would experience a significant visual effect due to the Proposed Scheme, the NWL would cross the centre of the byway, giving rise to a more direct and extensive visual change. No other receptors have been identified which have the potential for significant visual effects. Receptor 31 (Hall Farm) is located north of the A47 Scheme and approximately 1km east of the NWL, however it is likely to have views screened by intervening tree cover. Wood Lane is bordered by mature tree and hedgerow cover which would limit views from receptors to the west. The A47 Scheme and topography undulations would screen views from receptors located south of the A47 Scheme.

15.9.18. At the time of this assessment, and in the absence of an assessment of the landscape and visual effects of the NWL, there is insufficient information available to identify residual significant cumulative effects during the construction phase.

Noise and vibration

15.9.19. The assessment of cumulative effects includes the embedded mitigation measures for the Proposed Scheme, but does not include any mitigation for the NWL. Noise and vibration due to the NWL will need to be considered, and mitigated where necessary, as part of the EIA for that scheme.

15.9.20. There are no noise sensitive receptors within 300m of the NWL junction with the Proposed Scheme. Therefore, no significant cumulative effects are anticipated during construction.

Air Quality

15.9.21. There are no air quality sensitive receptors within 200m of the NWL junction with the Proposed Scheme. Therefore, no significant cumulative air quality effects are anticipated during construction.

Geology and Soils

9.10.5. The NWL and Proposed Scheme construction phases could cumulatively contribute to soil compaction and soil damage where construction works may overlap. This may occur in areas of land at and around the junction of the NWL

and the Proposed Scheme and will depend on the detailed layout of the NWL construction works. These temporary impacts are not expected to result in significant effects. The NWL EIA is expected to include standard good construction practice measures to limit impacts on soils during the construction phase.

Road Drainage and the Water Environment

15.9.22. The Proposed Scheme and the NWL will both have areas of construction works situated within the River Tud catchment. The NWL has potential to cause cumulative impacts on the River Tud. However, post-mitigation impacts identified within the RDWE assessment in the ES Chapter 13 (**TR010038/APP/6.1**) are assessed as no greater than negligible.

15.9.23. Furthermore, mitigation measures relating to surface water quality and flood risk will be employed; these comprise actions RD1 to RD10 and GS1 within Table 3.1 (Record of Environmental Actions and Commitments) in the Environmental Management Plan for the Proposed Scheme (TR010038APP/7.7). It is expected that water resources and flood risk assessments within the NWL EIA would propose similar mitigation measures.

15.9.24. It is therefore expected that mitigation outlined within the EIA for the Proposed Development and the NWL would sufficiently mitigate against significant cumulative effects relating to water quality, water quantity and flood risk within the River Tud catchment.

15.9.25. It is not anticipated that there would be any significant cumulative effects on groundwater resources during the construction phase. It is expected that mitigation measures for the protection of groundwater quality and quantity during construction will be outlined within the NWL EIA. There is a groundwater public water supply abstraction at East Tuddenham (**TR010038/APP/6.1**). However, this public water supply abstraction is situated up-hydraulic gradient of the NWL and furthermore separated by the River Tud. There is therefore no conceivable hydrogeological pathway between the public water abstraction and the NWL, and so no cumulative impacts are anticipated on this abstraction.

Population and Human Health

15.9.26. Properties accessed from Berrys Lane, including Merrywood House and Berry Hall Cottages, are within 0.5km of the NWL junction with the Proposed Scheme. As these receptors are within the combined study area as defined within Table 15-10, an assessment of cumulative effects is required. Residual construction phase effects on these receptors as a result of the Proposed Scheme are assessed as **moderate adverse** within the Proposed Scheme's ES Chapter 12 (**TR010038/APP/6.1**). These receptors are situated south of the existing A47, and it is not envisaged that the NWL construction traffic will utilise

Berrys Lane. Therefore, no cumulative effects as a result of the NWL are anticipated at these properties.

