

# Road Investment Strategy

## East Area 6

### A47 Blofield to North Burlingham

#### Scheme Assessment Report

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### List of Acronyms

AADT	Annual Average Daily Traffic
AS14	Autumn Statement 2014
AST	Appraisal Summary Table
AQMA	Air Quality Management Areas
BCR	Benefit Cost Ratio
BGS	British Geological Society
BT	British Telecom
CCTV	Closed-circuit Television
CDM	Construction Design and Management Regulations
COBA	Cost Benefit Appraisal
CPO	Compulsory Purchase Order
CSR	Client Scheme Requirements
CWS	County Wildlife Site
DCO	Development Consent Order
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environmental Assessment
EAST	Early Assessment and Sifting Tool
GNLP	Greater Norwich Local Plan
HA	Highways Agency (replaced by Highways England on 1 April 2015)
HADDMS	Highways Agency Drainage Data Management System
IAMIS	Integrated Asset Management Information System
ICD	Inscribed Circle Diameter
IDC	Investment Decision Committee
JCS	Joint Core Strategy
GCN	Great Crested Newt
KPI	Key Performance Indicator
LEP	Local Enterprise Partnership
LNR	Local Nature Reserve
MAC	Managing Area Contract
NCC	Norfolk County Council
NDD	Network Delivery and Development Directorate
NMU	Non-Motorised User
NSIP	Nationally Significant Infrastructure Project
OAR	Options Assessment Report
OME	Order of Magnitude Estimate
PCF	Project Control Framework
PCU	Passenger Car Unit
PERA	Preliminary Environmental Risk Assessment
PSSR	Preliminary Sources Study Report
RAG	Red, Amber, Green
RFC	Ratio to Flow Capacity
RIS	Roads Investment Strategy
SAC	Special Area of Conservation
SEP	Strategic Economic Plan
SOBC	Strategic Outline Business Case

SPA	Spatial Planning Arrangement
SRN	Strategic Road Network
SSR	Solutions Summary Report
SSSI	Site of Special Scientific Interest
TAME	Traffic Appraisal, Modelling & Economics
TAR	Technical Appraisal Report
TEE	Transport Economic Efficiency
TM	Traffic Management
TRADS	Traffic Flow Data System
TSR	Transport Summary Report
TSRGD	Traffic Signs Regulations & General Directions
TUBA	Transport appraisal and modelling tools
UXO	Unexploded Ordnance
VM	Value Management
WebTAG	Web based Transport Analysis Guidance
WLR	Western Link Road

## Executive Summary

The A47 and A12 trunk roads form part of the strategic road network and provide for a variety of local, medium and long distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich and Peterborough, the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area.

Highways England (previously Highways Agency) is responsible for planning the long term future and development of the Strategic Road Network and has identified through previous route feasibility study key investment needs on the A47 corridor. The A47 Blofield to North Burlingham Dualling scheme was identified as one such location in the Department for Transport's Road Investment Strategy (RIS) which was published in March 2015.

This report summarises the work done in PCF Stage 1 and PCF Stage 2 to identify a number of feasible Options which solve the transport problem identified and to reduce these options to a practical number of options prior to public consultation (PCF Stage 1). In PCF Stage 2 the options were taken to public consultation following which further assessment and route selection of the preferred route.

Eight initial options were identified for consideration. An initial assessment was made of these options to identify their performance against environmental, engineering, transportation and economic criteria so that they could be compared and contrasted to allow the most appropriate options to be taken forward. Four options from the eight were selected for further assessment.

An updated local transportation model has been developed based on the Norwich Area Transportation Strategy model which has been used to further assess the Options and to provide transportation information to inform the Economic analysis of each of the Options.

Following consideration of public and stakeholder comment and the assessment of the four options a preferred route was selected and a preferred route announcement was made in August 2017.

The completed transportation, economic and Environmental Assessments have verified the preferred route decision.

# 1 Introduction

## 1.1 Background

1.1.1 Highways England (previously the Highways Agency) is responsible for planning the long term future and development of the Strategic Road Network including its maintenance, operation and improvement. In 2014 Highways England published its Strategic Business Plan (SPB) in response to the Government's Road Investment Strategy (RIS). The SPB sets out Highways England's main activities and strategic outcomes and sets how Highways England will deliver the Investment Plan. Highways England's Delivery Plan builds on the SPB, setting out in detail how strategic outcomes will be delivered and success measured, while identifying future goals and plans. Highways England's strategic outcome are:

- Supporting Economic Growth
- A Safe and Serviceable Network
- A More Free-Flowing Network
- Improved Environment
- An Accessible and Integrated Network

1.1.2 Highways Agency developed a Route Based Strategy approach to identify key investment needs on the Strategic Road Network.

1.1.3 The Route Based Strategy has brought together both national and local priorities which have been captured in 18 Route-Based Strategy Evidence Reports, used to inform the Road Investment Strategy (RIS).

1.1.4 In 2014 AECOM carried out feasibility studies for the then Highways Agency and the Department for Transport (DfT) to identify issues on the Strategic Road Network on the A47/A12 Corridor between the A1 west of Peterborough and Lowestoft (south of the A47's junction with the A12). The study was completed in three PCF Stages that, overall, broadly aligned with Steps 5 to 9 of the DfT's Transport Analysis Guidance (WebTAG).

1.1.5 Twenty two locations were identified that were considered to have current or imminent problems and these were considered further at high level using criteria from the DfT's Early Assessment and Sifting Tool (EAST). AECOM developed the Options Assessment Report (OAR) for each scheme and from this recommended a solution for which Strategic Outline Business Cases (SOBC) was produced.

1.1.6 As a result of this work, an initial case was made to carry out the following improvements:

- A47 Wansford to Sutton Dualling
- A47 Guyhirn Junction Improvements
- A47 North Tuddenham to Easton Dualling
- A47 Thickthorn Interchange Improvements
- A47 Blofield to North Burlingham Dualling

- A12 Junction Improvements<sup>1</sup>

1.1.7 This study was published on the DfT website and can be found at

<https://www.gov.uk/government/publications/a47-and-a12-corridor-feasibility-study-technical-report>

1.1.8 In December 2014 the DfT published the RIS for 2015-2020. The RIS sets out the list of schemes that are to be developed by the HA (now Highways England) over the period of April 2015 to March 2020). The RIS confirmed their commitment to the schemes listed above for the A47/A12 Corridor.

1.1.9 Following the publication of the RIS, AECOM produced a high-level appraisal of benefits for the identified schemes on behalf of the DfT. This work was summarised in the A47 & A12 Corridor Feasibility Study (March 2015).

1.1.10 In April 2015 Highways England assumed responsibility for the Strategic Road Network and for delivering the Government's vision for that network as set out in the RIS. As a result, Highways England took ownership of the previously DfT lead Strategy, Shaping and Prioritisation phase (PCF Stage 0) of scheme development.

1.1.11 Amey, supported by AECOM, were appointed to lead on the work to be carried out on the A47 and A12 in Norfolk in March 2015, to jointly progress the six schemes which comprise the A47 Improvements Programme through Project Control Framework (PCF) PCF Stage 0. This was completed in October 2015 and the Amey/AECOM team were retained to complete PCF Stage 1 for all six schemes.

1.1.12 For PCF Stage 2, the six schemes were divided between Amey and AECOM based on the below division:

1.1.13 Amey were appointed to progress four schemes, namely:

- A47 Wansford to Sutton Dualling
- A47 Guyhirn Junction Improvements
- A47 North Tuddenham to Easton Dualling
- A47 Blofield to North Burlingham Dualling

1.1.14 AECOM were appointed to progress two schemes, namely:

- A47 Thickthorn Interchange Improvements
- A12 Junction Improvements (later renamed A47 Great Yarmouth junctions)

1.1.15 Each of the six schemes have been progressed separately but collaboratively under this approach.

1.1.16 This report will focus on:

#### **A47 Blofield to North Burlingham Dualling**

1.1.17 Hereafter A47 Blofield to North Burlingham Dualling will be known as the Scheme.

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<sup>1</sup> This combines the schemes previously known as A47/A12 Vauxhall Junction improvements and A12 package of roundabout improvements

## 1.2 Project Control Framework

- 1.2.1 Highways Agency, now Highways England, introduced the Project Control Framework (PCF) for their Major Projects directorate in 2008. The framework sets out how major highways schemes should be managed and delivered with consistent products and a well defined and consistent approach to project governance. The PCF Stages are broken down in Table 1.1 below.
- 1.2.2 This Scheme Assessment Report covers the work done in the Options Phase and covers both PCF Stage 1 and PCF Stage 2 (the stages highlighted orange in **Table 1-1** below).

**Table 1-1 – Major Projects Lifecycle**

PCF Stage	Delivery Item	Phase
PCF Stage 0	Strategy, Shaping and Prioritisation	Pre-project
PCF Stage 1	Option Identification	Options Phase
PCF Stage 2	Option Selection	
PCF Stage 3	Preliminary Design	Development Phase
PCF Stage 4	Statutory Procedures and Powers	
PCF Stage 5	Construction Preparation	
PCF Stage 6	Construction, Commissioning and Handover	Construction Phase
PCF Stage 7	Close Out	

## 1.3 The Identified Problem

- 1.3.1 The RIS announced the Scheme as “dualling of the single carriageway Section of the A47 between Norwich and Acle, linking together two existing sections of dual carriageway”
- 1.3.2 The section of the A47 between Blofield and North Burlingham experiences congestion and is currently operating at over capacity. Growth in Norwich and the immediate local area around Blofield will exacerbate this condition.
- 1.3.3 The A47 Blofield to North Burlingham has an average speed significantly lower than the daily average during the AM peak. This is an indicator of congestion and affects journey reliability on the link.

- 1.3.4 The A47 Blofield to North Burlingham stretch of single carriageway has a poor safety record.
- 1.3.5 Due to the lack of nearby alternative routes, the route resilience on this link is an issue.
- 1.3.6 Dualling of the section of the A47 offers a solution to the congestion and will allow economic growth in the area

## 1.4 Purpose of this Report

- 1.4.1 The purpose of this Scheme Assessment Report (SAR) is to:
  - present the unpublished PCF Stage 1 Technical Appraisal Report (TAR)
  - report on the options development work completed during PCF Stage 2
  - review the non-statutory public consultation responses
  - recommend a Preferred Route
- 1.4.2 One of the outputs of PCF Stage 1 is the Technical Appraisal Report (TAR) which brings together technical, operational, safety, traffic, economic and environmental assessments and forms the basis for recommendations for which option(s) should be taken forward for Public Consultation during PCF Stage 2.
- 1.4.3 In PCF Stage 2 the Scheme Assessment Report is produced which normally includes a summary of the TAR (from PCF Stage 1) along with reporting on the non-statutory public consultation and consultation results and on any further surveys investigations and assessment work undertaken on the scheme. The Scheme Assessment Report also recommends a Preferred Route.
- 1.4.4 In order to meet the RIS target date for start of works on the scheme in March 2020, we took the decision, that where it was necessary to maintain programme, that PCF Stages could be overlapped. Where appropriate this has allowed overall progress on the programme to be achieved by allowing formal technical assessment and completion of reporting from PCF Stage 1 to continue into PCF Stage 2. At the start of PCF Stage 1 it was also assumed that PCF Stage 3 would commence whilst PCF Stage 2 reporting and close out work was being completed
- 1.4.5 In line with the decision to keep the project on programme and overlap PCF Stages, we decided to not complete the TAR prior to the start of PCF Stage 2. As a result the PCF Stage 1 TAR had an incomplete status at the end of PCF Stage 1. To ensure the history and development of the Options Phase is reported in full this document includes a more detailed report of PCF Stage 1 than might usually be included in a Scheme Assessment Report. This document has therefore been structured as follows;

Chapter 1	Introduction (this Chapter)
Chapters 2 – 19	reports on the PCF Stage 1 work and includes the majority of the incomplete TAR document, presenting the information as it was known at the time, including any limitations and recognition of unknown factors.
Chapter 20	reports the conclusions of PCF Stage 1 and transition to PCF Stage 2
Chapter 21 - 35	reports on the PCF Stage 2 work including the determination of the preferred route



Chapter 36 reports the conclusions of PCF Stage 2 and recommendations for next steps

## 1.5 Overview of Timeline of PCF Stages and the Document

### Chapter 2-19 (December 2015 to November 2016)

- 1.5.1 PCF Stage 1 commenced in December 2015 and continued until November 2016. As described in Chapter 9 of this report, the Option Identification stage (PCF Stage 1) included developing and expanding new designs based on those that were determined at PCF Stage 0 (completed October 2015). PCF Stage 1 included a sifting of these options at an Options Review Meeting (ORM) (see Chapter 11) part way through PCF Stage 1 (June 2016). These options were then assessed in terms of performance from a technical, operational, safety, traffic, economic and environmental perspective
- 1.5.2 The assessment work undertaken following the ORM informed the recommendations for the options that should progress to PCF Stage 2 and be presented at the non-statutory public consultations. The assessments of the information available supported the depth and quality of work undertaken during stage 1 to allow Highways England to proceed to PCF stage 2. The available qualitative and quantitative information was robust enough to provide a clear decision on the options being taken forward. This information has since been produced and further validates that decision.
- 1.5.3 This first Chapter of the report (Chapters 2 -19) captures PCF Stage 1 as it was at the end of the stage (Nov 2016) including the limitations imposed by programme constraints. Therefore some elements may have progressed / evolved / changed and these are reflected in the second part of this report.

### Chapter 20 (December 2016)

- 1.5.4 The conclusion of PCF Stage 1 and the transition to PCF Stage 2 is reported in Chapter 20 and includes the governance process that was followed to ensure the scheme could progress to the next stage.

### Chapter 21 to Chapter 27 (January 2017 to June 2017)

- 1.5.5 Following a review of the commercial information available at the end of PCF Stage 1, it was determined that all the sifted options from PCF Stage 1 were unaffordable when compared to the scheme budgets allocated as part of the RIS 1 commitments. PCF Stage 2 therefore commenced with a value management review of the sifted options to determine if a viable affordable option could be promoted. The value management exercise is described in Chapter 21. In parallel, although limited by the value management exercise, PCF Stage 2 commenced in January 2017. Early PCF Stage 2 activities included the engineering development of the sifted option assessments (Chapter 23) as well as preparing for the Non-Statutory Public Consultation; the latter is covered in Chapters 24 and 25.
- 1.5.6 A further review of the programme pressures and requirements to meet the March 2020 deadline lead to the programme date for the Preferred Route Announcement being brought forward. The determination of the preferred route and a summary of the available information at the time of the decision, is presented in Chapter 27

### Chapter 28 to Chapter 35 (June 2017 to October 2017)

- 1.5.7 In order to validate the early Preferred Route Decision, assessment work continued beyond the Preferred Route Announcement to a thorough conclusion; this is reported in Chapters 28 to 35. Any variance or issues associated with the early determination of the Preferred Route are captured in these Chapters.

**Chapter 36 (November 2017)**

- 1.5.8 Chapter 36 presents the conclusions from PCF Stage 2 and recommendations for future stages.

## 2 Planning Brief

### 2.1 Introduction

- 2.1.1 This Chapter summarises relevant national and local policies which were considered during the design and appraisal of the Scheme during PCF Stage 1.
- 2.1.2 Further details regarding how these continued to influence the process of scheme development during PCF Stage 2 can be found in Chapter 32.

### 2.2 National Policy

#### National Policy Statement for National Networks

- 2.2.1 The National Policy Statement for National Networks (NPSNN) sets out the need for Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England, and the Government's policy to deliver these projects. The National Policy Statements supplement the National Planning Policy Framework. NPSNN sits alongside the Road Investment Strategy.
- 2.2.2 There is an assumption within NPSNN that significant improvements to the road network will be necessary in order to support the Government's vision for the national networks. Paragraph 2.21 of the document sets out a range of alternatives to major improvements to the network including Maintenance and Asset Management, Demand Management and Modal Shift. However, it is concluded that at a strategic level there is a compelling need for development of the national road network.
- 2.2.3 The NPSNN states that the assessment of the proposed scheme should consider the balance of potential benefits and adverse impacts (paragraph 4.3). Benefits to be considered include the facilitation of economic development, job creation, housing and environmental improvement, and any longer-term or wider benefits. Assessment of adverse impacts should include longer-term and cumulative adverse impacts, as well as planned mitigation of these impacts.
- 2.2.4 The NPSNN requires environmental, safety, economic and social impacts should be considered at a national, regional and local level. The information provided will be proportionate to the development (paragraph 4.4).
- 2.2.5 All projects should be subject to an options appraisal. The options appraisal should consider viable modal alternatives and may also consider other options (paragraph 4.27).
- 2.2.6 Section 5 of NPSNN gives guidance for decision making relating to impacts on environment, habitat, landscape, accessibility and existing infrastructure. In relation to environmental impacts, the guidance is clear that planning permission should not be granted for schemes which will have a detrimental impact on irreplaceable habitats, including ancient woodland (paragraph 5.32).
- 2.2.7 It is expected that schemes subject to a Development Consent Order (DCO) will be examined against criteria set out in Section 5 of NPSNN.
- 2.2.8 From the start of PCF Stage 0, it has been assumed that the scheme will meet the criteria for a National Significant Infrastructure Project and will be subject to the DCO process. In this case, the planning application will be judged primarily against the NPSNN, according to the decision-making framework set out in the Planning Act 2008. Further detail is discussed in Chapter 21 of this report.

## The Road Investment Strategy

### Strategic Vision

- 2.2.9 The Department for Transport's Road Investment Strategy (RIS) defines a national programme of improvements to the Strategic Road Network (SRN).
- 2.2.10 RIS introduces long-term strategic planning and funding for the Strategic Road Network (SRN), underpinned by a significant increase in investment in the SRN. It is the ambition of Highways England to substantially modernise the SRN within 25 years. This vision for improvement of the SRN is outlined in more detail through the Performance Specification and Key Performance Indicators (KPI's) in **Table 2-1**.
- 2.2.11 The RIS states that 127 major schemes will be undertaken over the course of the first Road Period (2015-2020), in order to deliver benefits quickly.
- 2.2.12 In the longer term up to 2040, Highways England look to achieve an upgraded network which makes use of the latest technology in line with KPI's and in order to fulfil the Performance Specification. (February 2015).

### Investment Plan

- 2.2.13 The RIS sets out a number of specific locations for improvements to the SRN. The A47 Blofield to North Burlingham Dualling is included, based on evidence gathered in the *A47 / A12 Corridor Feasibility Study*:

***A47 Blofield to North Burlingham Dualling; to complete a gap in dual carriageway between Norwich and Acle.***

- 2.2.14 As part of the Spending Review announcement made in June 2013, DfT committed to undertaking six feasibility studies to help identify and fund solutions to tackle some of the most notorious and long-standing road hot spots in the country. These studies included work at six locations within the A47/A12 corridor.
- 2.2.15 The study considered and analysed the evidence available on the current problems faced by each location and the potential issues or future pressures that may arise. The work identified the priority needs for investment and reviewed a number of potential investment options and their performance in tackling those issues. Further work and analysis looked at the strength of the economic case for the investment and their deliverability within the first RIS period.
- 2.2.16 An investment package worth over £300 million on the A47/A12 corridor is outlined in the RIS Part 2: Investment Plan, Page 25. Page 16 of the Road Investment Strategy: Investment Plan describes the 6 corridor feasibility studies which "investigated the priorities for the routes and tested that potential improvements demonstrate a robust case for investment, offer value for money and are deliverable" the document indicates that "summaries of these studies will be published shortly (these summaries have now been published in the Feasibility Summary Report - Chapter 8).
- 2.2.17 Page 25 and 26 of the Road Investment Strategy: Investment Plan detailed the announced investment package for improvements along the A47/A12 corridor. This lists the A47 North Tuddenham to Easton scheme as one of the schemes which make up the package of improvements as:
- "A47 Blofield to North Burlingham – dualling of the single carriageway section of the A47 between Norwich and Dereham, linking together two existing sections of dual carriageway."*
- 2.2.18 Page 42 of the Road Investment Strategy: Investment Plan lists the same scheme description for A47 Blofield to North Burlingham under "committed Schemes Newly announced in this Investment Plan"

**Performance Specification**

- 2.2.19 The RIS provides a Performance Specification and Key Performance Indicators (KPIs) for Highways England.
- 2.2.20 **Table 2-1** summarises the Key Performance Indicators as they apply to each point of the Performance Specification.
- 2.2.21 The RIS requires Highways England to develop detailed Performance Indicators (PIs) to provide further detail on how the Scheme is progressing on each KPI.

**Table 2-1 Road Investment Strategy – Performance Specification and Key Performance Indicators**

Topic	Measure	Key Performance Indicator Target	Performance Indicator
<b>Making the Network Safer</b>	The number of KSIs on the SRN	Ongoing reduction of at least 40% by end of 2020 against 2005-09 average baseline	Suite of PIs to illustrate the impact of activities undertaken by the Company, and the influence of external factors with regard to making the SRN safer. These should include: Incident numbers and causation factors for motorways; Casualty numbers and causation factors for APTRs; and IRAP based road safety investigations, developed in conjunction with the Department, to feed into subsequent Route Strategies.
<b>Improving User Satisfaction</b>	The percentage of NRUSS respondents who are Very or Fairly Satisfied.	Achieve a score of 90% by 31 March 2017 and then maintain or improve it.	Suite of PIs to provide additional information about the performance of factors that influence user satisfaction.
<b>Supporting the Smooth Flow of Traffic</b>	Network availability: the percentage of the SRN available to traffic.	Maximise lane availability so it does not fall below 97% in any one year	Suite of PIs to illustrate the impact of the activities undertaken by the Company, and the influence of other external factors, on traffic flow. This should include, at a minimum, reliability of journey times.
	Incident Management: percentage of motorway incidents cleared within one hour.	At least 85% of all motorway incidents cleared within 1 hour	
<b>Encouraging Economic Growth</b>	Average Delay (time lost per vehicle)	No Target Set	Suite of PIs to help demonstrate and evaluate what activities have been taken to support the economy. These should, at a minimum, include metrics on: Being an active and responsive part of the planning system; Supporting the business, and freight and logistics sectors; and

Topic	Measure	Key Performance Indicator Target	Performance Indicator
			Helping the government support small and medium sized enterprises.
<b>Deliver Better Environmental Outcomes</b>	Noise: Number of Noise important areas mitigated	At least 1,150 Noise Important Areas over RP1	Suite of PIs to provide additional information about environmental performance. These should, at a minimum, include: Air quality; and Carbon dioxide, and other greenhouse gas emissions for the Company and its supply chain that occur as they carry out work on the SRN.
	Biodiversity: Delivery of improved biodiversity as set out in the Company's Biodiversity Action Plan	Publish Biodiversity Action Plan by 30 June 2015 & report annually against the Plan to reduce net biodiversity loss on ongoing annual basis	
<b>Helping Cyclists, walkers and other vulnerable users</b>	The number of new and upgraded crossings	No Target Set	Suite of PIs to demonstrate the safety of the SRN for cyclists, walkers, and other vulnerable users.
<b>Achieving Real Efficiency</b>	Cost savings: savings on capital expenditure	At least £1.212 billion over RP1 on capital expenditure.	Suite of PIs to demonstrate that the portfolio is being developed and the Investment Plan delivered in a timely and efficient manner. These should include the progress of major schemes and programmes in construction through reporting CPI and SPI for schemes at Project Control Framework PCF Stage 5 and beyond.
	Delivery Plan progress: progress of work relative to forecasts set out in the Delivery Plan, and annual updates to the Plan, and expectations at the start of RP1	Meet or exceed expectations	

### Highways England Strategic Business Plan and Delivery Plan (2015-2020)

- 2.2.22 Highways England's Strategic Business Plan and Delivery Plan (2015-2020) responds directly to the Road Investment Strategy. The Strategic Business Plan defines Key Performance Indicators (KPIs) against which the performance of Highways England will be measured, based on the Performance Specification included in the Road Investment Strategy.
- 2.2.23 The SBP defines KPIs- against which the performance of Highways England will be measured, based on the Performance Specification included in the RIS.
- 2.2.24 Section 4 of the SBP gives the background to the subsequent publication of the Route Strategies for the entire national network, the relevant Route Strategy for the A47 Corridor being the East of England Route Strategy.

2.2.25 Seven Schemes are highlighted as being delivered in the East Region for Roads Period 1. No mention of any Feasibility Studies / Schemes in Roads Period 2.

2.2.26 Blofield to North Burlingham is not specifically mentioned in the document.

### **Highways England Delivery Plan (2015-2020)**

2.2.27 Highways England's Delivery Plan builds on the SBP and sets out in detail how the strategic outcomes and the Investment Plan will be delivered.

2.2.28 The A47 Blofield to North Burlingham is listed under the "Major Improvements Investment Plan Scheme Schedule 2015-2020" as one of the "Schemes identified following the outcomes from the six feasibility studies". The Feasibility Study relevant to the A47 corridor being The A47/A12 Corridor Feasibility Study (February 2015).

## **2.3 Local Policy**

### **New Anglia LEP Strategic Economic Plan**

2.3.1 New Anglia LEP's Strategic Economic Plan set out to address the regions' shortfalls and growth opportunities. The plan demonstrated the housing and employment commitments and potential growth locations with reference to specific improvements on the strategic road network in order to achieve this.

2.3.2 The New Anglia Strategic Economic Plan is produced by the New Anglia LEP and provides a plan for growth in Norfolk and Suffolk.