15.9.27. There are no other private property and housing, community land and assets, or development land and businesses receptors within the combined study areas. Therefore, no further assessment of potential cumulative effects has been undertaken on these receptors.

15.9.28. With regards to agricultural land holdings, the proposed route of the NWL intersects Agricultural Holding 7. Residual construction effects on this holding are assessed as **slight adverse** within the Proposed Scheme ES Chapter 12 (**TR010038/APP/6.1**). Agricultural Holding 7 is assessed as a High sensitivity receptor with a Minor impact within ES Chapter 12. However, there may be significant cumulative effects on Agricultural Holding 7 during the NWL construction phase which may overlap with the Proposed Scheme construction phase. The NWL Scoping Report notes that there is potential for access to agricultural land being impacted or severed during construction. DMRB LA 112 defines a moderate Impact as "…*severe severance with limited/moderate accessibility provision*". Therefore in the absence of knowing the proposed temporary land take of the NWL and any provisions for alternative access, it is not possible to conclude whether the Proposed Development and NWL will have significant cumulative effects on agricultural land during the construction phase.

Operational

Ecology and Biodiversity

15.9.29. Considering the potential for cumulative ecological effects during the operational phase, zones of influence and their associated study areas are compared between the two schemes. Study areas for a number of less mobile ecological features are removed from further consideration because they are outside of any overlap of study areas between the two schemes. These include aquatic invertebrates (including white -clawed crayfish), water voles and otters.

15.9.30. Where study areas overlap but areas are discrete so ecological features are not present in the area where cumulative effects may occur, these ecological features are also removed from further consideration. This is the case for habitats of principal importance (including ancient woodland) terrestrial invertebrates, great crested newts, breeding birds (including barn owls) and wintering birds and badgers.

15.9.31. Cumulative impacts on foraging and commuting bats are possible during the operational phase. The impacts that are possible are: killing and injury through increased likelihood of collision when crossing the dual carriageways for both schemes: permanent loss of foraging habitat; severance of commuting routes and foraging areas, resulting in avoidance and abandonment of habitat and

roosts. It is unknown whether mitigation involving planting of trees for hop overs, underpasses, overpasses and the River Tud Crossing for the Proposed Scheme, or the planned underpasses, green bridges and Wensum crossing will enable bats to fly safely across the new road network until monitoring surveys are complete. As such, on a precautionary basis, ES Chapter 8 Biodiversity concluded the impact for the Proposed Scheme to be major adverse due to the potential for permanent damage to populations of national significance. When considered together with the habitat loss and fragmentation from the Proposed Scheme and the NWL, the significance of the residual cumulative effect would be no greater than the residual effect of the Proposed Scheme, characterised as large adverse. This is due to the level of cumulative impact estimated to be major adverse on foraging and commuting bats in the area, including a significant population of barbastelle bats that are a national resource.

Landscape and Visual

15.9.32. Considering the potential for cumulative landscape effects during the operational phase, a similar principle identified in the construction phase applies. The addition of the Proposed Scheme and NWL is likely to give rise to adverse cumulative landscape effects, particularly prior to the establishment of mitigation planting beside the Proposed Scheme. There will likely be adverse cumulative landscape effects due to the presence of the two operational roads which will increase the number of large scale built forms within this arable landscape. However, the containment by surrounding tree cover and the presence of the existing A47 limit the cumulative change that would occur. At Year 1 of operation a significant landscape effect has been assessed on the character area within which the two roads would be located, LCA D2, due to the Proposed Scheme as a standalone development. It is also predicted that there would be an adverse cumulative landscape effect on LCA D2 due to the combined effect of the Proposed Scheme and NWL. At Year 15, once the mitigation related to the Proposed Scheme has established it is predicted that adverse cumulative landscape effects would be limited. Given the early stage of the NWL scheme development, mitigation details are not yet available. However, it is assumed that a proportionate mitigation scheme will be established which will further limit the cumulative landscape change that would occur.