2.3.3 Section 6.94 of the plan describes the A47 Alliance which "brings together stakeholders from all along the route including GCGP LEP, has a list of priorities, a number of which are already programmed for 2015-2021. These could release at least 10,000 jobs and at least an increase in GVA of £400m per annum across the New Anglia area. We welcome the Government's commitment to Route Based Strategies across the whole of the trunk road network and to the Feasibility Study (February 2015) on the A47. These studies, together with the SEP, should provide the basis for future investment decisions on the trunk road network."

2.3.4 The plan identifies Blofield to North Burlingham as a LTB Priority and a National Network Improvement (Road) for 'dualling'. The A11/A14 corridor between Cambridge and Norwich is identified as a growth area for life sciences – which the LEP sees as one of the key industries for the region.

### **Norfolk County Council Local Transport Plan (2011-2026)**

2.3.5 The NCC LTP includes a number of objectives which seek to address transport issues for which the measures include:

- Document shows that the Norwich area is significantly constrained and that a Northern Distributor Road, running from the A47 in the east at Postwick to the A1067 in the north-west, is vital to help unlock development to the north-east of the city and improve connectivity between North Norfolk and the trunk road network. Delivery of the Postwick Hub will alleviate current capacity issues, serve new development at Broadland Gate and form the junction between the Northern Distributor Road and the A47. These improvements will also free up capacity on the existing road network in the city centre, providing the scope to implement a package of complementary measures including bus priority, walking and cycling improvements.
- Co-ordinating bus and rail links to improve access into the town centre

- Improving access to employment and services by public transport, cycling and walking, particularly from the deprived areas by promoting specific workplace buses and other initiatives as part of workplace travel plans, where possible.
- Improving strategic access to the area by road and rail, including the entry and exit points, which in turn may reduce the real and perceived remoteness of the area that may be inhibiting economic growth.

### **Joint Core Strategy for Broadland, Norwich and South Norfolk, 2011**

- 2.3.6 The Joint Core Strategy for Broadland, Norwich and South Norfolk is the key planning policy document for the Greater Norwich area. It forms part of the Local Plans for the districts of Broadland, Norwich and South Norfolk setting out the broad vision for the growth of the area and containing strategic policies for the period 2008 – 2026.
- 2.3.7 The complete adopted Joint Core Strategy for Broadland, Norwich and South Norfolk comprises the JCS document adopted in March 2011, as amended by the Broadland Part of the Norwich Policy Area: Local Plan, adopted in January 2014.
- 2.3.8 Para 3.19 of the JCS acknowledges the congestion issues on the A47 to the west of Norwich caused by the single carriageway Sections of the road through the area
- 2.3.9 “The A47 to the west provides strategic road access to the Midlands and North. It is mostly single carriageway in Norfolk and suffers from congestion and safety issues. Significant growth is proposed at East Dereham and King’s Lynn.”
- 2.3.10 Policy 6 of the JCS seeks to improve the transportation system in order to develop the role of Norwich as a Regional Transport Node, particularly through the implementation of the Norwich Area Transportation Strategy, and will improve access to rural areas. One of the ways this will be achieved is “by promoting improvements to the A11 and A47” The policy recognises that supported strategic improvements to aid delivery and economic success include A47 improvements to reduce the significant stretches that remain single carriageway.

### **South Norfolk Local Plan,**

- 2.3.11 2.3.10 In addition to the Joint Core Strategy the Local Plan is made up of various documents; each of which is developed in consultation with the community of South Norfolk before it is finally adopted.
- 2.3.12 2.3.11 The Adopted Development Plan Documents were adopted by the Council on 26 October 2015 and now form part of the development plan for South Norfolk.
- Site Specific Allocations and Policies Document
  - Wymondham Area Action Plan
  - Development Management Policies Document
  - Long Stratton Area Action Plan

### **Greater Norwich Local Plan**

- 2.3.13 South Norfolk Council, Broadland District Council, Norwich City Council and Norfolk County Council are working together to prepare the Greater Norwich Local Plan (GNLP).
- 2.3.14 The Greater Norwich Local Plan builds on the joint working arrangements for Greater Norwich, which have delivered the current Joint Core Strategy (JCS) for the area. The JCS



plans for the housing and job needs of the area to 2026 and the GNLP will ensure that these needs continue to be met to 2036.

- 2.3.15 Similar to the JCS the GNLP will include strategic planning policies to guide future development and plans to protect the environment. It will look to ensure that delivery of development is done in a way which promotes sustainability and the effective functioning of the whole area.
- 2.3.16 In addition to strategic planning policy the Greater Norwich Local Plan will also allocate land for development. Initial work to develop the Greater Norwich Local Plan has begun and the councils have begun preparing evidence to enable them to assess what the main needs and constraints of the three districts.

### **Broadlands District Local Plan (2011)**

- 2.3.17 Broadland's current local plan is made up of several documents:
- Joint Core Strategy DPD (Broadland, Norwich and South Norfolk) adopted 2011, amendments adopted January 2014
  - Development Management DPD adopted August 2015
  - Site Allocations DPD adopted May 2016
  - Growth Triangle Area Action Plan adopted July 2016
- 2.3.18 These documents set out the general and specific planning policies and also contain detailed local policies. They aim to help planning officers and applicants to achieve high standard of development in the district and they are the main guide to determining planning applications.
- 2.3.19 The Plan highlights sections of congested single carriageway on the A47 as requiring improvement to dual status.
- 2.3.20 The Plan supports these improvements by restricting development of land adjacent to the single carriageway sections for potential future improvements by Highways England.
- 2.3.21 The frequency and quality of HGV and Road Side Services are highlighted as below standard on the A47. The Plan highlights recommendations of a minimum of 12 miles and maximum of 24 miles apart for services, which the A47, in general, does not meet.
- 2.3.22 The Plan specifically identifies the single lane carriageway between Blofield and Acle as requiring improvement to dual status to support local demand and growth aspirations on the corridor.

### **Norwich Area Transport Strategy**

- 2.3.23 The latest version of Norwich Area Transport Strategy (NATS4) was agreed in 2004, with an updated Implementation Plan published in 2013.
- 2.3.24 The 2013 Implementation Plan sets a timetable for completion of bus priority measures on Newmarket Road between Norwich and Wymondham by 2021. These will include improved vehicles and bus priority measures at junctions.
- 2.3.25 The Implementation Plan also includes major junction enhancements at the Thicketon Interchange post-2015 (part of the A47 Improvements Programme).
- 2.3.26 Blofield to North Burlingham is not specifically mentioned within the document.

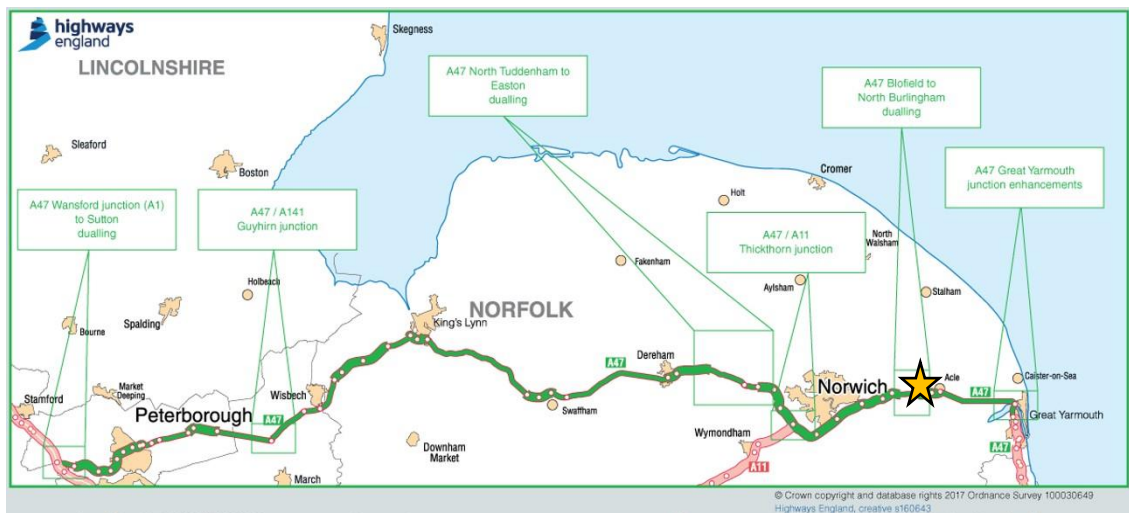
### 3 Existing Conditions

#### 3.1 Description of the Locality

##### A47 Corridor

- 3.1.1 The A47 and A12 trunk roads form part of the strategic road network and provide for a variety of local, medium and long distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 210,000) and Peterborough (population over 180,000), the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area. The route also passes through the Broads National Park. The location plan of the A47 corridor, including the 6 identified schemes from the RIS is shown in Figure 3-1 below and the Blofield to North Burlingham scheme is indicated with a yellow star.

**Figure 3-1 – Location Plan**



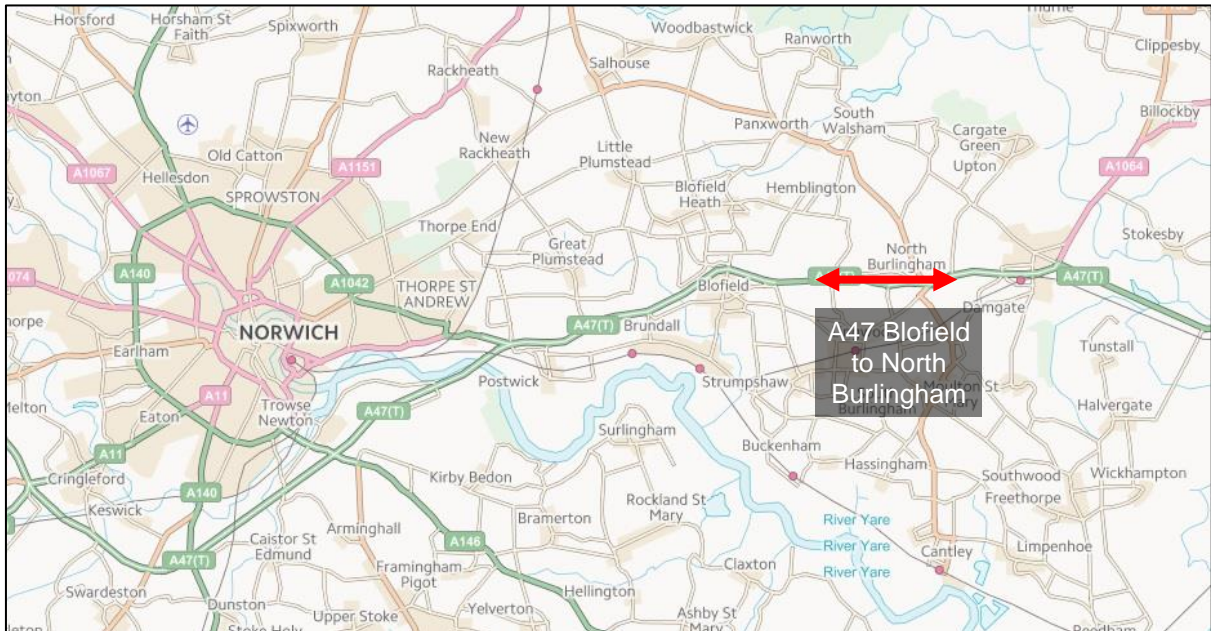
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- 3.1.2 Norwich and Peterborough have developed service-based economies and the towns along the route have retained market town and other functions including agricultural-related industry. In recognition of the potential on the eastern coast, the Chancellor announced in the 2011 budget the establishment of the Great Yarmouth and Lowestoft Enterprise Zone particularly for energy related businesses to maximise support for the offshore energy sector. In December 2013, the Government announced a Greater Norwich City Deal to enable knowledge based industries to develop.
- 3.1.3 There has been a rapid growth over the past decade and the area is expected to continue to grow. The cities of Peterborough and Norwich attract additional traffic along the route, particularly during the morning and evening peak periods.
- 3.1.4 The A47 Corridor is around 115 miles long; 54 miles (47%) is dual carriageway while 61 miles (53%) is single carriageway. Previous studies have proposed dualling a number of sections of the A47 in the short and long term, together with a number junction improvements.
- 3.1.5 The A47 Alliance, comprising of Local MPs, local government, businesses and other stakeholders, have been campaigning for comprehensive improvement of the A47. The aim is to capitalise on the potential economic benefits of improved accessibility to the Midlands and the North as well as address safety issues.

## Locality of the Scheme

- 3.1.6 The Blofield to North Burlingham section of the A47 is located approximately 9 kilometres to the east of Norwich. This 3.2km of single carriageway, forms a part of the main arterial highway route connecting Great Yarmouth to the east. The location of the scheme in relation to these population centres is shown in Figure 3-2.

**Figure 3-2 – Locality of the Scheme**



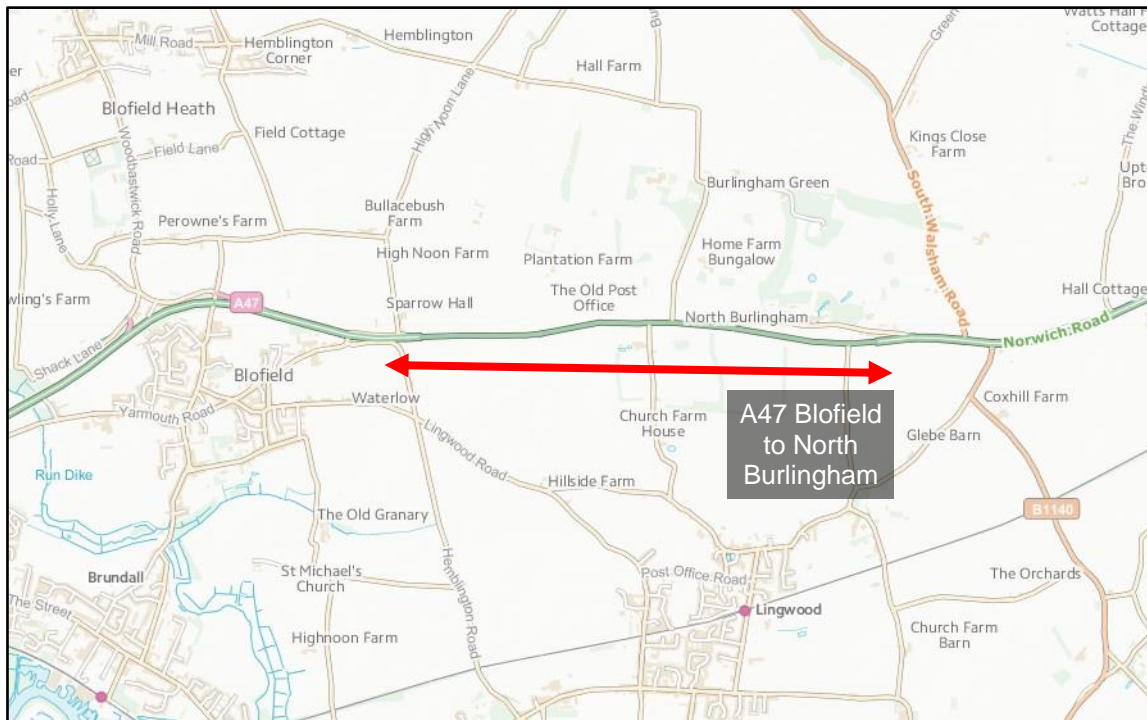
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- 3.1.7 Travelling from west to east towards Acle the A47 narrows from dual carriageway to single carriageway at the eastern outskirts of the town of Blofield, returning to dual carriageway to the south east of the village of North Burlingham. The villages in the surrounding area contain a number of domestic properties, businesses and places of interest.

## 3.2 Existing Highway Network

- 3.2.1 The following sections describe the existing highway network, the plan in Figure 3-3 shows the existing road network along the Scheme. Larger scale plans highlighting some of the key features along the Scheme are included in **Appendix A**.
- 3.2.2 The section of road is an important highway link for both local commuter traffic to and from the east of Norwich and for longer distance trips across the country travelling east and west. The scheme location is shown on Figure 3-3 below.

**Figure 3-3 – Local Highway Network**



Contains OS Data © Crown Copyright and database right (2016)

- 3.2.3 The following sections describe the existing highway network, the single carriageway is generally between 7.3 and 7.9m wide with central markings to delineate east and west bound traffic.
- 3.2.4 The existing single carriageway road in general terms from the west the horizontal alignment is a series of straights linked by short and fairly tight radius curves. There are no notable structures across the A47 east of Blofield until the village of Acle, 2.5km east of North Burlingham.
- 3.2.5 Travelling east the road has very low gradients and is generally at ground level. The speed limit on the sections of dual carriageway at either end of the scheme is the national speed limit; the speed limit within the single carriageway section is 50mph.
- 3.2.6 Footpath kerbing, including provision of tactile paving and dropped kerbs can be found within the section. A public right of way crosses the A47 west of North Burlingham. A lay-by develops on the north side of the A47 as it passes The Old Post Office. A kerbed footway is introduced at the back of the lay-by where there is a public telephone. This footway then continues adjacent to the eastbound carriageway. Dell Corner Lane joins the A47 at a T-junction on the north side 125m to the east of the Lingwood Road junction. The footway crosses the junction via dropped kerbs with tactile paving and continues eastbound, leaving the A47 and following North Burlingham's Main Road into the village. This in turn leads to Public Right of Way (PRoW) Burlingham FP1 running north of Main Road to The Green.
- 3.2.7 Opposite where the footway leaves the A47 a PRoW (Burlingham FP3) emerges onto A47 via a field access in the southern verge. Pedestrians walking west on the footway are directed across the A47 towards this right of way by a wooden fingerpost.
- 3.2.8 Sustrans online database highlights no national cycleways within this area.
- 3.2.9 The British Horse Society indicates that there are no bridleways within the area.

3.2.10 There are a number of side roads joining the A47 along the scheme length via at grade priority simple and right turn lane T junctions. From west to east the following side roads and junction types are noted:

- Yarmouth Road - T-junction
- Lingwood Road – T-junction
- Dell Corner Lane – T-junction
- Main Road – T-junction with eastbound exit link
- Lingwood Lane – T-junction
- Main Road – Left out only
- South Walsham Road – T-junction

3.2.11 There are direct accesses from the A47 into surrounding fields, one farm access track and one direct property access.

3.2.12 There are lay-bys on both sides of the road at the start of the single carriageway section travelling eastbound, a lay-by on the north side mid-way and on the south side before the recommencement of the dual carriageway.

3.2.13 There is no road lighting on this section of highway until the transition to dual carriageway at the eastern end.

### 3.3 Traffic

3.3.1 This section discusses the existing traffic conditions on the Blofield to North Burlingham section of the A47

#### Modelling

3.3.2 A review has been undertaken of available strategic models which may inform the study. Strategic models covering the A47/A12 corridor are summarised in **Table 3-1** below.

**Table 3-1 – Strategic Saturn Models covering the A47 Corridor**

Model	Geographical Scope	Model Base Year	Status
<b>East of England Regional Model (EERM)</b>	A47 and A12 routes	2006	Strategic SATURN model Age of base year data exceeds desirable time limit. The 2006 re-validation was based on additional RSI surveys in parts of Norfolk and Suffolk.
<b>Peterborough Transport Model (PTM)</b>	A47 (A1 to Thorney)	2003/ 2006	Strategic SATURN model Age of base year data exceeds desirable time limit.

Model	Geographical Scope	Model Base Year	Status
<b>Wisbech Area Transport Study (WATS) model</b>	A47 (A141 Guyhirn to B198 Lynn Road junction NE of Wisbech)	2008	Strategic SATURN model Base data is reaching time limit.
<b>King's Lynn Transport Model (KLTM)</b>	A47 (A17 to A149)	2007	Strategic SATURN model Base data is reaching time limit.
<b>Norwich Area Transportation Strategy (NATS)</b>	A47 from Dereham to Acle	2006/2012	Strategic SATURN model 2006 Base data is reaching time limit. Status of 2012 recalibration unclear.
<b>Great Yarmouth Area Transport Strategy (GYATS)</b>	Short section of A47 approaching Great Yarmouth A12 from A47 to Gorleston Golf Club on south edge of Great Yarmouth	2003	Strategic SATURN model Age of base year data exceeds desirable time limit.
<b>Lowestoft</b>	A12 – From B1375 north of Lowestoft to B1437 junction south of Lowestoft.	2001	Strategic SATURN model Age of base year data exceeds desirable time limit.

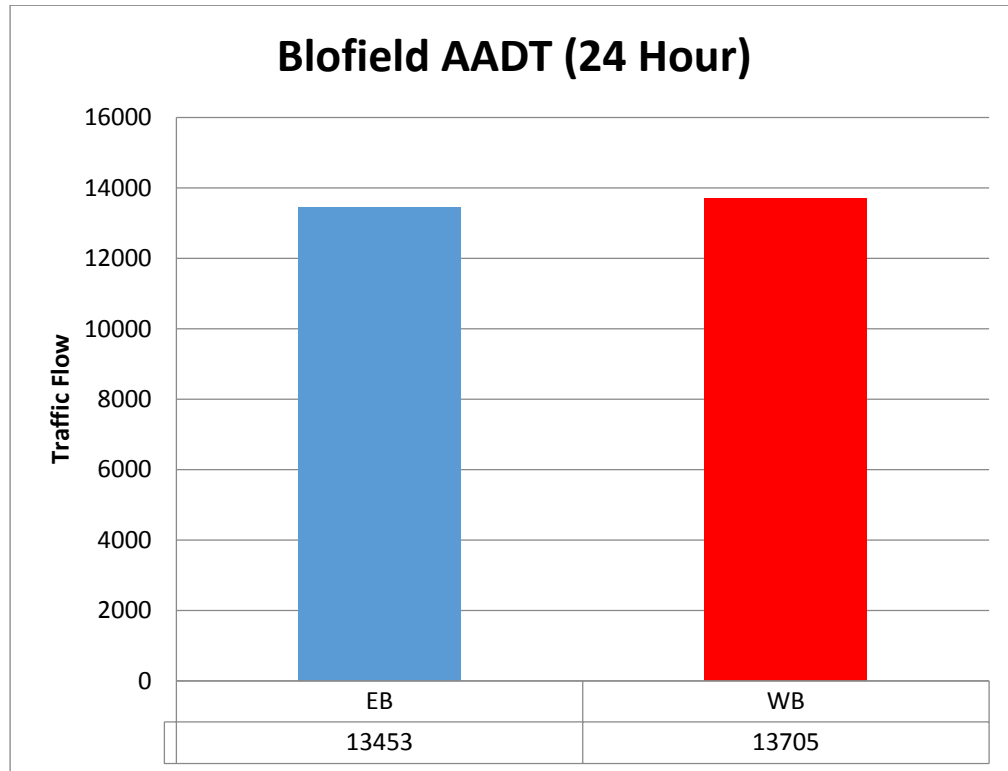
- 3.3.3 Currently suitable strategic modelling is not available for this study. Although some models exist the age of the base data is reaching or exceeds the desirable time set out in WebTAG guidance.
- 3.3.4 Following detailed discussion with Norfolk County Council with regard to the detail and status of the Norwich Area Transport Strategy (NATS) model and discussion with Highways England TAME with regards to transportation modelling an approach for updating and revalidating the NATS model for use as a transportation modelling tool to assess the Scheme was initially agreed.
- 3.3.5 The area covered by the NATS model also includes the areas for the other two RIS schemes in the Norwich Area, A47/A11 Thickthorn Junction and the A47 Blofield to Burlingham schemes. Due to programme constraints and to enable traffic forecasting and economic assessments to be completed prior to the end of PCF Stage 1, the initial agreed approach was to independently update and validate a separate version of the model locally to the three individual schemes.
- 3.3.6 Following further programme review of the likely time scales to combine and revalidate the models which would be required for PCF Stage 2, prior to route selection decisions it was agreed that a single NATS model update and validation exercise which covered the necessary detail to analyse all three of the Schemes would be undertaken. Due to the timescales involved in updating and validating a combined model the transportation forecasting and economics following the combined approach will not be available until PCF Stage 2. Further details are included in Chapter 12.

- 3.3.7 The following sections give details of the existing information available with regard to traffic on the section of the A47 between Blofield and North Burlingham.
- 3.3.8 The approach adopted for the A47/A12 Feasibility Study (2014) made use of existing available traffic data and made general assumptions about traffic growth. Existing traffic levels were generally sourced from the Highways England Traffic Flow Data System (TRADS) or DfT counts. In some cases, additional manual counts were undertaken.
- 3.3.9 Manual Classified Count (MCC) and queue length surveys were undertaken on Thursday 25th June 2015. Traffic flows for every hour of 2014 have been extracted from the TRADS database for the Blofield to North Burlingham section of the A47. Average Annual Daily Traffic (AADT) flows (24 hour) have been calculated based on this data.

**Existing Traffic Conditions**

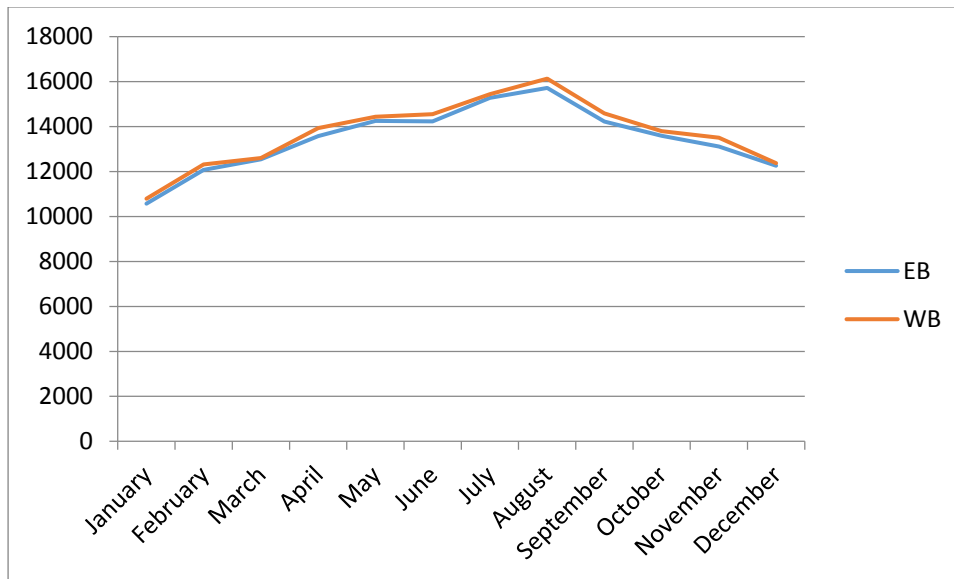
- 3.3.10 AADT flows on the A47 are shown in Figure 3-4 below. The data shows slightly higher flow in the westbound direction compared to the eastbound. It's not currently clear why this discrepancy exists and may simply be a result of how traffic data is captured for each carriageway

**Figure 3-4 – AADT Flows**



- 3.3.11 The daily total flows by month extracted from 2014 TRADS data on the scheme is shown on Figure 3-5. It shows noticeably higher flows in the period July to September. This is likely to be a result of summer tourist traffic to Great Yarmouth.

**Figure 3-5 – 2014 Daily Flows by Month Diagram**



3.3.12 The flow on this section of the A47 has 25.7% HGV's in the AM peak and 11.6% HGV's in the PM peak. HGV's have a greater impact on the operation of the highway than the same number light vehicles, increasing the potential for delays and congestion.

3.3.13 The theoretical capacity of the existing single carriageway has been calculated as 1,244 vehicles per hour per lane based on WebTAG Unit M3.1. The TRADS flows for 2014 has been compared against this threshold and the number of hours in which flow on the link reached or exceeded the theoretical capacity is shown in **Table 3-2** below number of hours near or above theoretical capacity in 2014.

**Table 3-2 – Number of hours near or above theoretical capacity in 2014**

Hours – per year (2014)	Eastbound	Westbound
Hours at or above theoretical capacity	482	655
Hours at or above 90% theoretical capacity	1064	1167

3.3.14 To put the figures in the table into context, there were 253 business days in the year 2014. Therefore on the assumption that times of highest flow occurred on business days, every working day has more than one hour in which the recorded flow is above or near the theoretical capacity of the road- see **Table 3-3**. The comparison of flows to theoretical capacity demonstrates that the single carriageway is currently reaching its capacity and therefore is highly susceptible to congestion.

**Table 3-3 – Average Hours per day near or above theoretical capacity in 2014**

Hours – per day average (2014)	Eastbound	Westbound
Hours at or above theoretical capacity	1.9	2.6
Hours at or above 90% theoretical capacity	4.2	4.6

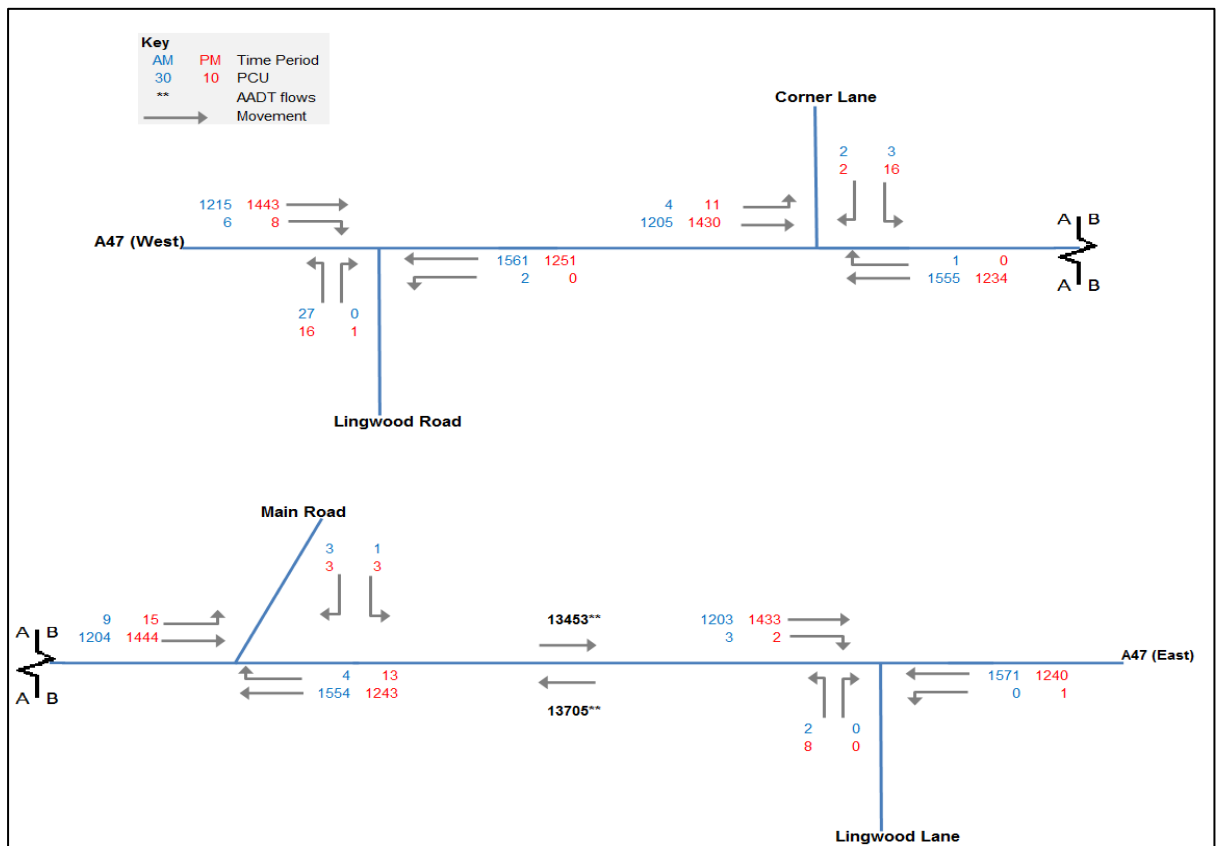
3.3.15 The figures do not record the affect that accidents or incidents on the links have on reducing the theoretical capacity of the road.

3.3.16 This situation is only expected to worsen with increased forecast traffic.



- 3.3.17 Although the calculation of theoretical capacity takes into account the percentage of HGVs, it does not take into account the effect of slower moving vehicles such as agricultural vehicles. The presence of these vehicles would negatively affect vehicle speeds and potentially the capacity of the road. On a single carriageway where there is limited opportunity to pass slower vehicles their presence will clearly impede the flow by reducing potential vehicle speeds on the road and hence reducing the number of vehicles which can use the route per hour.
- 3.3.18 The A47 Feasibility Report (Feb 2014) indicates that the average AM peak hour speed on the Blofield to North Burlingham section of the A47 is 69.5 km/h. It also indicates that the daily average speed on the section of road is 80 km/h.
- 3.3.19 The hourly variation in average speeds on the road can be an indicator of the congestion on the road. Generally, where average speeds are lower than the posted speed limit or drop for certain periods during the day the road is more likely to be congested. The lower figure in the AM peak against the daily average is a measure of the congestion on the link in the morning peak as vehicle speeds are limited due to numbers of vehicles and the lack of capacity provided by the single carriageway.
- 3.3.20 Junction turning count survey data was collected for junctions along the link late in June 2015. The turning count totals for the AM and PM peaks for significant junctions along the route show a slightly higher total flow in the PM peak than the AM peak.
- 3.3.21 The turning count figures are shown graphically in Figure 3-6 the number in the figure being shown in passenger car units (PCU's). In addition to the turning count data the AADT data for main line A47 flows has been shown on the diagram

**Figure 3-6 – 2015 Blofield to North Burlingham Flow Diagram**



- 3.3.22 The observed traffic movements highlighted above, show that the major movements are between the A47 arms in both peaks. There are some observed turning movements from the junctions; however, these figures are minimal.
- 3.3.23 The turning movements highlight, the left turn out of Lingwood Road onto the A47 westbound (27 AM and 16 PM), the right-hand turn from A47 westbound onto Main Road (13 PM), the left turn out of Corner Lane onto A47 eastbound (16 PM) and the left turn from A47 eastbound to Main Road (15 PM) are the highest observed from the data.
- 3.3.24 Using data extracted from the HATRIS Journey Time Database (JTDB), the report shows that the A47 Blofield to North Burlingham (westbound) has an average speed significantly lower than the daily average during the AM peak. This is an indicator of congestion and affects journey reliability on the link.
- 3.3.25 The Blofield to North Burlingham Scheme falls within the 'Next 15%' highlighted within the East of England Route Based Strategy (2014) on the A47 Corridor.
- 3.3.26 The 2012 Q4 Area 6 Route Report for Norfolk highlights the Blofield to North Burlingham link as above the National average collision and severity rating.

### 3.4 Collision Data

- 3.4.1 Records of collisions over the length of the scheme for the 5-year period between 1 Oct 2011 and 30 June 2016 have been reviewed. The locations and severities of collisions are shown in **Appendix B**.
- 3.4.2 A total of 33 collisions were recorded in the study area during this period. This includes 27 slight, 5 serious and 1 fatal collisions. The 33 collisions resulted in 58 casualties: 48 slight, 9 serious and 1 fatal.
- 3.4.3 This number peaked in 2014 when 10 collisions occurred.
- 3.4.4 Groupings of collisions can be seen at the Lingwood Road/Dell Corner intersections, the Lingwood Lane intersection, the B1140 South Walsham Road intersection and the B1140 Acle Road intersection.

### 3.5 Topography, Land use, Property and Industry

#### Topography

- 3.5.1 The topography of the study area falls in a south-western direction towards the River Yare. The land is generally flat and elevations vary between 10m and 20m above sea level.

#### Land use

- 3.5.2 The surrounding countryside is predominantly rural with a bias towards arable farming. Fields tend to be large and with hedgerow or fencing along the boundaries. There are few features of interest in the landscape. Woodland is scarce, although there are locally important areas of plantation and semi-natural woodland north of North Burlingham. Community woodland has been planted around the farm at Lingwood Road, just south of the A47.

#### Property

- 3.5.3 Housing tends to be concentrated in the villages of Blofield, Lingwood and Acle, although there are some scattered, isolated houses along the minor road network linking the villages. A significant number of these are associated with farms.

- 3.5.4 Blofield village has a population of 3,500 with approximately 800 homes and a mixture of commercial, retail and support services. At the eastern outskirts of the village, near the junction with the A47, there are several arable field plots together with a leisure / retail area that includes a garden centre, a café, a camping and leisure store, and a farm shop. There is some land currently being developed at Yarmouth Road, Blofield for housing.
- 3.5.5 North Burlingham lies approximately 80 metres north of the A47 and is accessed via Main Road that runs through the village with connections east and west. The village has approximately 35 residential properties, two churches, two business centres (15 units total), a plant nursery, scrap dealership, farm shops and a building supply merchants.

### **Industry**

- 3.5.6 The key industry in the area is farming. There are no areas of heavy industry.
- 3.5.7 There is a B&B located along Lingwood Road, south of the A47. Norwich School of Horticulture is in North Burlingham.

### **3.6 Climate**

- 3.6.1 All information in this section is sourced from the Met Office Website:

<http://www.metoffice.gov.uk/climate/uk/regional-climates/ee>

- 3.6.2 The mean annual temperature over the region varies from around 9.5 °C to just over 10.5 °C. Temperature shows both seasonal and diurnal variations. January and February are the coldest months with mean daily minimum temperatures across the region close to 1 °C. Mean daily maximum temperatures range from just over 6 °C to 8 °C during the winter months and from 20 °C to 23 °C in the summer.
- 3.6.3 Across most of the region there are, on average, about 30 rain days (rainfall greater than 1 mm) in winter (December to February) and less than 25 days in summer (June to August). Much of eastern England receives less than 700 mm per year and includes some of the driest areas in the country.
- 3.6.4 Eastern England is one of the more sheltered parts of the UK. As Atlantic depressions pass by the UK the wind typically starts to blow from the south or south-west, but later comes from the west or north-west as the depression moves away. Directions between south and north-west account for the majority of occasions and the strongest winds nearly always blow from this range of directions. Eastern England has the greatest frequency of tornadoes in the UK.
- 3.6.5 As climate change is likely to lead to warmer, wetter winters and drier, hotter summers with increased frequency of extreme flood events, Norwich Council has produced a Climate Change Strategy. With the majority of the study area used for agriculture, a change in climate can have serious consequences for local farmers with increased incidences of drought. The Climate Change Strategy highlights a number of actions required to adapt to a changing climate which include:
- 3.6.6 Cutting carbon emissions by reducing energy consumption and promoting a shift to low carbon technology
- 3.6.7 To improve Norfolk's resilience to the changing climate, including reduction of the socio-economic and environmental risks associated with flooding and coastal erosion.
- 3.6.8 Within Norfolk road transport accounted for around 31% of carbon dioxide emissions in 2006. As a rural area with limited public transport, private cars are an important mode of transport. Ways to reduce car usage within the district include improving public transport, promoting

alternative transport such as cycling, car sharing for school runs and additional park and ride facilities.

### 3.7 Highway Drainage & Flooding

3.7.1 No formal drainage surveys have been carried out at this stage. Information on the existing drainage system has been derived from a combination of:

- The Highways Agency Drainage Data Management System (HADDMS),
- Highways Asset Data from Integrated Asset Management Information System (IAMIS)
- Observations from Google Maps images

3.7.2 The carriageway is drained through a highway drainage network utilising a variety of drainage systems including:

- Kerb and gully
- Over edge run off
- Underground carrier and filter drain pipes with associated chambers
- Ditches
- Soakaways

3.7.3 HADDMS has a facility to show information on the service and structural condition of the drainage assets including pipework and chambers. However, for this section of the A47, the drainage assets have been classified as 'Not Graded', i.e. no such assessments have been carried out.

3.7.4 The existing drainage system will need to be investigated and verified on site to confirm the condition of it and outfalls particularly in any areas where it will remain in use or be adapted for future proposals.

3.7.5 For information on water courses, flood zones/plains, groundwater source protection zones, ponds and aquifers, see Chapter 4 (Environment including Environmental Status) and Chapter 16 (Environmental Assessment).

3.7.6 The scheme corridor is dominated by large agricultural fields. Field drainage systems are unknown at this time.

3.7.7 For this section of the A47 HADDMS shows two spots that had a carriageway Hot Spot flood severity 0 and 4. However, these are also classified as Closed Out, i.e. the issues have been resolved. Also, HADDMS does not show any records of spillages in this area.

### 3.8 Geology

3.8.1 This section provides information on the geology of the site that the scheme location. Further information can be found in the PCF Stage 2 Preliminary Sources Study Report, document reference A47-IMPS2-AME-BB-ZZ-DO-J0049.

3.8.2 British Geological Survey (BGS: [www.bgs.ac.uk/geoindex](http://www.bgs.ac.uk/geoindex)) records viewed on the Highways England Geotechnical Data Management System (HAGDMS: [www.hagdms.com](http://www.hagdms.com)) and displayed in **Appendix C** (Figure 1) identify the study area to be underlain by the following geological strata.

### **Artificial Geology**

- 3.8.3 Discreet areas of Artificial ground (Undivided) are recorded to the north and south of the existing A47 carriageway; however no artificial ground is recorded beneath the carriageway itself. The historic and recent infrastructure development of the site is however indicative of the likely presence of made ground beneath the existing carriageway and adjacent roads.

### **Superficial Geology**

- 3.8.4 The majority of the site is underlain by Lowestoft Diamicton Superficial deposits (unsorted sand and coarser particles in a mud matrix). The western end of the scheme has exposure of superficial Happisberg Glacigenic Formation Sand and Diamicton members. These have been exposed by apparent historic river erosion of the Lowestoft Formation of Quaternary age. All Superficial Deposits are dated from the Pliocene Epoch of the Quaternary Period (1.81 to 0.11 Million years before present).

### **Bedrock Geology**

- 3.8.5 The entire site is underlain by Bedrock of the Crag Group Sands and Gravels; dated from the Pliocene to Pliocene Epochs of the Quaternary Period (5.3 to 1.81 Million years before present).

### **Fault Geology**

- 3.8.6 No faults are recorded in the area of interest.

### **Historic Ground Investigation**

- 3.8.7 Borehole data provided in HAGDMS identifies thirty borehole records within 250m of the existing A47 carriageway. These holes have served to confirm the general geological model described by the geological mapping and noted above.
- 3.8.8 A review of the existing HAGDMS reports associated with A47 within the boundaries of the proposed development has been undertaken. Eleven relevant reports have been identified and will be reviewed as part of the Preliminary Sources Study Report (PSSR).

### **Sensitive Geological Sites**

- 3.8.9 A review of data available on HAGDMS does not identify any Sites of Special Scientific Interest (SSSI) relating to geologically sensitive sites. Data provided by the Geological Conservation Review (GCR) does not identify any GCR sites within the project area.

### **Geosure Datasets**

- 3.8.10 Geosure national datasets provide geological information about potential ground movement or subsidence that can help planning decisions. Geosure deposits are rated from A to E, with A indicating negligible risk, and E indicating deposits with potential for movement have been identified. A basic review of Geosure data for the site available on HAGDMS has been conducted and a detailed review of the data will be provide in the PSSR.
- 3.8.11 The entire project site is underlain by materials which are considered to have potential for collapse (Class B) when loaded or saturated. Soluble deposits are also present within the scheme extents which may present a risk to the scheme under extreme circumstances (Class A).
- 3.8.12 The Happisberg Glacigenic Formation is considered to present a possibility (Class C) of running sands; all other units are considered to have slight potential for running sands with rises in water level.

## Hydrogeology

- 3.8.13 Environment Agency (EA) and data available on HAGDMS provides the following information on the hydrogeological regime of the project area.
- 3.8.14 The Lowestoft Formation and Happisberg Formation (Diamicton) are described as unproductive aquifers, whereas the Happisberg Glacigenic Formation (sand) is defined as a Secondary A.
- 3.8.15 The underlying Crag Group is defined as a Principal Aquifer
- 3.8.16 The BGS Geoindex facility identifies four water wells in close proximity to the existing A47 within the area of interest.
- 3.8.17 The western extent of the site falls within Zone 3 of a source protection zone for ground water abstraction located 2.7km south of the A47.

## Hydrology

- 3.8.18 Environmental Agency data available on HAGDMS indicates that the site has no main rivers, recorded flood events. The PSSR will fully investigate the hydrological regime of the site.

## Geomorphological Review

- 3.8.19 Based on available topographic survey information provided by HAGDMS displayed in **Appendix C** the landscape is broadly flat with a minor channel feature running northeast to southwest.
- 3.8.20 A series of earthworks accommodating the existing A47 carriageway are recorded on HAGDMS; earthworks data is listed in **Table 3-4**.

**Table 3-4: A47 Existing Earthworks**

Earthwork	Type	Length	Max Height	Max Slope	Comment
<b>Eastbound Carriageway</b>					
6_A47_8411	Cutting	333m	3.5m	24°	Ch139-143m filled void under carriageway (Dec 2006) HD41/03 Class 3C
6_A47_38996	At-Grade	93m	0m	0°	-
6_A47_8417	At-Grade	342m	0m	0°	-
6_A47_39537	At-Grade	316m	0m	0°	-
6_A47_538	At-Grade	36m	0m	0°	-
6_A47_7669	At-Grade	691m	0m	0°	Ch200-247m Retaining wall
6_A47_38963	At-Grade	713m	0m	0°	-
6_A47_7670	At-Grade	233m	0m	0°	-
6_A47_39817	At-Grade	91m	0m	0°	-
6_A47_39818	At-Grade	637m	0m	0°	-
6_A47_39819	At-Grade	172m	0m	0°	-
6_A47_39208	At-Grade	156m	0m	0°	-
6_A47_39207	At-Grade	290m	0m	0°	Ch155m cracked pavement
6_A47_39206	At-Grade	318m	0m	0°	Ch267-272m Hydrophyllic vegetation
6_A47_39205	At-Grade	421m	0m	0°	-
6_A47_39204	At-Grade	79m	0m	0°	-
6_A47_7672	At-Grade	16m	0m	0°	-

Earthwork	Type	Length	Max Height	Max Slope	Comment
6_A47_7671	At-Grade	702m	1.4m	20°	End of Site at Ch340m
<b>Westbound Carriageway</b>					
6_A47_7681	At-Grade	94m	0m	0°	-
6_A47_7678	At-Grade	880m	1.1m	21°	Ch372m Transverse cracking
6_A47_7676	At-Grade	586m	0m	0°	Ch32m Transverse cracking
6_A47_7662	At-Grade	172m	0m	0°	-
6_A47_39467	At-Grade	1089m	0m	0°	-
6_A47_7666	At-Grade	1322m	0m	0°	Ch1118-1128m Slip at edge of drainage channel Feataure Grade 3  Ch1136-1146m Slip at edge of drainage channel Feataure Grade 3. Reinforced with sand and cement bags
6_A47_8419	At-Grade	260m	0m	0°	-
6_A47_8421	Cutting	490m	7m	21°	-

### 3.9 Unexploded Ordnance

3.9.1 A review of Unexploded Ordnance was undertaken and the area was considered low for the Scheme. Further assessment will be undertaken during the PSSR.

### 3.10 Mining

3.10.1 Coal Authority data held by HAGDMS indicates there are no coal mining related features, hazards or deposits within or in proximity of the site. Similarly, brine features are not identified in or around the site.

3.10.2 HAGDMS records three ceased opencast pits in proximity to the A47. Sand and gravel mineral sites as well as 4 No. ceased opencast limestone mineral sites are recorded within the vicinity of the site. **Table 3-5** provides details of these features.

**Table 3-5: Ceased Mineral Extraction Sites**

Name	Commodity	Geological Unit	X (NGR)	Y (NGR)
Burlington St. Andrew Sand Pit (1)	Sand	Crag Group	635100	309800
Burlington St. Andrew Sand Pit (2)	Sand	Crag Group	635330	309950
Hall Farm Pit	Sand and Gravel	Lowestoft Formation	638560	310050

### 3.11 Public Utilities

3.11.1 Utilities records in the area have been requested and, where these have been provided, the following information is available (STATs plans located in **Appendix D**):

3.11.2 Overhead electrical and buried communications cables are located in the eastbound and westbound verge of the A47 between Yarmouth Road and Hemblington Road. A medium pressure gas main is located in the westbound verge of the Yarmouth Road. The gas main

enters the A47 westbound verge and runs eastwards to Lingwood Lane where it veers southeast away from the A47.

- 3.11.3 Communications cables are located in A47 westbound verge throughout the total length. Communications and BT cables are also located in the eastbound verge of the A47 throughout the majority of the length. BT cables divert away from the A47 along Main Road at North Burlingham before re-joining the A47 to the east whereas the communications cables follow the line of the existing A47 throughout. There are a number of BT cable crossings of the A47 in the vicinity of Acle Road.
- 3.11.4 Water mains are located on the A47 in the westbound verge between Lingwood Road and Main Road; in the eastbound verge between Main Road and South Walsham Road; in the westbound verge to the east of Acle Road and in the westbound verge of Main Road.
- 3.11.5 Street lighting is located on the A47 dual carriageway section between Lingwood Lane and the eastbound layby to the east of Acle Road.
- 3.11.6 There are numerous locations where high voltage overhead electric cables cross the A47 throughout the length of the scheme.

### 3.12 Technology

- 3.12.1 From the asset data records provided to date and from visit to site the following key technology information along the length of the scheme was noted:
- 3.12.2 A Traffic Master camera with small feeder pillar is located in the A47 westbound verge at the junction with Lingwood Road.
- 3.12.3 Traffic loops (traffic counts) are located in the A47 eastbound and westbound carriageways approximately 50m west of Lingwood Lane. Loops are fed from a solar panel mounted on a post in the westbound verge adjacent to the loops.
- 3.12.4 An illuminated 50mph advisory message sign is located in the A47 central reserve facing westbound traffic 150m to the east of Acle Road.
- 3.12.5 A BT telephone is located in the A47 eastbound layby to the east of Lingwood Lane.
- 3.12.6 Asset data refers to 3 communications cabinets between Hemblington Road and Main Road. The presence of these communications cabinets was not evident from visual inspection.

### 3.13 Maintenance Access

- 3.13.1 There is limited existing infrastructure for maintenance at this location but there are a number of laybys as set out in Chapter 3.2.



## 4 Environment including Environmental Status

### 4.1 Introduction

- 4.1.1 The purpose of this chapter is to provide an overview of the existing environment where the proposed scheme will take place. It is based on Chapter 2 of the PCF Stage 1 Environmental Assessment Report (EAR) and its associated drawings and provides a summary of the key environmental receptors within the study area defined for the scheme, see **Appendix E**. Chapter 2 of the PCF Stage 1 EAR provides details of the methodology used to characterise the environmental baseline and describe its sensitivity to change.

### 4.2 Air Quality

#### Introduction

- 4.2.1 This section provides a summary of the air quality and greenhouse gas baseline within the study area, along with the key constraints which could result from changes in air and greenhouse gases.