15.9.33. Considering the potential for cumulative visual effects during the operational phase there is potential for adverse visual cumulative effects on Viewpoint H which is located on a restricted byway within open arable fields. A significant effect was assessed on Viewpoint H during the opening year (Year 1) of the Proposed Scheme (as a standalone development) and an adverse cumulative effect would occur when the NWL is also considered. The adverse cumulative effect would be due to the NWL in the most part. While users of the very southern extent of the route would experience a significant visual effect due to the

Proposed Scheme, the NWL would cross the centre of the byway, giving rise to a more direct and extensive visual change. No other receptors have been identified which have the potential for significant visual effects. Receptor 31 (Hall Farm) is located north of the A47 Scheme and approximately 1km east of the NWL, however it is likely to have views screened by intervening tree cover. Wood Lane is bordered by mature tree and hedgerow cover which would limit views from receptors to the west. The A47 Scheme and topography undulations would screen views from receptors located south of the A47 Scheme. Similar to the landscape assessment, at Year 15, once the mitigation related to the Proposed Scheme has established it is predicted that adverse cumulative visual effects would be limited.

15.9.34. At the time of this assessment, and in the absence of an assessment of the landscape and visual effects of the NWL, there is insufficient information available to identify residual significant cumulative effects during the operational phase. The operational effects of the NWL will be assessed within the EIA for that project.

Noise

15.9.35. No change to the Proposed Scheme and NWL cumulative noise and vibration effects assessment presented in paragraphs 15.5.36 to 15.5.41 of Section 15.5 in this ES chapter.

Air Quality

15.9.36. No change to the Proposed Scheme and NWL cumulative air quality effects assessment presented in paragraphs 15.5.42 to 15.5.47 of Section 15.5 in this ES chapter.

Geology and Soils

15.9.37. Due to the scale, type and location of the NWL project, it is expected to give rise to significant effects on agricultural land during operation (i.e. land classified under the Agricultural Land Classification system). However, this cannot be confirmed as no detailed assessment has been undertaken. The NWL in combination with the Proposed Scheme is expected to result in a cumulative effect on agricultural land from additional loss of Grades 2, 3a and 3b agricultural land.

15.9.38. The Proposed Scheme's ES Chapter 9 Geology and Soils (**TR010038/APP/6.1**) concludes that the long-term residual effects on agricultural soils would be limited to the permanent loss of agricultural land. The permanent loss of Grade 2 land is considered to be of large adverse significance, the permanent loss of Grade 3a agricultural land is considered to be of very large adverse significance,

while the permanent loss of Grade 3b agricultural land is considered to be of moderate adverse significance of effect.

15.9.39. In the absence of knowing the proposed land take of the NWL, it is not possible to conclude whether the Proposed Development and NWL will elevate the level of impact significant already estimated for the Proposed Scheme. However, no additional mitigation measures are recommended beyond the measures relating to soils within Table 3.1 in the Environmental Management Plan for the Proposed Scheme (**TR010038APP/7.7**).

Cultural Heritage

15.9.40. The Norwich Western Link (NWL) study area overlaps the following designated heritage assets identified within the study area of Proposed Scheme:

- Berry Hall (Grade II listed NHLE 1306730)
- Icehouse at Berry Hall (Grade II listed NHLE 1077350)
- 39, 40 and 41, The Street (Grade II listed NHLE 1170745)
- Honingham and East Tuddenham War Memorial (Grade II listed NHLE 1458759)
- Stables and coach house to Honingham Hall (Grade II listed NHLE 1372666)

15.9.41. The Environmental Impact Report for the NWL Outline Business Case (WSP 2021) predicts a possible effect on the Stables and coach house to Honingham Hall (NHLE 1458759) through the loss of surrounding rural and agricultural land, as well as impacts from traffic flow, traffic noise and road lighting. The immediate surroundings of this asset screen it from the surrounding land, and the distance from both the Proposed Scheme and the NWL mean that the overall effects are not likely to be different to those already assessed for the Proposed Scheme. The effect due to removal of landscape context is more properly an impact on the non-designated Honingham Park (MNF49020) and this is discussed below.