#### Baseline Conditions

- 4.2.2 The study area is largely rural in nature and the main source of air quality pollutants is from road traffic along the A47 and the minor road network. Blofield and North Burlingham fall under the remit of Broadland District Council, which has a duty under the Environmental Protection Act 1990 to review and monitor air quality in the district. Existing air quality in the study area is deemed to be good, as the council has not declared any Air Quality Management Areas. There is a non-automatic nitrogen dioxide monitoring diffusion tube located at the junction of the A47 and Main Street, North Burlingham. The recorded level of nitrogen dioxide in 2014 was  $30.8\mu\text{g}/\text{m}^3$ . This is below the annual mean air quality objective for nitrogen dioxide of  $40\mu\text{g}/\text{m}^3$ .
- 4.2.3 Background levels of nitrogen dioxide and Particulate Matter (PM) of 10 microns or less were approximately  $11\mu\text{g}/\text{m}^3$  and  $17\mu\text{g}/\text{m}^3$  respectively in 2016. These levels fall within the required air quality objectives of  $40\mu\text{g}/\text{m}^3$  for nitrogen dioxide and PM10.

#### Receptors

##### Human exposure

- 4.2.4 There are a number of residential and community receptors located within the study area, mainly concentrated in Blofield, Lingwood and North Burlingham. Especially sensitive receptors include schools and nursing homes, and there are two nursery schools, a primary school and a nursing home located in the area. Within the study area there is a total of 1300 houses and 15 community facilities. Community facilities include playing fields and recreational walks.
- 4.2.5 Receptor counts are shown in Table 4-1 and presented on PCF Stage 1 EAR Figure 2.4.1.

**Table 4-1: Air Quality Receptors**

Type	Count
Community	15
Residential	1300
Commercial	17
Development (residential dwellings under development)	258

**Designated Sites**

- 4.2.6 There are no designated sites or other ecological receptors within the study area sensitive to changes in air quality.

**Key Constraints**

**Temporary (construction)**

- 4.2.7 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust and exhaust gas pollutants and are therefore potential constraints to development.
- 4.2.8 Risks from construction dust come from the inhalation of particles suspended in the air and through the deposition of particles on receptor surfaces. Construction dust can include material that contributes to ambient concentrations of fine PM and far coarser particles. There are no statutory limit values for deposition, however, dust from wet or dry deposition on receptor surfaces can result in a loss of amenity, and as such is considered a statutory nuisance under the Environmental Protection Act 1990. Risks from construction vehicles and plant come from the inhalation of exhaust gas emissions which include the same pollutants as road traffic.
- 4.2.9 Receptor sensitivity is considered medium to the risk of amenity impacts from construction dust. With proper mitigation, the risks of construction dust can be significantly reduced. Receptor sensitivity is considered very high to the risk of emissions of construction vehicle and plant exhaust gas emissions.

**Permanent (local air quality)**

- 4.2.10 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of vehicle exhaust gas pollutants and are therefore potential constraints to development.
- 4.2.11 Permanent risks to local air quality can result from changes in the alignment of road centrelines and road edges to a position closer to sensitive human and ecological receptors, and through changes to traffic, such as volume, composition, speed and flow. Whilst realignment of the road may reduce the distance between pollutant source and receptors, this may be countered by improvements in flow that reduce stationary or low-speed traffic and the amount of time that engines are operating at sub-optimal levels. Changes in composition that can affect ambient air quality could be the proportion of HGV to LGV traffic that could result in changes to the release of particulate matter, NO<sub>x</sub> and NO<sub>2</sub>.
- 4.2.12 All receptors within the study area are considered to be exposed to this risk and their sensitivity is considered very high because emissions from road traffic have the potential to cause mortality.

- 4.2.13 Pollutant concentrations will not be impacted in any AQMAs because there are no AQMAs in the study area.

#### **Risk to ecosystems**

- 4.2.14 There are no ecological receptors within the study area which could act as a constraint to the development.
- 4.2.15 Deposition of sulphurous compounds and their acidic effects is no longer considered a risk due to the removal of sulphur from road fuels and is not a constraint to development.

#### **Compliance risk (EU Directive on ambient air quality (2008/50/EC))**

- 4.2.16 The Compliance Risk is the likelihood that the EU air quality limit values are exceeded either in the study area or at locations on the local Compliance Risk Road Network linked to the route corridor. The latest UK air quality compliance report states that the Eastern non-agglomeration area in which the study area is located, did not meet the EU mean annual average limit values for NO<sub>2</sub>, but did comply with other objectives.
- 4.2.17 Whilst it is uncertain whether there will be exceedances locally on the network resulting from modifications to the A47, there is the risk that the compliance risk could increase in the wider Eastern non-agglomeration area.

### **4.3 Cultural Heritage**

#### **Introduction**

- 4.3.1 This section provides a summary of the cultural heritage assets within the study area, and the key constraints on any potential scheme resulting from impacts on such assets are described.

#### **Baseline Conditions**

##### **Scheduled Ancient Monuments**

- 4.3.2 There are no scheduled monuments within the study area.

##### **Recorded Archaeological Sites**

- 4.3.3 There are 124 recorded sites, monuments and finds located across the study area. The known archaeological resource comprises sites dating from the Bronze Age through to the 20<sup>th</sup> century. They include a small Bronze Age Barrow cemetery located to the south east of Blofield; an Iron Age or early Roman enclosure and associated field system to the north of High Noon Lane and two possible Roman enclosures along Lingwood Lane. These are shown on PCF Stage 1 EAR **Figure 2.5.1**.

##### **Unrecorded Archaeological Remains**

- 4.3.4 The known archaeological sites record within the study area suggests that there is high potential for further buried archaeological remains to survive.

##### **Listed Buildings**

- 4.3.5 Within the study area are located 23 listed buildings, as shown in **Table 4-2** and on PCF Stage 1 EAR **Figure 2.5.1**

**Table 4-2: Listed Buildings within the Study Area**

Map ref.	NMR No.	UID No.	Grade	Description
1	1391670	496175	II	Blofield Court House, Yarmouth Road, Blofield
2	1152821	228459	II	Hollybank and garden wall, Yarmouth Road, Blofield
3	1152819	228457	II	The White House, North Street, Blofield
4	1051518	228460	II	Turrett House, Yarmouth Road, Blofield
5	1304590	228448	II	Beech House, Church Road, Blofield
6	1304595	228451	I	Church of St Andrew & Peter, Church Road, Blofield
7	1051516	228449	II	The Rookery, Church Road, Blofield
8	1051517	228452	II	Church Farm Barn, Church Road, Blofield
9	1372652	228450	II	Thatched Cottage, Church Road, Blofield
10	1152807	228456	II	Little Timbers, Danesbower Lane, Blofield
11	1304603	228455	II	Owls Barn, Lingwood Road, Blofield
12	1051521	228467	I	Church of St Peter, Church Road, Lingwood
13	1263410	228576	II	Manor Farm, west barn and attached building to southeast and south west, Church Road, Lingwood
14	1051477	228575	II	Manor Farm, east barn and attached building to southeast and south west, Church Road, Lingwood
15	1051523	228471	II	Thatched Cottage, Post Office Road, Lingwood
16	1152881	228477	II	School House, 39 School Road, Lingwood
17	1051526	228476	II	The Manor House, School Road, Lingwood
18	1152869	228470	II	Home Farm House, Dell Corner Lane, N.Burlingham
19	1051522	228468	I	Church of St Andrew, Main Road, N.Burlingham
20	1304547	228469	II	Church of St Peter, Main Road, N.Burlingham
21	1051527	228478	II	Lingwood Lodge, S.Burlingham Road, Lingwood
22	1068835	359871	II	Bullock shed, Whites Farm, The Windle, Fishley
122	1372653	228454	II	House at Owls Barn, Lingwood Road, Blofield

#### **Undesignated Historic Buildings and Structures**

- 4.3.6 A review of the Historic Environment Record for Norfolk indicates there are a large number of undesignated heritage assets located throughout the study area. These are mostly buildings which range from probable post medieval cottages and farm buildings to a milepost along the A47. Other assets include cropmarks identified from aerial photography, stray finds from field walking, sites identified from historic maps and information from previous archaeological investigations.
- 4.3.7 Across the study area an array of stray finds have been recovered representing all periods from the Mesolithic to post medieval. The greatest concentration of finds were recovered from the former Burlingham Park at North Burlingham.

#### **Registered Parks and Gardens and Battlefields**

- 4.3.8 There are no registered parks and gardens or battlefields within the study area.

### **Conservation Areas**

- 4.3.9 There are no conservation areas within the study area.

### **Historic Landscape**

- 4.3.10 The historic landscape of the study area reflects the influence of agricultural intensification of the 20<sup>th</sup> century. Relict landscapes survive in the form of two post medieval landscape parks, one to the west of Burlingham Green associated with Burlingham House and the other to the north of North Burlingham associated with Burlingham Hall.

### **Key constraints**

- 4.3.11 There are 23 listed buildings located within the study area. They are assigned a High value due to the designated status. There is the potential for the scheme to have a direct or indirect impact upon these designated heritage assets or their settings.
- 4.3.12 There are 15 undesignated historic buildings and structures located within the study area. Their contribution to the historic character of the wider landscape is beyond the scope of this study, but they are likely to be of local significance and are therefore of low value.
- 4.3.13 There are 124 recorded archaeological sites, monuments and findspots dating from the Mesolithic to the post-medieval within the study area. Of these 23 are un-investigated cropmarks/soilmarks and nine are geophysical surveys, eight of which positively indicated archaeological activity. There is the potential that many of these sites represent prehistoric to Roman activity and are therefore of medium value. The findspots are indicative of human activity within the landscape from the Mesolithic period onwards but will not be physically impacted by any future development; consequently, they are of negligible value. The 11 demolished structures depicted on OS map probably originated in the post medieval period. These sites are of local significance and are therefore of low value. Some could be directly impacted by the scheme.
- 4.3.14 The wealth of recorded archaeological sites within the study area indicates that there is the potential for currently unrecorded archaeology to survive. This potential increases with greater land take. The value of this resource is uncertain.
- 4.3.15 Locally significant historic landscapes have been identified in the area around North Burlingham and Burlingham Green, including areas of 18th and 19th century relict landscape parks and associated field systems. These landscapes are of low value. There is the potential for the scheme to directly or indirectly impact upon these landscapes.

## **4.4 Landscape and Visual**

### **Introduction**

- 4.4.1 This section outlines the various landscape and visual constraints within the study area and identifies their sensitivity to change.
- 4.4.2 Landscape and visual characterisations are undertaken as separate procedures. Landscape impacts are the changes to the physical landscape which change landscape character, while visual impacts are the modifications to existing views and how the landscape is experienced by people (visual receptors).

### **Baseline Conditions**

#### **Landscape Designations**

- 4.4.3 There are no designated landscapes or registered parks and gardens within the study area.

### **National Character Areas**

- 4.4.4 The study area lies within the National Character Area (NCA) North East Norfolk and Flegg. The inland section of the NCA is a rich agricultural area with small to medium scale fields and is mainly unwooded. Isolated farmsteads and small villages with large medieval churches are linked by a dense network of lanes. The study area is located in the south west of the NCA with the main commuter villages of Brundall and Blofield close to the city of Norwich.

### **Local Landscape Character Areas**

- 4.4.5 On a more local level, the study area lies within the Blofield Tributary Farmland Landscape Character Area (LCA) and the Freethorpe Plateau Farmland LCA, as shown on PCF Stage 1 EAR **Figure 2.6.1**. The Landscape Character Assessment undertaken by the Broadland District Council describes the Blofield Tributary Farmland LCA as having a strong rural character, a mosaic of rolling arable fields and mature woodland within the grounds of old houses, and strong landscape setting of historical halls and churches.
- 4.4.6 The Freethorpe Plateau Farmland LCA is described as having an open, rural character, with sparse settlement, historic landscape features such as ponds, hedgerows and tracks and wide views over a vast arable landscape.

### **Land cover, pattern and texture**

- 4.4.7 Land cover is predominantly arable, with some blocks of plantation woodland, particularly around North Burlingham and Burlingham Green, north of the current A47 alignment. To the south of the A47 the land is more open and dominated by arable farmland. **Figures 4.1** and **4.2** show the typical landscape.

**Figure 4-1: View south towards the A47 of arable fields with hedges and treelines. Traffic on the A47 is visible in the distance.**



**Figure 4-2: View from junction of Lingwood Lane and Acle Road, looking north east**



### Scale and appearance

- 4.4.8 The field sizes and hedgerow boundaries create a variety of close horizons and areas with a small-scale, enclosed character. Church towers and woodland to the north of the A47 create memorable features in these views.

### Tranquillity

- 4.4.9 Although the study area is located in rural Norfolk, its proximity to Norwich and the fact that the A47, a major transport route, cuts through the study area results in a loss of tranquillity. The tranquillity within the study area increases as the distance from the road increases.

### Cultural

- 4.4.10 There are 23 listed buildings in the study area which range from Medieval parish churches to 18<sup>th</sup> and 19<sup>th</sup> century farmhouses and cottages. The historic landscape reflects the intensification of agriculture in the later 20<sup>th</sup> century, with remnants of historic parklands associated with Burlingham House and Burlingham Hall.

### Human Interaction

- 4.4.11 The road network is composed of the A47 and associated minor roads which connect the settlements of Blofield, North Burlingham, Lingwood and Acle with Norwich and beyond. There are limited footpaths along the roads, but there is a comprehensive Public Rights of Way network throughout the study area. This allows pedestrians to move through the landscape away from the A47.

### Visual Receptors

- 4.4.12 Visual receptors in the study area include the scattered houses along the A47 and the minor road network. Many of these properties are surrounded by mature vegetation and views towards the roads are generally obscured. These include properties at Main Road, Lingwood Road and Lingwood Lane. Properties along the A47 such as the Old Post Office have partial views of the road with some mature vegetation obscuring views.
- 4.4.13 Users of the Public Rights of Way (PRoW) network in the study area are also considered visual receptors. These are shown on EAR **Figure 2.6.3**. Views from the PRoWs are variable, from wide views across arable land to enclosed views where they go through wooded areas.

### Key constraints

- 4.4.14 The areas of locally significant woodland to the north of the A47 provide a constraint to development as any impact on them will significantly affect the local landscape.
- 4.4.15 The arable landscape is moderately sensitive to change as given the generally flat nature of the surrounding countryside any new infrastructure would be visible in the wider, extensive area.
- 4.4.16 The scattered farmhouses and clusters of dwellings on the minor road networks and along the A47 are sensitive to change, as new infrastructure may be prominent in their views which had previously been of quiet, tranquil countryside.



## 4.5 Nature Conservation and Biodiversity

### Introduction

4.5.1 This section outlines the various ecological constraints within the study area and identifies their sensitivities to change. It is informed by baseline information gathered through a desk top study and fieldwork undertaken by Amey ecologists in spring/summer 2016.

### Baseline Conditions

#### Designated Sites

4.5.2 There are three internationally designated sites within 10km of the project and one nationally designated site. These are shown on PCF Stage 1 EAR **Figure 2.7.1** and listed in **Table 4-3** below with their distance from the A47 and qualifying features.

**Table 4-3: Designated Sites**

Designated site	Distance from A47	Reason for designation
The Broads SAC	1.17 km SW (from A47 at Brundall)	Site of the largest example of calcareous fens in the UK with examples of transition mire. Rare fauna and flora species as well as protected freshwater mammals are qualifying features: Desmoulin's whorl-snail <i>Vertigo moulinsiana</i> , little whirlpool ram's-horn snail <i>Anisus vorticulus</i> , fen orchid <i>Liparis loeselii</i> , and otter <i>lutra lutra</i> .
Broadland SPA	1.17 km SW (from A47 at Brundall)	Annex 1 species from which the site derives its designation include: Eurasian bittern <i>Botaurus stellaris</i> , Bewick's swan <i>Cygnus columbianus bewickii</i> , marsh harrier <i>Circus aeruginosus</i> , hen harrier <i>Circus cyaneus</i> and ruff <i>Philomachus pugnax</i> .
Broadland Ramsar	1.17 km SW (from A47 at Brundall)	Low-lying wetland complex straddling the boundaries between east Norfolk and northern Suffolk. Includes river valley systems of the Bure, Yare, and Waveney. Occupying the same extent as Broadland (SPA).
Decoy Carr, Acle SSSI	0.6km S (from Acle on the A47)	Lowland, fen, marsh, and swamp with wet carr woodland. Designated for floral species of note such as marsh sow-thistle <i>Sonchus palustris</i> , mixed fen vegetation, and rare mosses like <i>Cinclidium stygium</i> and <i>Camptothecium nitens</i> .

4.5.3 A large number of local sites are present within 2km of the project of which the closest are:

- Church and Drive Plantation County Wildlife Site (0.14km north)
- Belt Plantation County Wildlife Site (0.56km north)
- Woodbastwick Road Roadside Nature Reserve (0.29km north west).

### Habitats

4.5.4 Priority habitats within the study area include traditional orchards, lowland mixed deciduous woodland and ponds.

### Phase 1 habitat survey

- 4.5.5 A phase 1 habitat survey was carried out during April 2016 to map the habitats within the study area. The main habitat was grassland and arable, with some areas of plantation woodland. Field boundaries were generally composed of hedgerows with scattered trees. A number of ponds or standing water in ditches were also recorded. Other habitats recorded include tall ruderal, allotments, ephemeral/short perennial, introduced shrub, marshy grassland and bare ground.

### Protected and Notable species

- 4.5.6 Following the phase 1 habitat survey and records search the study area has potential to support the following protected and notable species:
- Amphibians – 39 ponds were tested for eDNA for great crested newt *Triturus cristatus* (GCN) and of these five tested positive with three indeterminate. This confirms the presence of GCN within the study area.
  - Badger - two badger setts were identified within the study area, as well as field signs such as latrines and footprints, confirming that badgers are present in the study area.
  - Bats - throughout the study area are numerous trees and groups of trees suitable for use by roosting bats. Habitat connectivity is good with hedgerows, lines of mature trees and pockets of woodland providing suitable foraging and commuting habitat for bat species.
  - Birds - suitable areas of habitat are also present throughout the study area for a range of bird species. Barn owl boxes were noted in the area and a dead owl *Tyto alba* was recorded during the habitat surveys. Other notable bird species recorded in the area include marsh harrier *Circus aeruginosus* and skylark *Alauda arvensis*. The arable fields also provide suitable foraging habitat for a range of overwintering birds, such as whooper *Cygnus cygnus* and Bewick's *Cygnus columbianus Bewickii* swans. There are also records of a number of birds of conservation concern.
  - Otter and water vole – ditches and ponds within the study area provide suitable habitat for water vole *Arvicola amphibius*, however there is a lack of large watercourses that would be suitable for otter *Lutra lutra*.
  - Reptiles – no records were available but during the phase 1 survey common lizard *Zootoca vivipara* was observed. Previous surveys have also recorded grass snakes *Natrix natrix* in some of the ponds. Suitable areas for refugia are located throughout the study area.
  - Invertebrates – numerous records of invertebrates were supplied. The Acle Straight, east of the study area along the A47 is a known site for the little whirlpool ram's-horn snail *Anisus vorticulus*. Drainage ditches and wetland areas in the vicinity provide suitable habitat for a range of invertebrate species.

### Invasive species

- 4.5.7 Invasive species recorded in the study area include American mink *Mustela vison*, Himalayan balsam *Impatiens glandulifera*, Muntjac deer *Muntiacus reevesi*, Spanish bluebell *Hyacinthoides hispanica* and rhododendron *Rhododendron ferrugineum*.

### Key constraints

- 4.5.8 Values assigned to key ecological features are given in **Table 4-4** and have been assigned using desk and field study information available to date alongside professional judgement.

**Table 4-4: Ecological Features**

Ecological Feature	Resource valuation
<b>Designated Sites</b>	
The Broads (SAC)	International
Broadland (Ramsar/SPA)	International
Decoy Car, Acle (SSSI)	National
All CWSs	County
<b>Habitats</b>	
Priority habitats	County
Important hedgerows	County
Other hedgerows	Local
All other habitats	Local
<b>Protected/notable species</b>	
Great crested newt	County
Breeding bird species	National
Wintering bird species	Not assigned
Terrestrial Invertebrates	Local
Little Ramshorn Whirlpool Snail	National
Other aquatic invertebrates	Local
Badger	Local
Bat	Regional
Otter	County
Reptiles	Local
Small-flowered catchfly	National
Veteran trees	Local
Invasive species	Negative

## 4.6 Materials

- 4.6.1 Most construction, improvement and maintenance schemes on the road network will require the acquisition and use of primary raw materials and manufactured products, and this scheme will require large quantities of raw materials, the use of which has the potential to cause adverse impacts such as the depletion of natural resources and the generation of waste.
- 4.6.2 **Table 4-5** identifies the materials use and potential waste that are likely to arise from the scheme.

**Table 4-5: Summary of materials and waste that have potential to generate significant environmental effects**

Project Activity	Material use and potential to generate effects	Potential waste arisings and potential to generate effects
Site remediation / preparation / earthworks	Site clearance will involve the removal of street furniture (e.g. street lightening, cabinets, CCTV) and traffic signs as well as any affected boundary walls and fencing. These should be retained wherever possible for reuse after the scheme's completion.	The scheme will involve considerable earthworks with all excavated earthwork material being re-used on site (where possible) rather than disposed of and importing virgin aggregates. Maximising the reuse of materials won on site for example through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials needing to be imported onto the site and reduce the number of haulage journeys. This practice will have its own cost benefits

Project Activity	Material use and potential to generate effects	Potential waste arisings and potential to generate effects
		and will aid in the reduction of airborne pollutants and greenhouse gas emissions from transport. A reduction in waste leaving the site for landfill also has significant cost savings and long term environmental benefits
Demolition	Equipment and machinery will likely be mini-digger, large digger, planer, spreader, jack-hammer, tipper lorries and cranes.	Vegetation that is removed to allow construction of the earthworks and drainage structures should be chipped on site and used as a mulch to help establish new planting once construction is completed
Site construction	<p>This scheme will require a large amount of materials in order to construct, most obvious of which is the materials required to construct the new widened carriageways, and any cycleways and/or footpaths.</p> <p>Recycled aggregates can be sourced for road construction to reduce costs and improve sustainability of the scheme. Materials that are required should be sourced from local quarries and suppliers to reduce the length of the haulage route</p> <p>Kerbs and drains will all be precast concrete, with footways being finished with a mix of asphalt surfacing and paving. Tactile paving will be used along the route for any pedestrian crossings.</p>	<p>Materials should be ordered as and when required to minimise storage times on site. This will prevent deterioration of materials and reduce wastage</p> <p>Any material excavated and not reused within the scheme boundaries will also likely be removed from site to a materials reclamation site. Any materials not suitable for reuse will likely be disposed of at a landfill site. This may include any excavated material from contaminated land. There is potential for road planings to contain coal tar which would be classified as hazardous waste and would require disposal at a hazardous landfill site.</p> <p>If waste is disposed of at a landfill site, it would create a large impact, as landfill space within both inert and hazardous landfill sites is a finite resource, (medium sensitivity and major magnitude leading to a large impact). However, if suitable inert material can be reused either on site or from a materials reclamation centre it would reduce the impact</p>
Operational / maintenance	The material resources and waste post construction cannot be estimated as the requirements will be subject to change over the life of a road. However assumptions can be made in that any road repairs will require granular sub base, asphalt binder and surface course and will have road planings as waste. There may also be material and waste issues from the upkeep of road furniture and lighting.	

- 4.6.3 As the design is on-going there is insufficient information at present to accurately forecast waste streams that will be produced on site. Therefore, local landfill capacity as a whole has been reviewed. The EA has information on the nearest landfill sites to the study area as summarised in **Table 4-6**.

**Table 4-6: Nearest waste infrastructure**

Name of site	Licence number	Distance	Type of site
Postwick Waste Site	EAEPR\EA/EP R/LP3098VN/V002	5.95km west	A06: Landfill taking other wastes (Non-hazardous and

Name of site	Licence number	Distance	Type of site
Site, Griffin Lane, Saint Andrew, Norwich, Norfolk, NR7 0SL			Hazardous)
Spixworth Quarry Grange Farm, Buxton Road, Spixworth, Norwich, NR10 3PR	EAEPR\EA/EP R/CB3401LP/A001	12.4km west	L05: Inert Landfill
Easton Inert Landfill Site Easton Lodge Farm, Dereham Road, Costessey, Norwich, Norfolk, NR9 5EQ	EAEPR\EA/EP R/YP3598NU/V002	20km west	A05: Landfill taking Non-Biodegradable Wastes (Non-hazardous)
Attlebridge Landfill Site Reepham Road, Attlebridge, Norfolk, NR9 5TD	EAEPR\EA/EP R/VP3399NP/V002	20.6km west	A01: Co-Disposal Landfill Site (Non-hazardous and hazardous waste in the same cells.) A06: Landfill taking other wastes (Non-hazardous and Hazardous)

## 4.7 Geology and Soils

### Introduction

4.7.1 This section describes the constraints from geology and soils in the study area.

### Baseline Conditions

#### Designated Sites

4.7.2 There are no designated sites for geological features within the study area.

#### Geomorphology

4.7.3 The local geomorphology includes a locally significant geomorphological feature (periglacial urstromatal), a broad glacial valley formed by meltwaters flowing parallel to the glacial ice margin. The feature forms a physical divide between Blofield and Brundall. The landscape contains areas of contrasting sandy and chalky subsoils modified by freeze thaw action in a periglacial environment.

#### Bedrock Geology

4.7.4 The bedrock geology underlying the study area is composed of Crag Group sand and gravel, as shown on Appendix D Figure 2.11.1. of the PCF Stage 1 EAR.

### **Superficial Deposits**

- 4.7.5 The superficial deposits within the study area primarily consist of Lowestoft Formation diamicton till, with outwash sands and gravels, silts and clays. In the west of the study area, is an area of Happisburgh Glaigenic Formation deposits, which consist of till, sands and gravels and laminated silts and clays. These are shown on Appendix D Figure 2.11.2. of the PCF Stage 1 EAR.

### **Soils**

- 4.7.6 The soils within the study area are comprised of glacial till with a loamy and peaty texture. These are freely draining and are classified as Excellent or Very Good for agriculture, as shown on Appendix D Figure 2.11.3 and Figure 2.11.4. of the PCF Stage1 EAR.

### **Mineral Resources**

- 4.7.7 There are no active mines or quarries in the study area. A review of historical maps has shown there have been sand pits and gravel quarries as indicated on the 1880 to 1900 OS maps; however these have not been in use for over 100 years. It is likely that there are limited aggregate deposits (superficial sand and gravel Glaciofluvial deposits) in the area but they are unlikely to be present in economically viable quantities.

### **Hydrogeology**

#### ***Aquifers and groundwater vulnerability***

- 4.7.8 The groundwater body underlying the study area comprises the Broadland Rivers Chalk and Crag groundwater body which has been classified by the EA in 2015 as having an overall status of poor, the current quantitative quality of poor and the current chemical quality of poor.
- 4.7.9 The Environment Agency classify the groundwater vulnerability as high with a groundwater total catchment (zone 3) protection area in the study areas western extents.
- 4.7.10 The variable characteristics of the superficial deposits located within the study area mean that the groundwater productivity within the area can vary between unproductive and low productivity. The superficial aquifer within the study area is therefore classified as a secondary (undifferentiated) superficial aquifer.
- 4.7.11 The British Geological Society (BGS) indicates that the bedrock aquifer underlying the study area is the Neogene to Quaternary Rocks (Undifferentiated) moderately productive aquifer which comprises 'fine-grained, largely unconsolidated sands and silts aquifer up to 80m thick. Yields of [groundwater] up to 40 L/s can be obtained but water is hard and ferruginous'.
- 4.7.12 The bedrock underlying the study area supports a principal aquifer. Principal aquifers typically have a high permeability, a high capacity of storage and typically support water supply and/or river base flow on a strategic scale. According to the BGS, the yield from the underlying aquifer is typically moderate to low (10l/s), water quality can be poor, iron rich and hard, particularly below a cover of boulder clay.

#### ***Groundwater Wells***

- 4.7.13 BGS indicates there are 15 groundwater wells within the study area. The EA indicates there are three groundwater abstraction licences within the study area.

#### ***Groundwater Dependent Terrestrial Ecosystems***

- 4.7.14 Groundwater dependent terrestrial ecosystems (GWDTE) are wetlands which critically depend on groundwater flows and /or chemistries. The Water Framework Directive (WFD) sets out objectives for the water environment. These include the protection, enhancement and

restoration of surface water, groundwater and water dependent protected areas and prevention of deterioration.

- 4.7.15 There are ponds located throughout the study area, these areas are likely to be dependent on the local surface water drainage regime, they may also be dependant to an extent on groundwater.

### **Contaminated Land**

#### ***Historical Map Review***

- 4.7.16 The historical mapping does not indicate any potential contamination sources within the study area. Early maps from the 1880s show small sand or gravel pits, smithies and a saw mill; however these are not shown on later maps and have been closed for over 100 years. The land has been in agricultural use since the earliest mapping available (1800s). Current sources of potential contamination include livestock farms, arable farms, a used car garage and the current roads and associated infrastructure.

#### ***Landfill Sites***

- 4.7.17 The Environment Agency have no records of any landfill sites located within the study area.

### **Petroleum Stores**

- 4.7.18 There are no commercial petroleum stores located within the study area. There is the potential for private petroleum storage tanks to be located on the agricultural properties within the study area.

### **Key constraints**

- 4.7.19 The geological and soils features and their sensitivities are summarised in **Table 4-7**. Those features with a medium or higher sensitivity are considered to be key constraints.

**Table 4-7: Sensitivity for geology and soils**

<b>Feature</b>	<b>Sensitivity</b>
Designated sites	Low
Geomorphology	Low
Drift and solid geology	Low
Soils	Low / Medium
Mineral Resources	Low
Hydrogeology	High
Contaminated land	Not defined

## **4.8 Noise and Vibration**

### **Introduction**

- 4.8.1 This section describes the noise environment, highlights the sensitive receptors and reports any constraints within the study area. It is informed by desk study and preliminary baseline noise measurements undertaken by Amey surveyors in summer 2016.
- 4.8.2 The realignment or improvement of an existing road has the potential to change the existing noise and vibration levels at sensitive receptors and therefore has the potential to cause either beneficial or adverse effects. These potential effects may arise either during

construction (which are typically temporary in nature) or during operation (which are typically permanent in nature).

## Baseline Conditions

### Desk study

- 4.8.3 As noted in the EAR, traffic volumes have been recorded at a location along the A47 within the study area. Count point 28827 recorded an Annual Average Daily Flow of 37,354 vehicles in 2015. From these figures it is likely that the A47 is the main source of noise in the area.
- 4.8.4 Traffic noise along the A47 at Blofield was mapped by Defra and can be viewed on the England Noise Map Viewer website as described in the PCF Stage 1 EAR. The Noise Map Viewer website also shows the location of Noise Important Areas (NIAs). Noise Important Areas (NIA) are defined by Defra as areas where the top 1% people affected by noise in England reside.
- 4.8.5 There are four NIAs located within the study area, as shown on PCF Stage 1 EAR **Figure 2.8.1** and listed below:
- NIA 5206, located along the A47 directly north of Blofield
  - NIA 5207, located approximately 140m west of the junction with Yarmouth Road/A47 and contains 2 residential receptors
  - NIA 5208, located at the junction of Lingwood Road and the A47 and contains 2 residential receptors
  - NIA 5209, located 590m east of the Acle Road/A47 junction and includes 1 residential receptor.
- 4.8.6 Noise sensitive receptors (NSRs) are receptors potentially sensitive to noise and vibration and include residential properties, community receptors, schools, care homes and churches. Within the study area the residential receptors are concentrated in Blofield, Lingwood and North Burlingham. There are sporadic residential receptors scattered throughout the study area such as Jarys Farm, the Old Post Office and properties on Lingwood Road.
- 4.8.7 Community receptors are located in Blofield, Lingwood and North Burlingham, and include Blofield Primary School, Blofield Day Nursery and the Parish church of St Andrew and St Peter. In Lingwood, receptors include St Peter's Church and Lingwood Junior School, while within North Burlingham receptors include Burlingham House Nursing Home.

### Field Survey

- 4.8.8 During the site visit in June 2016 short term noise measurements were undertaken at sample locations throughout the study area. The survey locations were chosen due to the proximity to NIAs and sensitive receptors. The main source of noise in the study area is from road traffic on the A47 and on local road, particularly in Blofield and Lingwood. Further from the A47 and local roads, natural sounds such as birdsong are also present.
- 4.8.9 The results of the noise survey show that noise levels are highest close to the A47, and generally decrease with distance from the A47. Road traffic noise on local roads, particularly in Blofield, result in noise levels of up to 65dB LAeq, 15min. At some of the survey location points, noise from the A47 is not audible, e.g. in Lingwood.



## Key Constraints

- 4.8.10 There are 1300 residential receptors and 15 community receptors located within the study area, which are considered to have a high sensitivity to changes in noise levels
- 4.8.11 Any change in the alignment of the A47 has the potential to affect noise levels at receptors within the study area. Potential effects can be beneficial as well as adverse, for example receptors located close to the existing A47 may experience a reduction in noise levels if the road were to move further away.
- 4.8.12 There are four Noise Important Areas (NIAs) within the study area which will require special consideration. This is because even if the proposed options are predicted to have no significant impacts on noise levels, the presence of NIAs means that mitigation must be considered to reduce the noise levels within these areas. However, mitigation will only be included within any scheme design if it can be determined to provide value for money.

## 4.9 People and Communities

### Introduction

- 4.9.1 This section identifies the key features and constraints in the study area in relation to people and communities including vehicle travellers, non-motorised users (pedestrians, cyclists and equestrians), as well as land use (private property, community land, development land and agricultural land). It is informed by a desk study and site walkover undertaken in summer 2016.
- 4.9.2 An Equality Impact Assessment has been undertaken as part of the Highways England PCF Stage 1 process.

### Baseline Conditions

#### Public Rights of Way

- 4.9.3 There are numerous Public Rights of Way (PRoWs) located throughout the study area, often linking the villages along quieter routes away from the roads, shown on PCF Stage 1 EAR **Figure 2.10.1**. The level of use of these PRoWs varies, with some used frequently, while others have become overgrown.

#### Footways

- 4.9.4 There is a section of footpath along the northern section of the A47 between Dell Corner Lane and Main Road, North Burlingham. This allows access to the bus stops along the A47. The footpath is narrow and the verge is largely overgrown. It continues into the village of North Burlingham, but stops at the edge of the housing along Main Road.

#### Cycle Routes

- 4.9.5 There are no designated cycleways located within the study area, however some of the PRoWs are suitable for use by cyclists.

#### Equestrians

- 4.9.6 There is one designated bridleway in the study area, located between South Walsham Road and Acle Road.

## Land Use

### Private Property

- 4.9.7 The majority of private land (residential housing) is located in the villages of Blofield, North Burlingham and Lingwood. Scattered isolated properties are located along the minor road network throughout the study area.

### Community Land

- 4.9.8 Community facilities such as schools, shops and churches are also concentrated within the villages. Other community facilities on the outskirts of the villages are Norwich School of Horticulture, Norwich Football Club and Blofield community allotments.

### Development Land

- 4.9.9 During the site visit it was noted that new housing developments were being constructed at Yarmouth Road in Blofield. There are also planning applications for residential development at Plantation Road.

### Agricultural Land

- 4.9.10 The dominant land use within the study area is agricultural. The majority of the fields located around the A47 are used for arable farming, indicating that the soils are of good quality. Some fields are used for grazing livestock.

## Vehicle travellers

### Driver Stress

- 4.9.11 The A47 is a major route between Norwich and Yarmouth and in the study area is a section of single carriageway road located between dual carriageway sections. This is a factor in causing driver stress as drivers have to slow down over the single carriageway section. In addition, traffic flows on the A47 are high as mentioned previously in the noise section.
- 4.9.12 During the site visit it was noted that traffic along the A47 was continuous with noticeably more traffic during peak rush hours as the A47 is a commuter route.

### View from the road

- 4.9.13 The view from the road for vehicle travellers is of open fields, rolling hills, a variety of close horizons, church towers and woodland. In some areas the views are obscured by roadside vegetation.

## Key Constraints

- 4.9.14 The scheme will be constrained by the need to preserve NMU mobility and access to community facilities. Given the high possibility of vulnerable users of such routes and facilities, and the importance of PRowS, the sensitivity of such constraints is high.
- 4.9.15 As the scheme has the potential to influence views from the road, travellers' views and journey amenity are assessed to be of medium sensitivity due to the quality and character of the landscape within the study area.
- 4.9.16 Driver stress is considered to be moderate along the single carriageway section and high along the dual carriageway section of the A47 due to the increase in speed of the road.

- 4.9.17 The scheme will be constrained by the need to adhere to local and national planning policy; particularly the need to conserve high value agricultural land and community land. Similarly, development land, although generally small in scale and low in sensitivity, may also represent a constraint to the development, either in terms of land take or access.
- 4.9.18 Where agricultural land is concerned, Grade 1 land is considered to be of high sensitivity.

## 4.10 Road Drainage and the Water Environment

### Introduction

- 4.10.1 This section will identify sensitive receptors with respect to the water environment and highlight any constraints.

### Baseline Conditions

#### Surface water

- 4.10.2 The western extents of the study area (including Blofield to North Burlingham) are located in the Witton Run catchment area. The Witton Run catchment forms the eastern section of the larger River Yare catchment. The source of the Witton Run is located in Plumstead Green. The river migrates in a north-south direction through Brundall before merging with the River Yare. Although the main channel of the Witton Run is beyond the study area, there are drainage ditches and minor streams that flow into the river in the western extents of the study area (including Run Dike). Despite its highly modified nature, the overall water quality of the Witton Run is moderate and the chemical quality is good.
- 4.10.3 The central and eastern extents of the study area (including North Burlingham and Acle) are located in the River Bure catchment area. The River Bure rises at Melton Constable and flows south west through the heart of the Broads towards the sea at Great Yarmouth. There are a small number of drains located within the study area which flow into the River Bure. The overall water quality of the River Bure is moderate and its chemical quality is good.
- 4.10.4 Surface water features are shown on PCF Stage 1 EAR **Figure 2.9.1**.
- 4.10.5 There are sixty-six ponds located within the study area and approximately ten drainage channels which flow into tributaries of the River Bure and the River Yare.
- 4.10.6 According to the EA, there are no surface water abstraction points, Surface Water Safeguard Zones or Surface Water Nitrate Vulnerable Zones located within the study area

#### Aquatic Ecology

- 4.10.7 As discussed in Chapter 4.5: Nature Conservation and Biodiversity, the desktop study identified the presence of designated wetland sites (The Broads SAC and Broadland SPA/Ramsar) in the wider area. These sites have potential to support notable/protected aquatic species (such as otter, great crested newt, white-clawed crayfish, little-whirlpool ram's-horn snail, shining ram's horn snail, narrow mouth whorl snail and Desmoulin's whorl snail). These sites also support wetland such as running water and standing water – ponds and wet ditches which depend on the water environment within the study area. Results of the ecological site survey indicate that 5 ponds within the study area support great crested newts.

#### Groundwater features/abstractions

- 4.10.8 The study area is underlain by Crag Group sand and gravel bedrock. The bedrock supports a principal aquifer. Principal aquifers typically have a high permeability and a high capacity of water storage which can typically support water supply and/or river base flow on a strategic scale.

4.10.9 The superficial deposits within the study area main consists of Lowestoft Formation Diamicton with localised areas of Happisburgh Glacigenic Formation Sand, Happisburgh Glacigenic Formation Diamicton and Breydon Formation Peat located in the eastern and western extents of the study areas.

4.10.10 The BGS Aquifer Map indicates that:

- The Lowestoft Formation Diamicton layers form a secondary (undifferentiated) aquifer due to the variable characteristics of the deposit.
- The areas of Happisburgh Glacigenic Formation Sand, Happisburgh Glacigenic Formation Diamicton and Breydon Formation Peat layers support a secondary 'A' aquifer. These permeable layers are capable of supporting water supplies at a local scale and can form an important source of base flow to rivers.

4.10.11 According to the HADDMS records, the Broadland Rivers Chalk and Crag aquifer underlies the entire study area. The groundwater body currently has a poor overall WFD status and an overall objective to achieve good status by 2027.

4.10.12 A review of the Environmental Agency 'What's in Your Backyard?' interactive maps indicate that there are three medium sized groundwater abstraction licences in operation within the eastern and western extents of the study area. The water abstracted is used for general agricultural and make up/top up purposes. BGS information indicates that there are approximately 19 water wells located within the study area.

4.10.13 According to the EA the western extent of the study area forms part of a groundwater source protection zone - total catchment (Zone 3). The study area lies within the total catchment from which groundwater is recharged. The groundwater will eventually be discharged at the source (such as a well, borehole or spring used for public drinking water supply). The study area is located in a Groundwater Nitrate Vulnerable Zone (area designated as being at risk from agricultural nitrate pollution). Records also indicate that the study area is not located in a Groundwater Safeguard Zone.

4.10.14 Groundwater is shown on PCF Stage 1 EAR **Figure 2.9.3**.

### **Flooding**

4.10.15 This takes into account the effect of any flood defences that may be in this area. According to the EA the land surrounding the River Yare and the Witton Run is located within Flood Zone 3. Flood zone 3 comprises area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

4.10.16 The study area is not affected by surface water flooding.

4.10.17 HADDMS records indicate that the western and eastern extents of the study area have a groundwater flood risk less than 25 per cent. Thus there is a limited potential of groundwater flooding.

### **Key constraints**

4.10.18 The sensitivity of the River Bure and Witton Run is considered to be medium as the watercourses have a moderate status under the Water Framework Directive.

4.10.19 The various drainage channels and pond features throughout the study area are considered to be of low sensitivity.

4.10.20 The sensitivity of aquatic ecology is given in the nature conservation section.

4.10.21 The sensitivity of the groundwater is considered to be medium due to the presence of the groundwater source protection zone and the presence of multiple groundwater abstraction licences within the study area.

4.10.22 Due to the lack of major watercourses within the study area, the sensitivity of receptors to flooding is negligible.

## **5 Accessibility & Integration**

### **5.1 Existing NMU Provision**

5.1.1 NMU provisions are described in Chapter 4.8 above.

### **5.2 Existing access to transport Provision**

#### **Rail & Bus Services**

5.2.1 Rail into East Anglia operates through Cambridge and Ely where it then branches off westwards towards Peterborough, northwards towards Kings Lynn or eastwards towards Norwich, Great Yarmouth and Lowestoft. The services are currently operated by Abellio Greater Anglia, East Midlands and Thameslink Great Northern.

5.2.2 There are no direct train services parallel to the A47 between Peterborough and Norwich. Rail journeys between these two locations are made via Ely. Train services between Ely and King's Lynn are run by Abellio Greater Anglia and Thameslink Great Northern.

5.2.3 The railway line operates approximately a mile south of this section of the A47. Brundall and Brundall Gardens Stations are the closest to the residential area of Blofield. Lingwood and Acle Stations are the closest to the residential area of North Burlingham.

5.2.4 There are a number of bus services that operate end to end along the corridor. First Group operates the Excel X1 service along the A47/A12 corridor connecting Peterborough, King's Lynn, Norwich, Great Yarmouth and Lowestoft. There are no park and rides within the immediate vicinity of the Scheme.

### **5.3 Existing Severance**

5.3.1 Community severance is defined here as the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows. Severance will only be an issue where either vehicle flows are significant enough to significantly impede pedestrian movement or where infrastructure presents a physical barrier to movement.

5.3.2 For the local residents to the west of the scheme, located in Blofield, it can be difficult to access the A47. There are a number of attractors including the petrol station and McDonalds restaurant.

5.3.3 There are vehicular routes across the A47 via existing side road cross roads with current levels of traffic along the A47 in the area these vehicle manoeuvres can be difficult to make comfortably.

### **5.4 Integration**

#### **Transport Interchange**

5.4.1 There are no passenger or freight interchanges located in the vicinity of the scheme.

### **Land-Use Policy**

- 5.4.2 Broadland District is predominantly rural in nature and is dominated by agricultural use. See Chapter 2.3 for further detail on the Broadland District Council Local Plan (2014) and Chapter 4 for existing land use information.

## 6 Maintenance

### 6.1 Introduction

- 6.1.1 This section focusses on the existing approach to maintenance of the A47/A12 trunk road and the highways within the scheme study area.
- 6.1.2 Whilst PCF Stage 1 works were progressing the existing highway network along the A47 corridor was maintained on behalf of Highways England as part of the Area 6 Asset Support Contract (ASC) by Amey. During PCF Stage 2 the supplier changed to Kier (April 2017).
- 6.1.3 The highway is maintained in accordance with the requirements of their contract as set out in the Asset Maintenance and Operational Requirements (AMOR) in the Maintenance Requirements Plan. This details Highways England's mandatory requirements for the delivery of routine maintenance and operational services. A Maintenance and Repair Strategy Statement for the A47/A12 trunk road was not available at this Stage 1.
- 6.1.4 Strategic diversion routes for works requiring closures along the A47/A12 trunk road have been provided by Area 6 Maintenance Contractor and are included in **Appendix F**.
- 6.1.5 The Highway Authority for the local side roads connecting with the Blofield and North Burlingham section of the A47 trunk road is Norfolk County Council and the roads are currently maintained by Norfolk County Council's Highways Department.
- 6.1.6 Norfolk County Council's approach to their highway asset and management is documented in "Norfolk's Transport Asset Management Plan 2016/17 – 2020/21" (TAMP) The purpose of this document is to set out an approach for Norfolk County Council for the management of its transport and highway assets. The Transport Asset Management Plan (TAMP) pulls together all the relevant strategies, goals, objectives, plans and methods in use within the County Council and the Community Environment Services (CES) department for managing the transport and highway assets in the County.
- 6.1.7 Norfolk County Councils TAMP, contains details of Norfolk's routine highway maintenance regime and any targeted capital maintenance projects.

### 6.2 Asset Condition

- 6.2.1 The asset condition data has been taken from the latest information using Highways England databases (HAPMS) and information from the local Area 6 Maintenance Contractor.

#### **CHART Referencing**

- 6.2.2 The trunk road network is divided up for maintenance referencing into a series of lengths. These chart section lengths are identified on the carriageway by a series of physical markers known as CHART nodes, the position of the nodes and sections are then referenced on OS plans. This allows maintenance surveys to easily reference data to actual sections of the highway.

#### **Available Data on Asset Condition**

- 6.2.3 The Area 6 Maintenance Contractor have provided digital survey data which they hold for the section of the A47. Below are examples of some of the data held:

- Surface Skid Resistance



- Pavement road layer information
- Deflectograph survey information – for analysis of pavement residual life
- TRACS

6.2.4 In addition to digital copies of numerical data being available. The Area 6 ASC team have developed an Asset Manager visualisation and analysis tool which allows the digital data to be visualised and analysed as a series of visualised layers of asset information which can be viewed as overlays to Google mapping.

6.2.5 Over the years the road pavement over the Scheme length has been subject to numerous maintenance interventions to maintain the road in a safe and serviceable condition.

6.2.6 The Asset Manager analysis shows that the pavement is in a reasonable condition, there are areas of the pavement construction which require resurfacing these areas correspond to the areas of road covered by the maintenance interventions detailed in Chapter 6.3.3 below

6.2.7 The drainage in the area is subject to ongoing routine maintenance to ensure ditches and over the edge drainage systems remain unblocked by vegetation and debris. Specific maintenance works to the highway drainage system.

6.2.8 Fencing and lighting provisions need to be investigated further in future PCF stages.

### 6.3 Planned Maintenance

6.3.1 Maintenance works are carried out by the Area 6 Maintenance Contractor.

6.3.2 Generally the following routine operations are carried out annually:

- Cut back foliage to maintain visibilities
- Cut / spray around fixed furniture.
- Clear gullies, piped grips, catchpits
- Clean signs
- Structural maintenance

6.3.3 The Area 6 Maintenance Contractor also had the following planned maintenance activities in the area of the scheme:

- A47 Blofield Westbound Resurfacing in 2016-17
- Geotechnical works at North Burlingham in 2017/18
- Resurfacing at North Burlingham in 2018/19
- Resurfacing at Blofield in 2019/20

6.3.4 The local roads are maintained by Norfolk County Council.

6.3.5 NCC have a routine maintenance regime for the side roads in the area which is included in the NCC TAMP document.

6.3.6 There are currently no targeted capital maintenance works in the area of the Scheme, within NCC's TAMP.

#### 6.4 **Strategic Diversion Routes**

6.4.1 Strategic diversion routes for works requiring closures along the A47 trunk road were provided during PCF Stage 1 by the Area 6 ASC and are included in **Appendix F**.

## 7 Planning Factors

### 7.1 Committed Developments

7.1.1 There are a number of potential Planning Applications currently either approved or being reviewed by South Norfolk and Broadlands District Council in the vicinity of the scheme. **Table 7-1** highlights this list, which is not exhaustive and will evolve overtime independently of the Scheme.

**Table 7-1 Key Developments to be included in transportation modelling**

Local Authority	Type	Planning App No	Location	Description	Status
South Norfolk Council	Mixed-use	2013/0567	Lodge Farm Dereham Road, Costessey	495 dwellings, associated infrastructure	Planned
South Norfolk Council	Commercial	2013/1259	Longwater Retail Park, Costessey	Proposals for the creation of an A1 non-food retail unit with Gross Floor Area 6,763sqm	Planned
South Norfolk Council	Residential	2008/2347	Cringleford, North-east of Thickthorn	Application for residential development (626 units) and associated infrastructure including open space and recreational woodland, site for Primary School, Community facilities and up to 1486sqm mixed use (A1, A2, A3, A4, A5) Neighbourhood Centre	Completed
South Norfolk Council	Mixed-use	2011/1804/O	Land north of Hethersett Village Centre, Little Melton Road	Mixed use development of 1,196 dwellings and associated uses including primary school, local services (A1, A2, A3, A4, A5, D1 and B1 uses), comprising shops, small businesses, community facilities.	Approved
South Norfolk Council	Residential	2013/1793	New Found Farm, Cringleford	Outline planning permission for a development of 800 dwellings together with a small local centre, primary school with early years facility, Two new vehicular accesses off Colney Lane, associated on-site highways, pedestrian and cycle routes, public recreational open space, allotments, landscape planting and community woodland.	Pending Decision
South Norfolk	Residential	2077/0505	Land North of The A11 At Park Farm Silfield Road Wymondham	Proposed development to include up to 500 dwellings, Community facilities, site infrastructure including new access roads, public rights of way and drainage, green infrastructure including public open spaces and structural landscape planting	Approved with Conditions

Local Authority	Type	Planning App No	Location	Description	Status
South Norfolk	Mixed-use	2012/0371	Land to The East and West of Rightup Lane Wymondham	Mixed use development of up to 730 dwellings, up to 128 bed care home / homes (in one or two buildings), up to 250 square metres of retail / commercial floor space, a new primary school together with all other associated temporary and permanent infrastructure and green infrastructure, including new access arrangements, sports pitches, allotments and community orchard.	Approved with Conditions
South Norfolk Council	Residential	2013/1494	West of Roundhouse Way, Cringleford	Outline planning application with all matters reserved (save access) for the creation of up to 650 residential dwellings (use class C3), up to 2,500 sqm of use class A1, A2, A3, A4, A5 and D1 floorspace, together with highways works, landscaping, public realm, car parking and other associated works.	Pending Decision
Broadland District Council		20121638	Cucumber Lane, Blofield	150 Dwellings at Brundall, Norfolk	Committed
Broadland District Council	Commercial	2008/1773	Broadland Business Park & Broadland Gate	Expansion of around 25ha for a range of employment uses to include approximately 50,000sqm of B1 uses a new business park east of the existing park.	Approved

7.1.2 The Planning Applications cover a variety of uses, including Commercial, Residential and Mixed Use. The area is currently experiencing a high amount of growth.