15.9.42. The remaining designated assets are screened from the NWL by a combination of existing landform, buildings and vegetation, as well as by the Proposed Scheme (including mitigation planting). No cumulative effects are predicted for designated assets.

15.9.43. There are no additional or increased effects on known and potential non-designated archaeological remains, as these will be appropriately mitigated within the Proposed Scheme.

15.9.44. The NWL will remove or sever additional areas of 18th to 20th century enclosure. These historic landscape types are of negligible heritage value and both the magnitude of impact and significance of effect is not larger than that already assessed for the Proposed Scheme.

15.9.45. The NWL may have a potentially significant effect on the non-designated Honingham Park (MNF49020) through removal of landscape elements and severance of the western edge of the park form the main body. The precise effect

of the NWL on the park is unknown, as this is not discussed in the Environmental Impact Report (WSP 2021). The heritage impact assessment for Honingham Park (Chapter 6, Section 6.14, deadline 3 submission) has been revised due to construction methodology changes. This revises the significance of effect of the Proposed Scheme on the asset to Neutral and therefore, any effects of the NWL are not cumulative with the Proposed Scheme.

15.9.46. No cumulative effects with the NWL are predicted.

Population and Human Health

15.9.47. Agricultural Holding 7 is the only identified agricultural land holding located within both red line boundaries of the Proposed Scheme and the NWL. Table 12.14 of ES Chapter 12 (**TR010038/APP/6.1**) assesses holding 7 as a high sensitivity receptor and the magnitude of the impact from construction activities due to the Proposed Scheme as a minor impact. The residual effect is concluded as **slight adverse** and not significant.

15.9.48. There is potential that agricultural holding 7 is subject to cumulative impacts from the two schemes by increasing the land lost. As per Table 3.12 in DMRB LA 112 a 'minor' impact is defined as a 'minor loss' and a 'moderate' impact is a 'partial loss'. In the absence of knowing the proposed temporary and permanent land take of the NWL, it is not possible to conclude significant effects.

15.9.49. The public right of way Honingham RB1 will be permanently diverted as a result of the construction of the Proposed Scheme and the NWL. Paragraph 12.10.80 in the Proposed Scheme ES Chapter 12 (**TR010038/APP/6.1**) concludes that as the permanent increase in journey length would be in excess of 500m the magnitude of the impact is major. However, taking account of the amenity, reduced severance and potential road safety benefits associated with the provision of the underpass and applying professional judgement, the magnitude of the impact has been reduced to moderate. Effects by the Proposed Scheme were therefore assessed as permanent **Moderate adverse** given the very low usage of this recreational route.

15.9.50. Construction of the proposed NWL and implementation of its associated non-motorised user strategy would see the stopping up and permanent diversion of the remaining northern section of Honingham RB1, which runs between Wood Lane and the northern boundary of the A47 Scheme, to the east of the NWL. The permanent diversion of this section of Honingham RB1 could result in additional journey length increases for some users when compared to the increases resulting from the Proposed Scheme. The overall permanent increase in journey length for some users associated with the Proposed Scheme and NWL combined would also be in excess of 500m and this suggests that the magnitude of the impact is Major. However, taking account of the amenity, reduced severance and potential road safety benefits associated with provision of the underpass of the

A47 plus the grade separated crossing for walkers, cyclists and equestrians to be provided at The Broadway, as part of NWL, and applying professional judgement, the magnitude of the impact remains as moderate. Therefore, the cumulative effect of the combined schemes is assessed as permanent **Moderate adverse** given the very low usage of this recreational route; the same level of impact significance already estimated for the Proposed Scheme.