7.1.3 Typically applications within the area above include details of between 500 – 850 residential dwellings or many thousands of square meters of development.

7.1.4 The largest development is an approved Planning Application within Broadlands District Council for a 25ha expansion of a new Business Park (Broadlands Business Park & Broadlands Gate) adjacent to the existing Business Park.

7.1.5 An application for an Adventure Golf Course was passed in November 2015, Yarmouth Road, Blofield which is nearing construction completion.

7.1.6 The above Planning Applications are linked to the National and Local growth plans / targets identified by a number of Government Bodies that will increase strain on the existing A47 Network at this location with the addition of dwellings / business uses and associated traffic that they will generate.

## 7.2 Potential Developments

7.2.1 A Planning Application for B1 Class 2500sqm Land at Yarmouth Road, Blofield, has recently been registered for review.

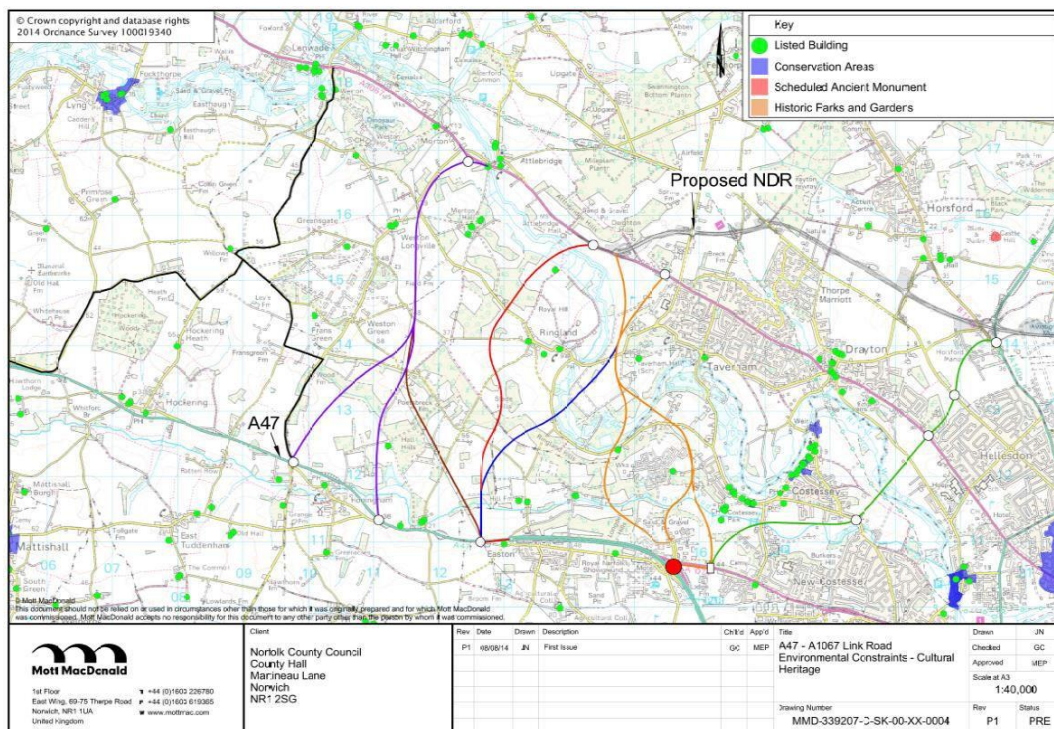
### **A47-A1067 Western Link Road (WLR)**

7.2.2 In June 2015 Norfolk County Council obtained approval through the DCO process for the Norwich Northern Distributor Road (NDR). Construction of the road commenced on site in

2016. The road when completed will provide a link road around the north and east sides of Norwich linking to the A47 to the east of Norwich.

- 7.2.3 There is also a scheme in options feasibility stage to provide a link to potentially complete the north western section of the distributor road. The western link would potentially join to the A47 within the Tuddenham to Easton scheme or close to the limits of the scheme and potentially change traffic choices impacting Blofield to North Burlingham.
- 7.2.4 In addition to the Norwich NDR scheme the council are also in the initial stages of developing a scheme (A47-A1067 Western Link Road) which would join the northern end of the proposed NDR to the A47 to the west of Norwich.
- 7.2.5 A preliminary assessment by NCC of alternatives for a new western link was carried out during 2004/2005, as part of the Stage 2 assessment of the NDR. However, in 2005, as part of the development of the NDR project, NCC Cabinet agreed that the NDR should be built only from the A47 at Postwick to the east of Norwich to the A1067.
- 7.2.6 The consultation on the NDR, now under construction, showed a strong desire for a link between A1067 and A47. A detailed Scoping Study was prepared in 2014. The Scoping Study assessed a total of 13 route options for a potential link. The alignments considered, labelled green, orange, blue, red, brown and purple options, are shown in Figure 7-1 below:

**Figure 7-1 – Location Plan A1067 to A47 Route Options (source: 2014 Scoping Study)**



- 7.2.7 The Norwich Western Link Project was taken to the Environment Development and Transport Committee of Norfolk County Council on the 8th of July following a report undertaken by Mouchel to Appraise the potential solutions to the transport issues in the western quadrant of Norwich.

*"A tentative programme envisages some preliminary work prior to the opening of the NDR and work required after the NDR is opened and following a period of monitoring. This would also need to take regard of A47 improvements being*

*progressed by Highways England (with construction currently suggested to start in 2020), the Food Hub proposal, and the update of the Greater Norwich Local Plan (GNLP). This report therefore recommends options to be progressed in the short-term over the next 18 months, in 6 month phases, with appropriate "review gateways" before further work is progressed."*

7.2.8 The report details that for a scheme to be delivered, a major scheme business case would need to be prepared for submission to either the New Anglia Local Transport Body or to the DfT. It would need to set out a compelling case for the scheme and must provide evidence that:

- There is a real problem to be solved.
- The scheme is part of a coherent wider strategy.
- A full range of options has been considered, and the best scheme has been selected.
- The scheme represents high or very high value for money.
- The scheme is feasible and affordable, and can be delivered within the planned timescale.

7.2.9 The NCC committee report indicates that

*"A tentative programme envisages some preliminary work prior to the opening of the NDR, with the main appraisal taking place after 2018 leading to a Full Business Case in 2022. This would need to take due regard of plans for A47 improvements being progressed by Highways England, the progression of the Food Hub, and the update of the Greater Norwich Local Plan (GNLP).*

7.2.10 The project team have maintained a close liaison with NCC Technical Officers throughout PCF Stage 1 and this will continue through future PCF Stages to ensure that progress on the WLR and any implications and effects on the A47 North Tuddenham to Easton Scheme and Blofield to North Burlingham scheme can be assessed as work proceeds. At this stage the WLR is not committed development but due to its potential impact to transportation movements in the area of the scheme it is proposed that the transportation modelling will be sensitivity tested with a potential WLR included.

## 8 Other Relevant Factors

### 8.1 Previous Relevant Studies and Reports

- 8.1.1 There are a number of previous studies and strategy reports which are relevant to the scheme some of which have been used to inform the national and local policy covered in Chapter 2. Those with particular relevance to the scheme are listed below

#### Central Government DfT and Highways England

- East of England Route Strategy Evidence Report (Highways Agency, April 2014)
- East of England Route Strategy Evidence Report Technical Annex (Highways Agency, April 2014)
- A47/A12 Study (Leaflet Highways Agency / DfT March 2015)
- A47 – A12 CORRIDOR Feasibility Study Summary (DfT March 2015)
- Norwich to Great Yarmouth Roads based Study (2001)
- Highways Agency Area 6 Quarterly Safety Report (Q4 2014), Skanska, January 2014

#### Local Authority

- A47 Dualling: Economic Assessment Methodology (July 2014 Report by Mouchel for Norfolk County Council)
- A47 Wider Economic Benefits Executive Summary (August 2012, Norfolk County Council)
- Norwich Area Transport Strategy (2006, implementation plan updated 2013)
- Norfolk Infrastructure Plan (version 1, 2012, Norfolk County Council)
- Norfolk Rural Development Strategy 2013-2020
- Delivering Economic Growth in Norfolk', The strategic role for Norfolk County Council 2012 – 2017
- Breckland District-Wide Infrastructure Needs, Funding and Delivery Study Final Report, 2009
- A47 –A1067 Western Link Road Scoping Study (September 2014 Norfolk County Council)

#### Local Enterprise Partnership

- New Anglia Strategic Economic Plan (2014, NEWANGLIA Local Enterprise Partnership for Norfolk and Suffolk)
- A47 Strategic Route Gateway to Growth (2014 published by A47 Alliance by NEWANGLIA Local Enterprise Partnership for Norfolk and Suffolk)

## 8.2 History of Blofield Scheme

- 8.2.1 The A47 Blofield to North Burlingham Dualling Scheme, in various stages, has been on the agenda of the local authorities / highways authorities for a number of years.
- 8.2.2 Norfolk County Council, as agents for the Department of Transport, originally developed proposals for dualling the A47 Blofield – North Burlingham Scheme in 1986. This culminated in a Preferred Route announcement in 1991, which recommended widening of the current single carriageway to dual carriageway standard to the south of the existing road.
- 8.2.3 A change in the Government's Road Policy, Strategic Roads Review, in November 1996 led to this scheme being withdrawn from the National Trunk Road Programme.
- 8.2.4 In October 2001, the A47 Norwich to Great Yarmouth Road Based Study Report was completed by Faber-Maunsell and recommended that the Blofield to North Burlingham section be upgraded to full Dual Two All Purpose (D2AP) standard carriageway.
- 8.2.5 On 22 August 2002, the Minister for Transport announced a series of measures for upgrading the A47 between Norwich and Great Yarmouth. In particular, the Minister noted that the A47 between Blofield and North Burlingham should be dualled and that this scheme should be incorporated into the Targeted Programme of Improvements.
- 8.2.6 In the December 2004 Spending Review, the Scheme was classed as a Regional Scheme and was remitted to the Regional Assembly to determine its priority in the regional funding allocation. Following the Regional Prioritisation Announcement in July 2006 by the Secretary of State, the scheme has been given a start of works date of 2011/12.
- 8.2.7 The Scheme was removed from the Major Projects Programme in 2009 due to budgetary constraints imposed upon the Highways Agency (now Highways England).
- 8.2.8 As described in Chapter 1, the Scheme was reintroduced for consideration as part of the A47 Feasibility Study, within the Road Investment Strategy Period 1.
- 8.2.9 As part of the Feasibility Study, cost estimates of the dualling option were carried out by Highways Agency Commercial Services, resulting in an estimated cost range of £54M to £80M. An economic appraisal was conducted by AECOM based on the cost estimate and an assessment of journey time savings created by the proposed scheme. The indicative Benefit Cost Ratio (BCR) for the dualling option scored high, as 2.8, indicating that the scheme would likely provide value for money. This was based on a desktop exercise with costings taken from the previously developed scheme.
- 8.2.10 For PCF Stage 0 and PCF Stage 1 Amey / AECOM have reviewed the scheme in line with the other 5 schemes on the A47 Programme, which has recognised previous iterations of the scheme whilst building upon the available information and building on the latest guidelines. In particular this has focused on:
- Highways England Project Control Framework
    - Introduction of PCF Protocol in 2008 by Highways England Major Projects to improve upon quality and delivery of Projects following an internal review.
  - Planning Act 2008
    - Historic scheme designs developed in line with Highways Act principles. Introduction of Planning Act has changed the approach to Statutory processes and the appropriate level of governance required.
  - Latest Design Manual for Roads and Bridges (DMRB) standards for highways design



- Historic designs for the Scheme may not meet all of the latest standards required for a Dualling Scheme
  - Latest traffic and environmental surveys and modelling (as detailed later in this Report)
    - Historic designs for the Scheme will have been based on previous traffic and environmental surveys and modelling which will no longer be current and may have outdated / incorrect information
  - Latest Highways England Key Performance Indicators (KPIs)
    - Historic designs for the Scheme may not have taken into consideration details held within the latest HE KPIs (as detailed later in this Report) as justification / validation for route options
- 8.2.11 As a result of the above, it was not possible to 'fast-track' the previously developed Scheme towards a significantly earlier construction date than announced in the RIS statement.
- 8.2.12 However, due consideration has been given to the information available regarding the previously proposed option.
- 8.2.13 The latest incarnation of the Scheme must be justifiable under the latest standards and Highways England PCF Protocol.

## 9 Description of Route Options

### 9.1 Route Option Development

9.1.1 The feasibility work undertaken in PCF Stage 0 identified that dualling the section of the A47 between Blofield and North Burlingham represented a feasible potential solution to solve the identified transportation problem. As part of the PCF stage 0 work 3 broad solution options were reviewed to ensure that dualling of the route represented a suitable and economically cost effective solution. The broad solution options considered were:

- Dualling the A47 online (PCF Stage 1 Option 1);
- Dualling the A47 offline to the south (PCF Stage 1 Option 8); and
- Dualling the A47 offline further to the south (PCF Stage 1 Option 7).

9.1.2 During PCF Stage1 these broad solutions were used as a basis to develop a number of more defined potential route options. At the start of the Stage 1 Option identification stage an optioneering exercise was undertaken to identify potential route options for the dualling.

9.1.3 The desk study work in PCF Stage 0 identified a number of potential key constraints and features within the study area, these were used as the starting point for a route identification optioneering workshop held on the 1st February 2016. The workshop was attended by a number of engineering, environmental and transportation technical staff.

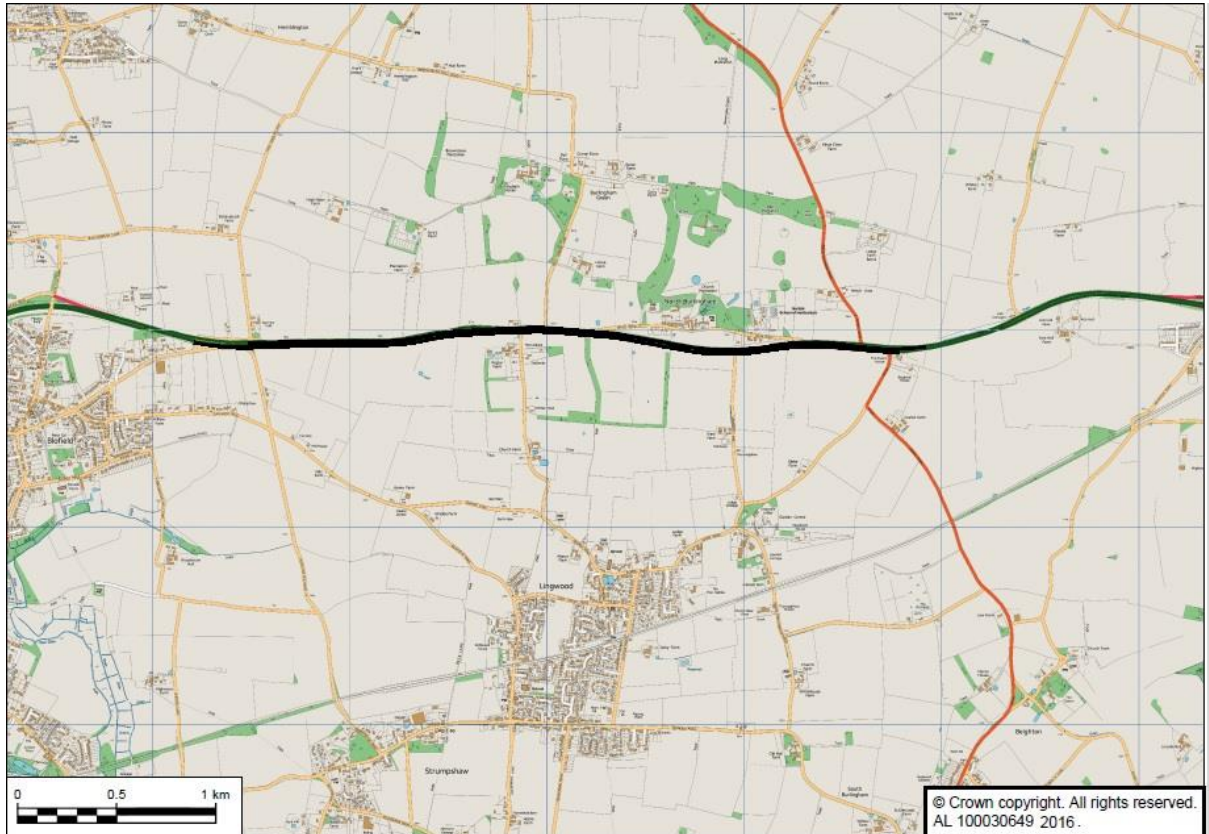
9.1.4 Using large scale printed plans of the study area the team hand drew potential routes for the dualling. Following the workshop the hand drawn sketches were developed into a number of initial route options. These route options were drawn out as high level engineering layouts which would potentially meet highway alignment layout standards, these layouts are included in **Appendix G** along with constraints plans.

9.1.5 The route options identified were numbered 1-8 for reference purposes and these options are described in turn in the following sections.

## 9.2 Option 1 (PCF Stage 1)

5.1.1 Option 1 is an online dualling of the existing A47 route as shown below.

**Figure 9-1 Option 1 (PCF Stage 1)**



9.2.1 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to dual carriageway standard by the construction of a new section of online dual carriageway with appropriate junction improvements.

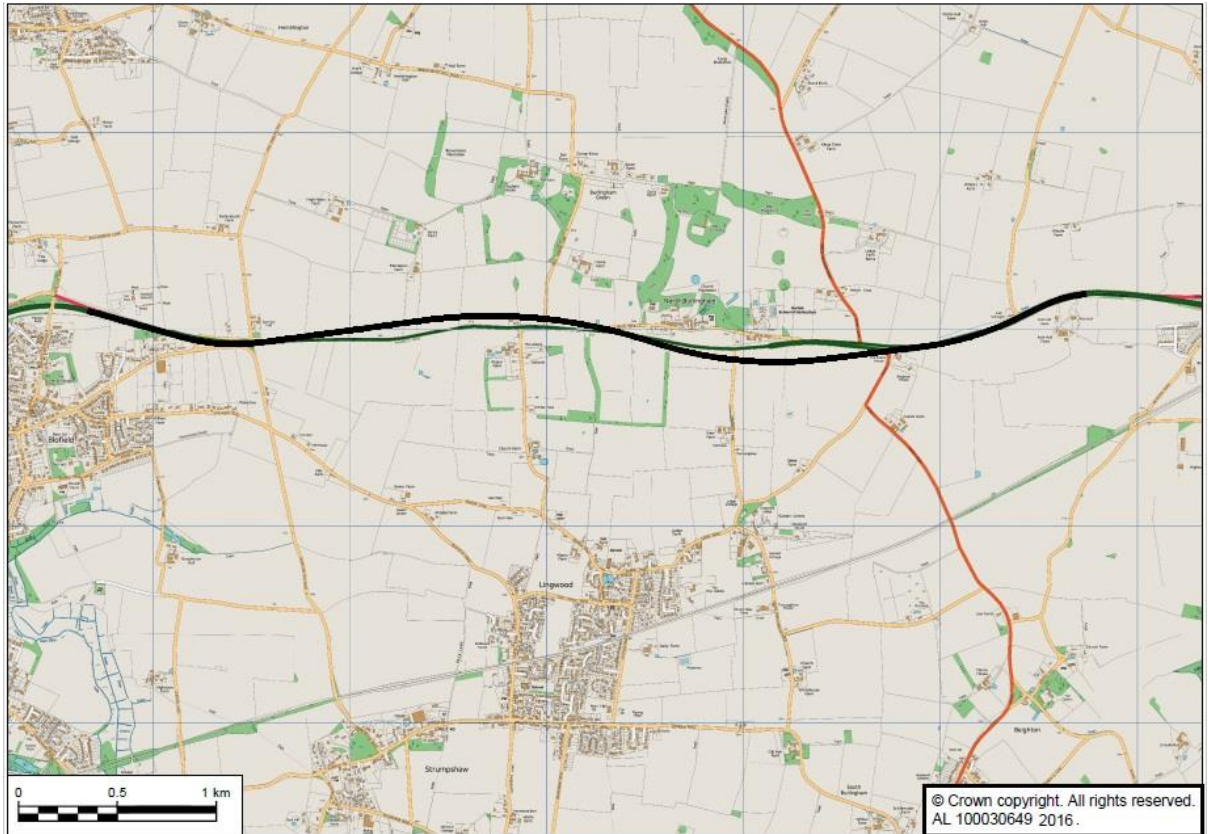
9.2.2 This online option will attempt to utilise as much of the existing carriageway as possible, however, due to the differences between single and dual carriageway standards, it may not be possible to achieve this in all locations.

9.2.3 As a result, it is highly likely that it would be necessary to acquire land adjacent to the existing road to accommodate improvement.

### 9.3 Option 2 (PCF Stage 1)

- 9.3.1 Option 2 is an offline dualling to the north of existing western part of the route and to the south of the existing eastern part of the route as shown below.

**Figure 9-2 – Option 2 (PCF Stage 1)**

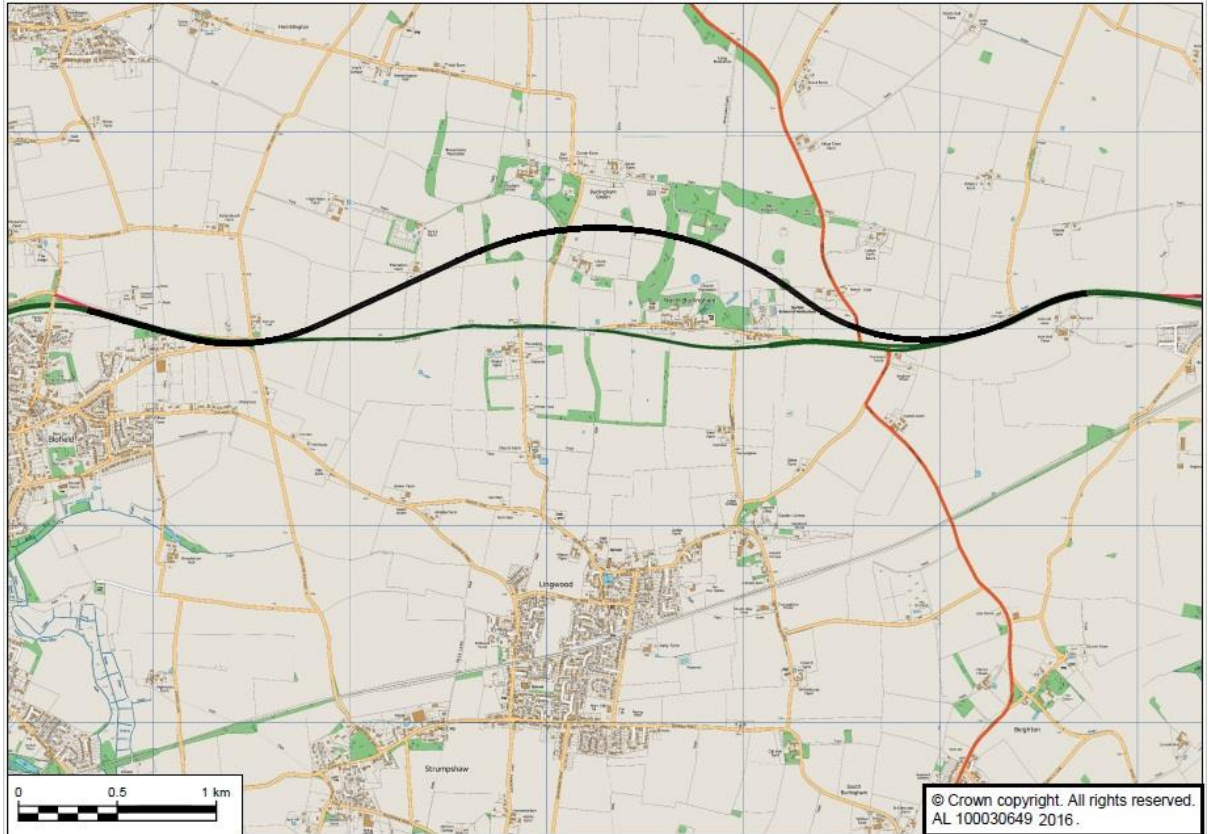


- 9.3.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 9.3.3 The proposed new dual carriageway for this option follows an alignment running to the north of the A47 as the route heads away from the village of Blofield and to the south of the existing A47 as the route passes the village of North Burlingham, crossing the existing A47 between the villages. The route passes predominantly through open farm land and some woodland habitat.
- 9.3.4 As a result, it would be highly likely to acquire land adjacent to the existing road to accommodate improvement.
- 9.3.5 The existing A47 would, where unaffected by the new dual carriageway, remain as part of the local road network.

## 9.4 Option 3 (PCF Stage 1)

9.4.1 Option 3 is an offline dualling to the north of the existing A47 as shown below

**Figure 9-3 – Option 3 (PCF Stage 1)**

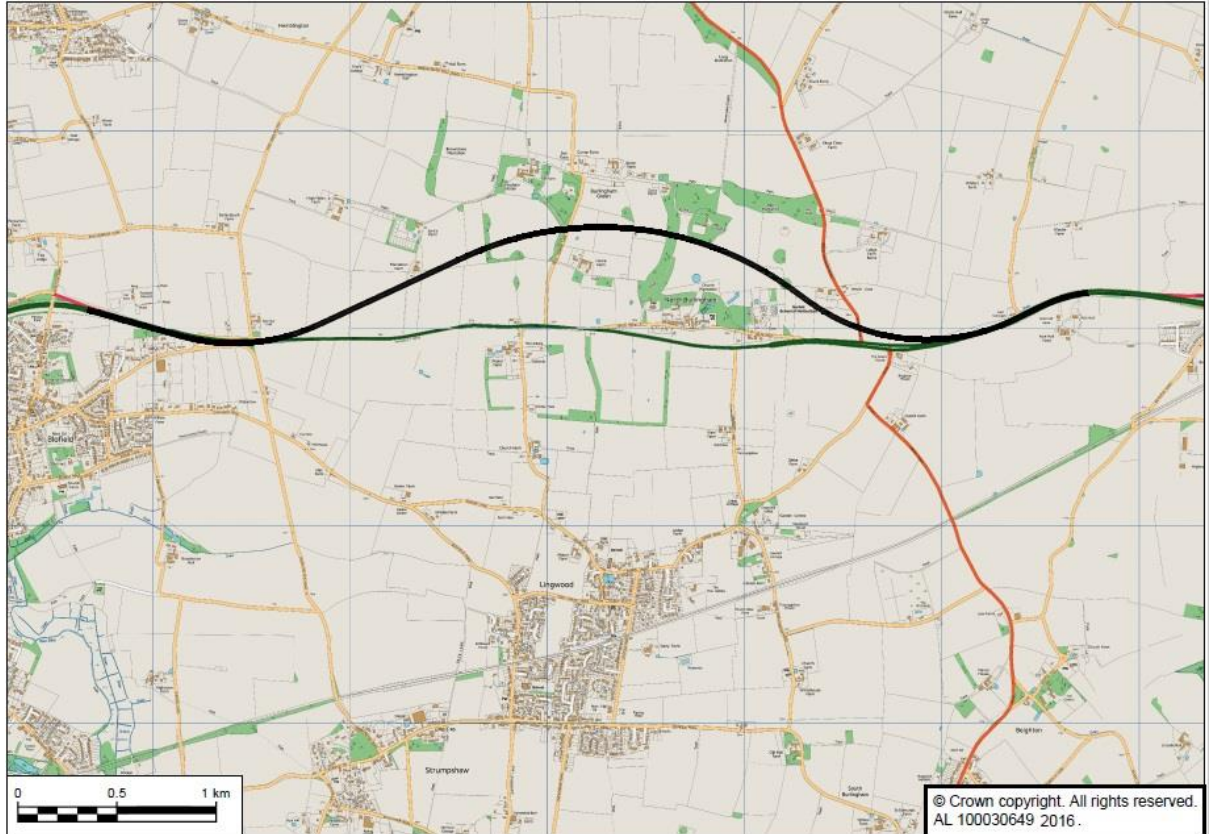


- 9.4.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway to the north of the existing A47 with appropriate junction improvements.
- 9.4.3 The alignment of the new dual carriageway would be to the north of North Burlingham and pass through predominately fields, through areas of local ponds and some areas of woodland.
- 9.4.4 The proposed route of the A47 corridor to the north of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.4.5 The existing A47 would where unaffected by the new dual carriageway would remain as part of the local road network

## 9.5 Option 4 (PCF Stage 1)

9.5.1 Option 4 is an offline dualling to the north of the existing A47 as shown below

**Figure 9-4 – Option 4 (PCF Stage 1)**

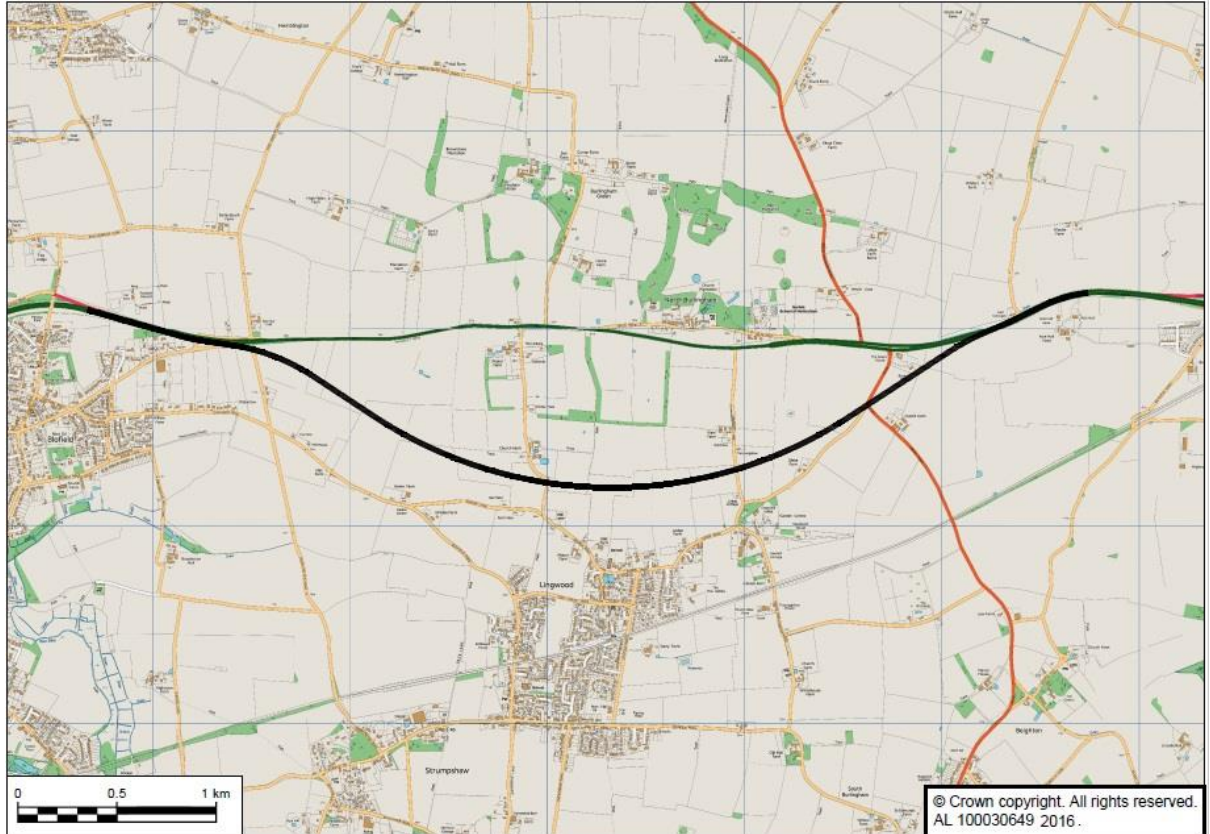


- 9.5.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway to the north of the existing A47 with appropriate junction improvements.
- 9.5.3 The alignment of the new dual carriageway would be to the north of North Burlingham and pass through predominately fields and some areas of woodland. Option 4 passes closer to North Burlingham than Option 3.
- 9.5.4 The proposed route of the A47 corridor to the north of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.5.5 The existing A47 would where unaffected by the new dual carriageway would remain as part of the local road network

## 9.6 Option 5 (PCF Stage 1)

9.6.1 Option 5 is an offline dualling to the south of the existing A47 as shown below

**Figure 9-5 – Option 5 (PCF Stage 1)**



- 9.6.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 9.6.3 The proposed new dual carriageway for this option follows an alignment running to the south of the A47. The route passes predominantly through open farm land and some woodland habitat. The alignment of Option 5 takes the route closer to the village of Lingwood to the south which contains a number of listed buildings and schools.
- 9.6.4 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.6.5 The existing A47 would remain where unaffected by the new dual carriageway and become part of the local road network.

## 9.7 Option 6 (PCF Stage 1)

9.7.1 Option 6 is an offline dualling to the south of the existing A47 route as shown below

**Figure 9-6 – Option 6 (PCF Stage 1)**



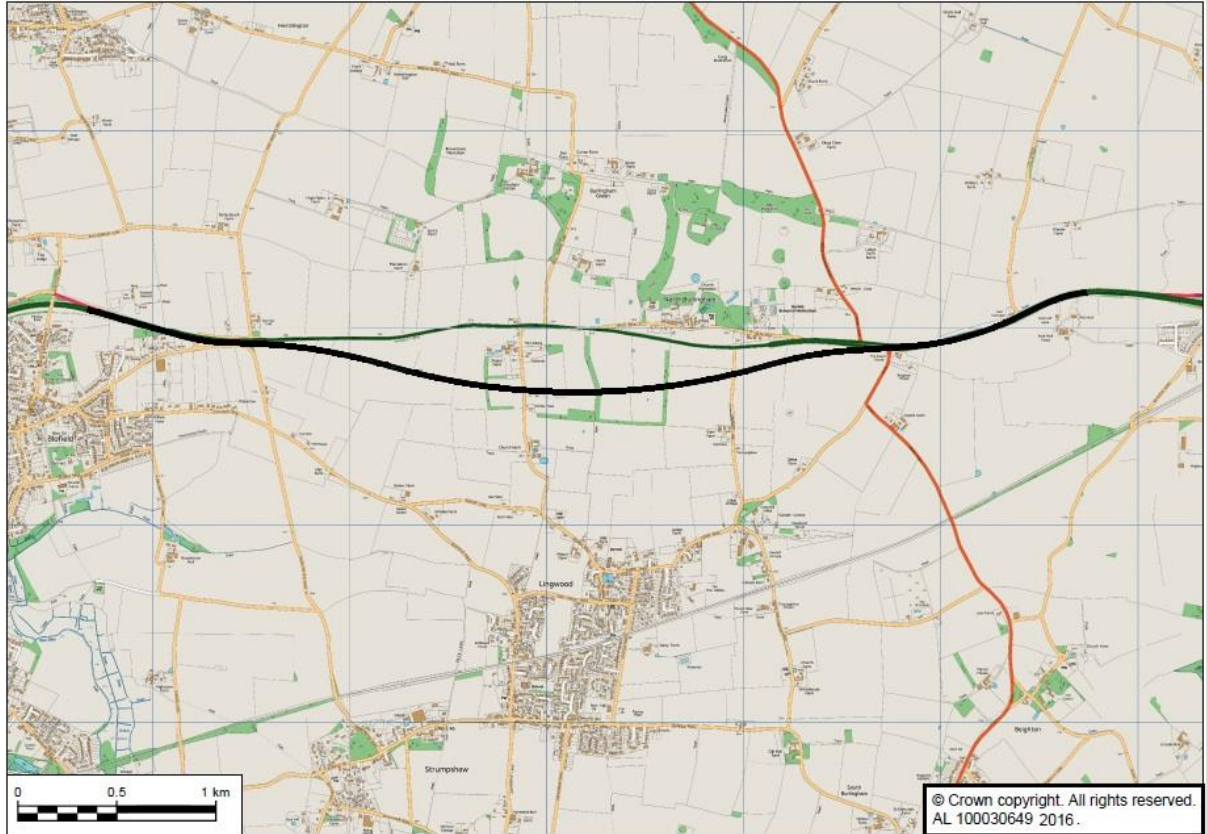
- 9.7.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 9.7.3 The proposed new dual carriageway for this option follows an alignment running to the south of the A47. The route passes predominantly through open farm land and some woodland habitat. The alignment of Option 6 is closer to the existing route of the A47 and therefore is not as close to the village of Lingwood as Option 5. The route is in closer proximity to a number of residential / farm properties on the south side of the existing A47.
- 9.7.4 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.7.5 The existing A47 would remain where unaffected by the new dual carriageway and become part of the local road network.



## 9.8 Option 7 (PCF Stage 1)

9.8.1 Option 7 is an offline dualling to the south as shown below

**Figure 9-7 – Option 7 (PCF Stage 1)**

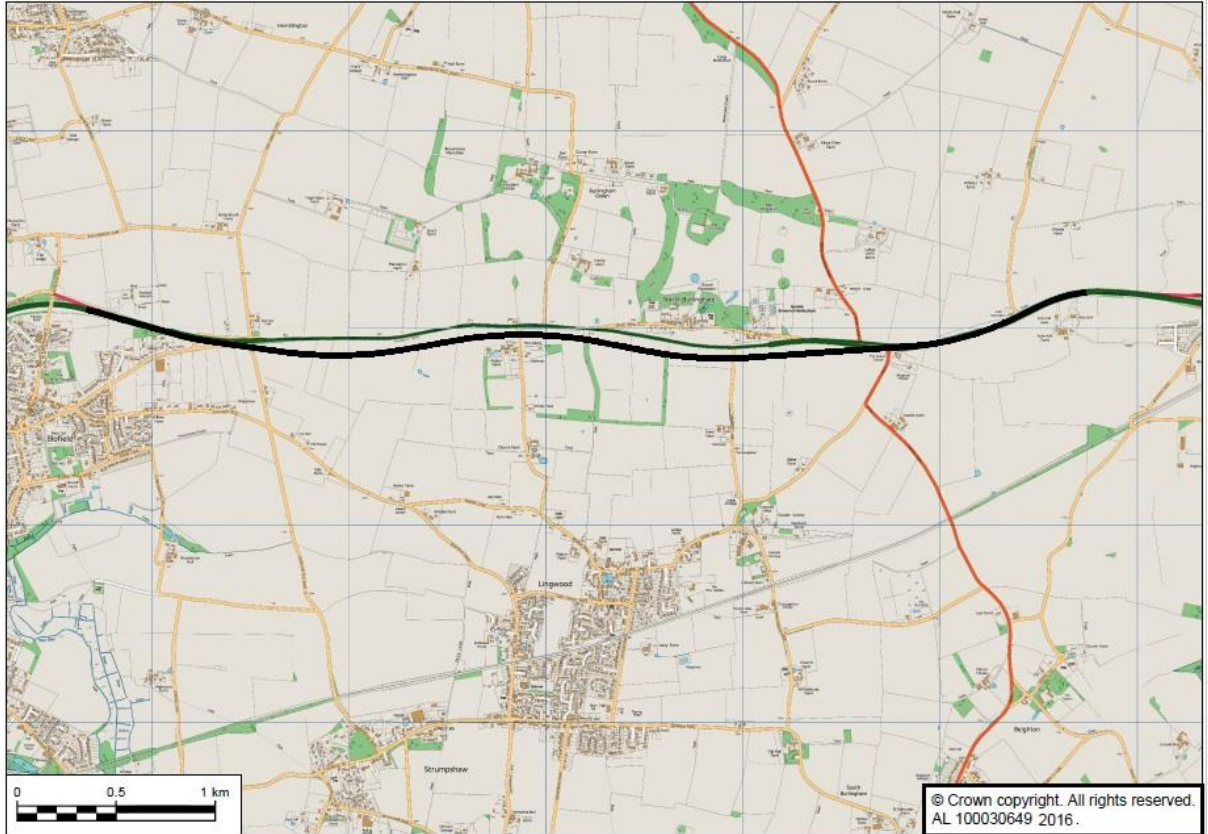


- 9.8.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 9.8.3 The proposed new dual carriageway for this option follows an alignment running to the south of the A47. The route passes predominantly through open farm land and some woodland habitat. The alignment of Option 6 is closer to the existing route of the A47 and therefore is not as close to the village of Lingwood as Option 5 or Option 6. Option 7 passes closer to farm buildings to the south of the existing A47.
- 9.8.4 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.8.5 The existing A47 would remain where unaffected by the new dual carriageway and become part of the local road network.

## 9.9 Option 8 (PCF Stage 1)

9.9.1 Option 8 is an offline dualling to the south as shown below

**Figure 9-8 – Option 8 (PCF Stage 1)**



- 9.9.2 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 9.9.3 The proposed new dual carriageway for this option follows an alignment running just offline to the south of the A47. The route passes predominantly through open farm land and some woodland habitat. The alignment of Option 8 is closest to the existing route, south of the existing A47 and passes closer to farm buildings to the south of the existing A47.
- 9.9.4 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be highly likely to acquire land along the route to accommodate the improvement.
- 9.9.5 The existing A47 would remain where unaffected by the new dual carriageway and become part of the local road network.

## 10 Initial Assessment of Options

### 10.1 Introduction

- 10.1.1 In order to reduce the number of options to be taken forward to more detailed assessment and to public consultation at PCF Stage 2 initial comparative assessments of the 8 options was undertaken.
- 10.1.2 Initial assessments were made of the options using Highways England's Early Assessment of Sifting Toolkit (EAST) and assessment against Highways England KPIs early in PCF Stage 1.
- 10.1.3 These are described briefly in Chapters 10.2 and 10.3 below and are based on PCF Stage 0 findings and Option concepts presented in Chapter 9 above. In all cases knowledge gained during the development of stage 0 has been captured in the assessments that follow upon the agreed hierarchy.

### 10.2 EAST (Early Assessment and Sifting Tool)

- 10.2.1 EAST is a Department for Transport (DfT) decision support tool that forms the initial part of the DfT's Transport Business Case. It is a high level assessment of the different options to discard any options that will not meet the transport objectives nor fit with local, regional, national strategies, or would be highly unlikely to pass key viability and acceptability criteria.
- 10.2.2 The EAST assessment rates the impact of the scheme against the following headline criteria:
- Strategic Impacts
  - Economic Impacts
  - Deliverable/ Managerial Impacts
  - Financial Impacts
  - Funding Considerations
- 10.2.3 Further detail with regard to the EAST assessment methodology and assessment undertaken can be found in **Appendix H**.
- 10.2.4 Due to the high level nature of the EAST assessment the results and ratings for each of the Options showed no discernible difference between the options identified.
- 10.2.5 The conclusion of the EAST assessment being that all of the options would meet the transport objective in a similar manner and that a more detailed assessment of the options would be necessary to identify the differentiators between the 8 options.

### 10.3 Highways England KPI Assessment

- 10.3.1 As presented in Chapter 2, as part of the Highways England Delivery Plan, a series of KPIs have been developed to ensure that schemes that Highways England deliver, achieve their strategic outcomes.
- 10.3.2 Each option was appraised and scored 1 to 5 where 1 is poor and 5 is good. The overall score is rounded average of the eight assessed KPIs scores, which are then ranked accordingly.

10.3.3 As part of the Highways England Business plan a series of KPI's have been developed to ensure that the work that Highways England undertake meets these requirements

10.3.4 These KPIs are based on the following topics,

- Managing the Network Safer
- Improving User Satisfaction
- Supporting the Smooth Flow of Traffic
- Encouraging Economic Growth
- Deliver Better Environmental Outcomes
- Helping Cyclists, walkers and other vulnerable users
- Achieving Real Efficiency

10.3.5 A summary table of the KPI assessment is shown below in **Table 10-1**:

**Table 10-1: Ranking of Options from KPI Assessment**

Option	Fit with wider transport and government objectives							
	Managing the network safer	Improving user satisfaction	Supporting the Smooth Flow of Traffic	Encouraging Economic Growth	Delivering better environmental outcomes	Helping cyclists, walkers and other vulnerable users	Achieving real efficiency	Keeping the Network in Good Condition
1	4	4	5	3	3	3	3	4
2	4	4	5	3	3	3	3	4
3	4	4	5	3	3	3	3	4
4	4	4	5	3	3	3	3	4
5	4	4	5	3	3	3	3	4
6	4	4	5	3	3	3	3	4
7	4	4	5	3	3	3	3	4
8	4	4	5	3	3	3	3	4

10.3.6 The conclusion of the assessment against the Highways England KPIs was that as the KPIs are at a reasonably high level that each of the route options is likely to meet the KPIs and score against the KPIs in a very similar way. As with the EAST assessment the conclusion being that in order to differentiate and compare options a more detailed assessment of the options would be necessary to identify the differentiators between the route options

## 10.4 Further Sifting Assessment

10.4.1 The EAST and KPI assessments showed that the 8 options all met the transportation objectives of the projects based on the level of assessment and information considered within the assessments made.

10.4.2 The EAST and KPI assessment methods however were too high level to effectively differentiate between the 8 options to allow the options to be reduced to a practical number of

options to be taken forward for more detailed assessment and for potential sustainable route options for public consultation in Stage 2.

10.4.3 It was agreed that further initial assessment of the 8 options should be undertaken. Using the desktop information and previous work undertaken on the representative solutions in PCF Stage 0, as new traffic, engineering and environmental surveys had not yet been undertaken, further assessment and appraisal work was undertaken on the 8 options. Initially for each option a qualitative appraisal summary table was completed based on available information. The assessment work was then developed to allow assessment and ranking of the 8 options against the following headings

- Environment Assessment
- Engineering Assessment
- Transportation Assessment
- Comparative Economics Assessment

10.4.4 The way in which these assessments and the results from each are presented in the following sections, each section is scored as 1 to 8, with the best performing option ranked as 1 and worst performing option ranked as 8.

## 10.5 Environmental Assessment for initial options review

10.5.1 For each of the 8 options a qualitative assessment was made of the likely environmental impact against the following environmental topic areas by environmental specialists based on Stage 0 data to qualitatively complete the AST style data:

- Noise
- Air Quality
- Greenhouse gases
- Landscape
- Townscape
- Historic Environment
- Biodiversity
- Water Environment

10.5.2 Experienced technical environmental specialists made the qualitative assessments from the baseline environmental data readily available from the desk studies and previous work undertaken.

10.5.3 The 8 topic areas and the estimated impacts were compiled for each option and this was used to determine an environmental ranking of the 8 options. Where options were considered to have comparable environmental impacts they were ranked with equal rankings. The environmental ranking assessment is included in **Appendix I**. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding: ranks 1 to 2 green, 3 to 5 amber and 6 to 8 red.

10.5.4 **Table 10-2** below shows the results of the Environmental assessment and ranking exercise

**Table 10-2: Ranking of Options from Environmental Assessment**

Option	Option Rank (based on Environmental Assessment)	Comment
Option 1	1	Predominately neutral scores due to alignment remaining online as existing alignment.
Option 2	5	Mixture of neutral and slightly adverse scores due to alignment being offline but crossing existing alignment
Option 3	7	Scored largely adverse and moderately adverse due to large offline nature / extent of new land take required affecting landscape and biodiversity. Close proximity to North Burlingham and perception of road to north and south of village.
Option 4	7	Scored largely adverse and moderately adverse due to large offline nature / extent of new land take required affecting landscape and biodiversity. Noise / Air impacts due to close proximity to North Burlingham and perception of road to north and south of village.
Option 5	6	Scored moderately adverse due to large offline nature / extent of new land take required affecting landscape and biodiversity. Noise / Air impacts of moving route closer to Lingwood. Impact on Schools / setting of listed buildings.
Option 6	4	Scored moderately adverse due to large offline nature / extent of new land take required affecting landscape and biodiversity. Noise / Air impacts due to close proximity to farm / residential properties.
Option 7	1	Predominately neutral scores, with slight beneficial scores for noise taking route further away from North Burlingham
Option 8	1	Predominately neutral scores, with slight beneficial scores for noise taking route further away from North Burlingham

## 10.6 Transportation Assessment for Initial Options Review

10.6.1 The 8 options all provide a dual carriageway replacing the length of single carriageway between Blofield and North Burlingham. From a transportation assessment all routes will predominantly perform in a similar way, the only real differentiating factor in terms of preliminary initial transportation assessment prior to the detailed transportation modelling was the difference between the options based on proposed route length. The longer the proposed route length the lower the scheme ranked in the assessment.

10.6.2 In terms of an initial transportation ranking to inform the option assessment this was based on route length. The longer the proposed route length the lower the scheme ranked in the assessment, as the longer the journey time.

10.6.3 **Table 10-3** below shows the ranking result of the initial transportation assessment and ranking. The numbered rankings 1 best performing with regard to initial transportation assessment through to 8, the worst performing with regard to initial transportation assessment. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding of ranks; 1 to 2 green, 3 to 5 amber and 6 to 8 red.

**Table 10-3: Transportation Assessment and Ranking**

Option	Length new carriageway	Option Rank (based on transportation assessment)	Comment
Option 1	4.215 km	1	All Options were relatively similar in length, but Option was shortest
Option 2	4.23 km	3	All Options were relatively similar in length
Option 3	4.43 km	7	All Options were relatively similar in length, but Option was longer than most
Option 4	4.295 km	5	All Options were relatively similar in length
Option 5	4.55 km	8	All Options were relatively similar in length, but Option was longest
Option 6	4.34 km	6	All Options were relatively similar in length, but Option was longer than most
Option 7	4.24 km	4	All Options were relatively similar in length
Option 8	4.22 km	2	All Options were relatively similar in length

## 10.7 Engineering Assessment for Initial Options Review

10.7.1 An Engineering assessment was undertaken of the 8 route options. Each of the options was assessed and ranked comparatively based on the following seven criteria

- Buildability
- Landtake
- General Alignment
- Accommodation works
- Geotechnical
- Structures
- Impact on Statutory Undertakers

### **Buildability**

10.7.2 The buildability of the route was reviewed based on a qualitative assessment of the likely ease of construction of the option, predominantly assessing the level of offline and online construction which would be required. Online construction being more difficult disruptive and requiring more complex phasing and traffic management arrangements than building offline. The Options were ranked 1 to 8, the least challenging from a buildability being ranked highest through to the most challenging being ranked lower.

### Landtake

10.7.3 The landtake requirements of each of the route options was determined from the engineering layouts. The options were then ranked from 1 to 8 according to the area of landtake required by the option. The route option with the smallest area of landtake being given the highest ranking through to the route with the largest area of landtake being given the lowest ranking

### General Alignment

10.7.4 The general alignment of each route option was reviewed based on an analysis of the geometric alignment in particular the radii and curvature of the alignment to give a measure of overall route alignment which could be used to compare the options. The 8 Options were ranked 1 to 8. Those with the worst alignment being ranked lowest through to the options with the better alignment being ranked higher.

### Accommodation Works

10.7.5 The potential amount of accommodation works required by each route option was reviewed and assessed. These Options were ranked 1 to 8. Those scoring lower and estimated to require comparably less accommodation works being ranked highest through to the route options estimated to require more accommodation works being ranked lower.

### Geotechnical

10.7.6 The geotechnical complexity of each route option was reviewed based on the available desk top information. These Options were ranked 1 to 8. Those scoring lowest and offering comparably the more complexity with regard to geotechnical scheme input ranked lowest through to the options with less complexity and higher scores being ranked higher.

### Structures

10.7.7 The structural complexity of each route option was reviewed based on the number, size and complexity of potential structures (bridges and culverts) required for the option. These Options were then ranked 1 to 8. Those scoring lowest and offering comparably more complexity with regard to structural input ranked lowest through to the options with less complexity and higher scores being ranked higher.

### Impact on Statutory Undertakers

10.7.8 The potential amount of works required to divert or protect statutory undertakers plant in order to accommodate each route option was reviewed and assessed. These Options were then ranked 1 to 8. Those scoring lower and estimated to require comparably less statutory undertakers' works being ranked highest through to the route options estimated to require more statutory undertakers' works being ranked lower.

### Engineering Assessment Overall Ranking

10.7.9 The rankings for the seven individual engineering criteria assessed are contained in **Appendix I**. The individual ranks were combined to give an overall initial engineering assessment ranking of the 8 options.

10.7.10 The overall ranking is presented in **Table 10-4** below with key overall comment regarding the ranking. The rankings have also been RAG (red –amber – green) rated to give an easy visual comparison based on the following banding: ranks 1 to 2 green, 3 to 5 amber and 6 to 8 red.



**Table 10-4: Ranking of Options from Engineering Assessment**

Option	Option Rank (based on Engineering Assessment)	Comment
Option 1	8	Online Option was considered difficult to build due to disruption and works required to bring existing carriageway up to modern standards. Option would need to interact with large number of STATs. Large amount of complex Traffic Management required.
Option 2	5	Option required large areas of land take but considered least difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47
Option 3	6	Option required large areas of land take but considered least difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47
Option 4	2	Option was considered least difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47
Option 5	4	Option was considered least difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47
Option 6	7	Option was considered low difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47. Option would need to interact with large number of STATs.
Option 7	3	Option was considered low difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47. Option would need to interact with large number of STATs.
Option 8	1	Option was considered least difficult to build due to offline nature and not requiring the traffic management of an online solution. Majority of works would occur without interruption to existing A47. Option would need to interact with large number of STATs.

## 10.8 Comparative Economic Assessment for Initial Options Review

10.8.1 The cost and economic benefit provided by a highway scheme are important assessment criteria, however at the initial assessment stage information on the estimated costs and potential benefit to cost ratio for each option were not available. Benefits and order of magnitude estimates have previously been estimated for a typical widening solution for the Blofield to North Burlingham dualling scheme and these were used as a starting point for a comparative assessment.

- 10.8.2 Benefit Cost Ratio (BCR) information for each option did not exist for the options at the time of optioneering, so an exercise was undertaken to estimate the benefits and cost of each of the proposed 8 options based on the previous PCF Stage 0 Order of Magnitude Estimate and Benefits.
- 10.8.3 A rough order of cost estimate of the likely construction cost of each of the options was estimated based on the typical solution estimate from previous stages with an adjustment made to account for the split of the option length online to offline. Offline construction anticipated to be cheaper than online construction.
- 10.8.4 Scheme benefits from the typical solution analysed at PCF Stage 0 were used as a base and a comparative prorata based on option length applied to give an estimate of benefits for each option.
- 10.8.5 The benefits and the estimated costs were combined for each option to give a numerical figure representing an indicative BCR for comparative assessment.
- 10.8.6 The indicative BCRs were used to rank the 8 options the higher the figure the higher the scheme ranked in terms of the economic assessment, as shown in Table 4.1.1.
- 10.8.7 The economic assessment ranking of the route options is presented in **Table 10-5** below along with the indicative BCR for comparative purposes and high level comment.

**Table 10-5: Economics Assessment and Ranking**

Option	Indicative BCR for Comparative Purposes	Option Rank (based on economic assessment)	Comment
Option 1	1.25	6	Majority online works ranking more expensive and reduced benefits due to high construction congestion.
Option 2	1.39	1	Majority offline works ranking less expensive and high benefits due to reduced construction congestion.
Option 3	1.22	7	Majority online works ranking more expensive and reduced benefits due to high construction congestion.
Option 4	1.31	4	Majority offline works, but longer route proposed, ranking relatively more expensive and medium benefits due to reduced construction congestion / longer route. Disbenefit of being closer to North Burlingham (noise / air).
Option 5	1.11	8	Majority offline works, but longer route proposed, ranking relatively more expensive and medium benefits due to reduced construction congestion / longer route. Disbenefit of being closer to Lingwood (noise / air / impact on listed buildings).
Option 6	1.30	5	Majority offline works, but longer route proposed, ranking relatively more expensive and medium benefits due to reduced construction congestion / longer route.
Option 7	1.37	3	Majority offline works, but longer route proposed, ranking relatively more expensive and medium benefits due to reduced construction congestion / longer route.
Option 8	1.37	2	Majority offline works ranking less expensive and high benefits due to reduced construction congestion.

## 11 Options Ranking, Sifting and Review

### 11.1 Options Review Meeting (ORM)

11.1.1 The initial options assessment undertaken as described in Chapter 10 were reviewed at an Options review meeting which took place on 16th June 2016. The options, the assessment of the options and the rankings were presented to senior representatives from Highways England, AECOM and Amey.

11.1.2 A review of the options development assessment process was undertaken.

11.1.3 The EAST assessment and the Highways England KPI assessments didn't differentiate between the developed options in order to provide a suitable ranking for these criteria.

11.1.4 The 8 route options were presented to the options review meeting along with the environmental, transportation, engineering and economic assessments and ranking. The assessment methodology and the assessment rankings were discussed and agreed as being appropriate.

11.1.5 Each of the assessments as presented in tables 10-2 to 10-5 in Chapter 10 were combined to give an overall ranking for each option. These rankings along with the overall ranking are presented below in **Table 11-1**. The table has been Red – Amber – Green rated with the top performing options 1-2 green 3-5 amber and 6-8 red.

**Table 11-1: Overall Ranking from Initial Assessments**

Option	Option Rank				Overall Rank
	Environment Assessment	Engineering Assessment	Traffic Assessment	Economic Assessment	
Option 1	1	8	1	6	4
Option 2	5	5	3	1	3
Option 3	7	6	7	7	8
Option 4	7	2	5	4	5
Option 5	6	4	8	8	7
Option 6	4	7	6	5	6
Option 7	1	3	4	3	2
Option 8	1	1	2	2	1

11.1.6 The overall rankings presented to the review meeting and included in the table above were reviewed at the meeting alongside the assessments to determine which of the developed options represented the most appropriate options to take forward for further more detailed assessment the results from the review and the rationale behind the review decisions are described in the following section

## 11.2 Initial Options Review Conclusions and recommendations

11.2.1 The overall rankings from **Table 11-2** have been presented below with the conclusions of the options review meeting and the conclusions as to whether the option is to be taken forward for further assessment

**Table 11.2: Summary of route options to be taken forward for further assessment**

Option	Overall Rank from initial assessment	Option to be taken forward for further assessment	Overview of Key reasons
Option 1	4	YES	Minimal Environmental impact due to online nature requiring least amount of land take. Balanced against potentially higher costs of construction and interaction with existing STATs.
Option 2	3	YES	Minimal Congestion during Construction. Moving existing route away from North Burlingham improving noise over existing conditions. Cost reduces due to offline nature of Option. Adds resilience to local network de-trunk existing A47 route.
Option 3	8	NO	Large impacts due to increasing new route length and adversely affecting noise and conditions for residents of North Burlingham due to closer proximity
Option 4	5	NO	Large impacts due to increasing new route length and adversely affecting noise and conditions for residents of North Burlingham due to closer proximity
Option 5	7	NO	Large impacts due to increasing new route length and impact on existing natural environment adversely affecting noise and conditions for residents of Lingwood, including Schools and listed buildings due to closer proximity.
Option 6	6	NO	Impacts due to increasing new route length and impact on existing natural environment, does not perform as well as other Options in similar route location.
Option 7	2	YES	Minimal Congestion during Construction. Moving existing route away from North Burlingham improving noise over existing conditions. Cost reduces due to offline nature of Option. Adds resilience to local network de-trunk existing A47 route.
Option 8	1	YES	Minimal Congestion during Construction. Moving existing route away from North Burlingham improving noise over existing conditions. Cost reduces due to offline nature of Option. Adds resilience to local network de-trunk existing A47 route.

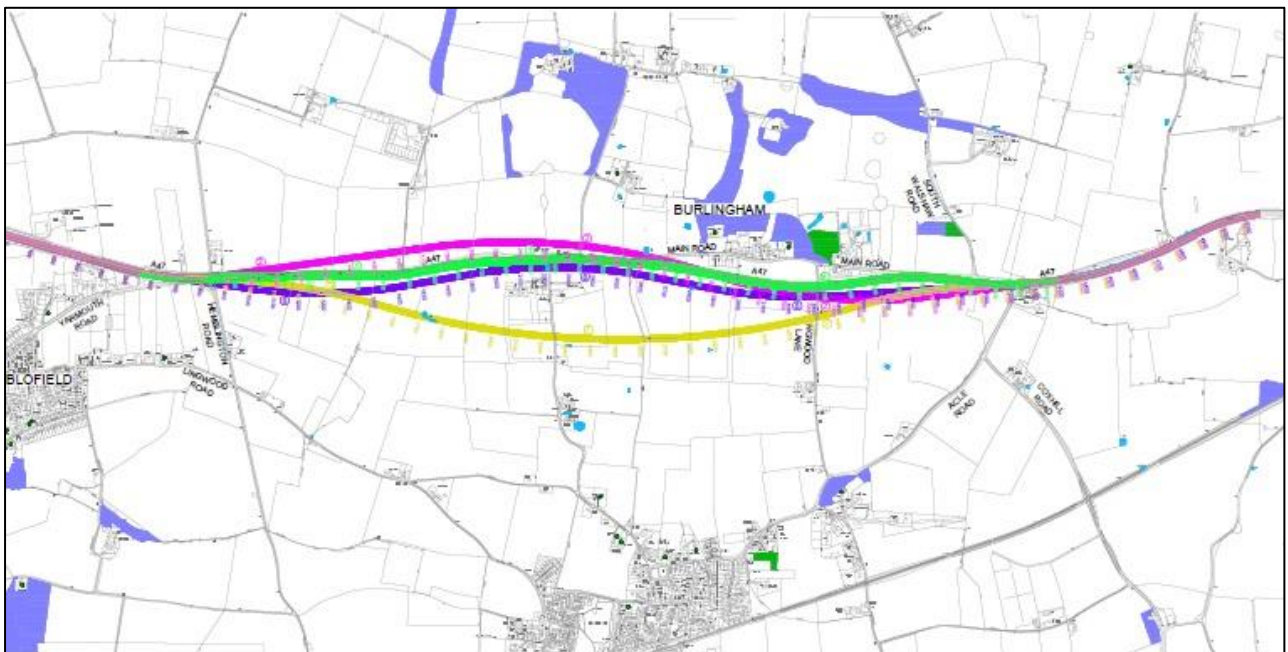
### 11.3 Options for Further Assessment

11.3.1 The four options to be taken forward for further assessment are

- Option 1 an online dualling following the existing A47 route
- Option 2 an offline dualling to the north of the existing A47 for the western part of the route and to the south of the existing for the eastern part of the route
- Option 7 an offline dualling to the south of the existing A47 route
- Option 8 an offline dualling to the south of the existing A47 route

11.3.2 The four options are shown below on figure 11-1

**Figure 11-1 – The 4 options taken forward for further assessment**



11.3.3 The four options being proposed to be taken forward into PCF Stage 2 and ultimately non-statutory public consultation will continue to evolve as further assessment is undertaken on each option in an increasing level of detail in the future.

## 12 Traffic Analysis of Sifted Options

### 12.1 Introduction

- 12.1.1 The NATS model has been developed by Norfolk County Council specifically for assessment of traffic in and around Norwich. The model covered the area of central Norwich in detail and the surrounding areas in varying levels of detail. The detail around the Blofield scheme was not sufficient for the model to simply be used without additional detail being added and the model revalidated.
- 12.1.2 At the start of PCF Stage 1 it was initially planned to utilise the NATS model with suitable updates and revalidation specifically for and local to the A47 Blofield to North Burlingham Scheme, so that the modelling would be available to inform the economics at the end of PCF Stage 1.
- 12.1.3 Taking this approach would have led to three separate local model updates being undertaken for the three schemes (North Tuddenham, Thickthorn and Blofield) with a further exercise in PCF Stage 2 to combine the three model updates and revalidate the joined up model.
- 12.1.4 A detailed review of the timescales and programme for PCF Stage 1 and 2 was undertaken to review timescales to construction. It became clear that the time scales and work involved to combine and revalidate the 3 models proposed to be built in PCF Stage 1 into one model in PCF Stage 2 was likely to delay the end of PCF Stage 2 due to the rework and revalidation.
- 12.1.5 It was therefore agreed with that a single NATS model update and validation exercise which covered the necessary detail to analyse all three of the Schemes would be undertaken from the start.
- 12.1.6 Due to the timescales involved in updating and validating a combined transportation model the forecasting and economics based on the model outputs would not be available until PCF Stage 2. As the model build work would not be sufficiently advanced by the end of PCF Stage 1 the following products would not be able to be produced in time for SGAR 1
- The Local Model Validation Report,
  - The Traffic Forecasting Report and
  - The Economic Assessment Report and
  - The Appraisal Summary Table (AST)
- 12.1.7 With the above in mind a technical note was produced to summarise and describe the available transportation and economic appraisal information at the time of the Scheme reaching SGAR1 in November 2016.
- 12.1.8 The technical note was prepared in lieu of the full set of Stage 1 PCF products. With each of the sections of this note corresponding to a PCF product. The products covered in this note were:
- Appraisal Specification Report
  - Traffic Data Collection Report
  - Local Model Validation Report
  - Traffic Forecasting Report

- Economic Assessment Report
- Appraisal Summary Tables

## 12.2 Traffic Modelling Approach

- 12.2.1 No strategic model is currently available to assess future year demand. In the absence of a calibrated strategic model and taking into account the timescales, the transport modelling was undertaken at a scheme level.
- 12.2.2 The assessment methodology is based on the assessment undertaken in Stage 0+, with the figures updated to reflect updated scheme details and costs. Forecast traffic numbers have been re-forecast using TEMPRO 7.0. The latest version of TUBA (version 1.9.7) has been used in the economic assessment.
- 12.2.3 The traffic modelling has been undertaken using a spreadsheet-based tool to assess the link schemes. This considers the impact of the scheme on capacity/flow/speed characteristics and resulting vehicle travel times and distances. Capacity and speed flow characteristics have been derived from WebTAG Unit M3.1. The model assumes fixed demand and is highway only.
- 12.2.4 Journey times along the link were calculated using speed-flow curves; do minimum journey times have been calculated using the speed/flow curve for a single carriageway and do something journey times have been calculated using the speed/flow curve for a dual carriageway.
- 12.2.5 No allowance was made for re-routing or induced traffic as a result of the scheme. Similarly, no assessment has been made of the impacts of construction or maintenance due to a lack of data. The methodology was acceptable and proportionate for the detail of assessment required for stage 0+.

## 12.3 Forecasting Methodology

- 12.3.1 Growth factors used to calculate future year demands have been derived from a combination of NTM and NTEM outputs as described in WebTAG Unit M4 Chapter 9.1: Using NTEM without a formal model. Different factors were calculated and used for cars, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV); with different growth factors for cars in the three peak periods assessed.
- 12.3.2 12 hour Manual Classified Count (MCC) traffic surveys were undertaken on 25th June 2015. Queue surveys were undertaken at the same time.
- 12.3.3 The growth factors for LGV and HGV traffic have been assumed to be constant over all time periods. The calculation of growth factors for cars for Nth Tuddenham has used adjusted NTEM factors averaged from the districts of Breckland and South Norfolk. Growth factors for LGV and HGV are based on NTM factors for East of England.
- 12.3.4 As there are no committed developments directly accessing the scheme, no specific allowance has been made for developments; their impact has been assumed to be included as part of the localised growth factors.
- 12.3.5 The scheme has been assessed with an opening year of 2021, a design year of 2036, an horizon year of 2051 and a 60 year assessment from the opening.
- 12.3.6 Analysis of the link has been based on flows for each hour over an entire year, based on observed TRADS data. Because the analysis has been done on data covering an entire year, an Annualisation factor of 1 has been used.



- 12.3.7 Future demand flows used in the assessment were calculated by applying TEMPRO 7.0 and NTM factors to the recorded hourly flows for an entire year and extracted from TRADS. They were then used as the basis of the modelling to predict future traffic performance with and without intervention in the Do-Minimum and Do Something Scenarios.
- 12.3.8 The modelling covers a core growth scenario, and no high and low forecasts have been developed at this stage.
- 12.3.9 Seasonality was included in the modelling because hourly flows for an entire year have been used as the basis of analysis. For the same reason an Annualisation factor of 1 has been applied in the economic analysis.
- 12.3.10 Western Link Road Norfolk County Council have previously looked at the feasibility of a Western Link Road between the A47 in the Easton area to join up with the end of the NDR and effectively complete the link between the A47 to the west of Norwich. This link is not committed and was not taken into account in the modelling.

## 13 Engineering Overview of Sifted Options

### 13.1 Introduction

13.1.1 The following section describes the engineering features assessment and key comparison between the four options selected for further development as described in Chapters 10 and 11 which were taken forward to non statutory public consultation.

13.1.2 The layouts for the 4 options, (Options 1, 2, 7 and 8) were further developed from the layouts used at the time of the sifting exercise to show indicative side road and junction layouts. This indicative side road and junction layout has been included at this stage to allow Highways England Commercial team to price the options more fully. Junction strategy and side road strategy are not developed and fully considered until later PCF Stages so the layouts should be treated as indicative only. The layouts, for options 1, 2, 7 and 8, with the indicative junction and side road layouts are included in **Appendix J** and are discussed in the following sections. A junction strategy and side road requirements specific to each option will be developed in more detail at a later PCF Stage.

### 13.2 Highways and Alignment

#### General

13.2.1 The proposed dual two all purpose carriageways would both be 7.3m wide with a provision of 1m hard strips on both sides of the carriageways. The central reserve would be a minimum of 2.5m however it is likely it would be wider at locations to accommodate forward visibility at bends or level differences between the two carriageways. The verge width would be a minimum of 2.5m but designed to accommodate forward visibility, traffic signs, vehicle restraints system and other network infrastructure.

13.2.2 At this PCF Stage the vertical alignment has not been reviewed in detail but the intention will be to comply with design standards. The road would be designed where practical to follow the existing ground to minimise the earthworks.

13.2.3 The national speed limit would apply on the proposed dual carriageway throughout its length. Any major junctions would be lit and laybys would be provided on both carriageways at appropriate locations. Current speed limits at either end of the scheme are 50mph and would tie into the new scheme.

13.2.4 Direct access from properties and gaps in the central reserve will not be permitted in the design options so alternative arrangements would have to be included as part of any online option. Feasible offline improvements would be to construct a new dual carriageway wholly to the south of the existing A47, or an alignment partly to the north at the western end and crossing the existing alignment to be to the south of the existing where it passes south of Burlingham. Any offline option would allow the existing single carriageway A47 to operate as a local access road potentially with improved non-motorised user facilities. Where assessment is required, local access roads may need to be diverted or include mitigation measures to provide access to properties and adjacent fields.

#### Option 1 On-line improvement (PCF Stage 1)

13.2.1 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to dual carriageway standard by the construction of a new section of online dual carriageway with appropriate junction improvements.

- 13.2.2 This online option will attempt to utilise as much of the existing carriageway as possible, however, due to the differences between single and dual carriageway standards, it may not be possible to achieve this in all locations.
- 13.2.3 As a result, it is highly likely that it would be necessary to acquire land adjacent to the existing road to accommodate improvement. Where required, local access roads may need to be diverted or include mitigation measures to provide access to properties and adjacent fields.
- 13.2.4 Given the fairly steep fall of the land from north to south, especially at the at the western end of the corridor, the new carriageway would be at a lower level than the existing. Where required, local access roads may need to be diverted or include mitigation measures to provide access to properties and adjacent fields.
- 13.2.5 The alignment of this online improvement would meet the standards of horizontal geometry. The horizontal alignment is a series of straights linked by short, and fairly tight radius curves but the proposed option is likely to have horizontal radii equal to or greater than the desirable minimum for the design speed.
- 13.2.6 Vertically the existing alignment falls eastwards on a gentle downhill gradient to a low point mid-way between Blofield and North Burlingham and then rises gently towards North Burlingham.
- 13.2.7 The proposed alignment is likely to have radii greater than the Desirable Minimum for the design speed of this road.
- 13.2.8 Generally the longitudinal gradients are very shallow, shallower than 0.2% for a considerable length.
- 13.2.9 Being on the line of the existing A47 and subsuming much of the existing carriageway means that little of the existing road would be left to be used for local accesses and non-motorised users. Other provision would be required.

### **Option 2 Off-line improvement (PCF Stage 1)**

- 13.2.10 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.
- 13.2.11 The proposed new dual carriageway would be constructed part offline to the north and part offline to the south of the existing A47. The route follows an alignment running to the north of the A47 as it heads away from the village of Blofield (some 55m further to the north east) and to the south of the existing A47 as the route passes the village of North Burlingham (some 90m further south), crossing the existing A47 between the villages before tying back in to the existing alignment near the existing A47/Acle Road junction. The route passes predominantly through open farm land and some woodland habitat.
- 13.2.12 The proposed route is offline therefore it is not so constrained by the existing A47 alignment as Option 1, although because the route crosses the existing A47 levels would have to be designed such that a through route could be maintained during construction. To move the alignment away from and then across the existing may require horizontal radii smaller than the existing alignment but they would always be in excess of the Desirable Minimum for the design speed.
- 13.2.13 The proposal would have vertical crest curve radii greater than the Desirable Minimum for the design speed. Given the local topography there would be little opportunity to give the vertical alignment any greater gradients than the existing highway so generally the longitudinal gradients would be very shallow, shallower than 0.2% for a considerable length.

13.2.14 Being a reasonable distance offline either to the north or south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local traffic, cyclists and pedestrians.

13.2.15 As a result of the route being offline, it would be necessary to acquire land adjacent to the existing road to accommodate improvement.

### **Option 7 Offline improvement (PCF Stage 1)**

13.2.16 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.

13.2.17 The proposed new dual carriageway for this option follows an alignment running to the south of the A47 (up to 330m away). The route passes predominantly through open farm land and some woodland habitat.

13.2.18 The proposed route is offline and because the route does not cross the existing A47 it is therefore not constrained by the existing A47 alignment either horizontally or vertically. Horizontal radii in excess of the Desirable Minimum for the design speed could be used throughout.

13.2.19 The vertical alignment could be improved compared to the existing and the proposal would have vertical crest curve radii greater the Desirable Minimum for the design speed.

13.2.20 The vertical alignment could be improved compared to the existing and the proposal would have vertical crest curve radii greater the Desirable Minimum for the design speed. Generally the longitudinal gradients would be 2% or shallower.

13.2.21 Being a distance offline either to the south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local traffic, cyclists and pedestrians.

13.2.22 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be necessary to acquire land along the route to accommodate the improvement.

### **Option 8 Offline improvement (PCF Stage 1)**

13.2.23 The single carriageway section of the A47 between Blofield and North Burlingham would be improved to current dual carriageway standard by the construction of a new section of offline dual carriageway with appropriate junction improvements.

13.2.24 The proposed new dual carriageway for this option follows an alignment running just offline to the south of the A47 (up to 70m away). The route passes predominantly through open farm land and some woodland habitat. The alignment passes close to farm buildings to the south of the existing A47.

13.2.25 The proposed route is offline and because the route does not cross the existing A47 it is therefore not constrained by the existing A47 alignment either horizontally or vertically. Horizontal radii in excess of the Desirable Minimum for the design speed could be used throughout.

13.2.26 The vertical alignment could be improved compared to the existing and the proposal would have vertical crest curve radii greater the Desirable Minimum for the design speed. Generally the longitudinal gradients would be 2% or shallower.

- 13.2.27 The proposed route of the A47 corridor to the south of the existing is effectively a new highway corridor and it would therefore be necessary to acquire land along the route to accommodate the improvement.
- 13.2.28 Being offline to the south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local traffic, cyclists and pedestrians.

### **Junction Strategy**

- 13.2.29 As noted above an indicative side road and junction layout has been developed for each option. This indicative side road and junction layout was included at this, PCF Stage 1 to allow Highways England Commercial team to price the options more fully. Junction strategy and side road strategy are not developed and fully considered until later PCF Stages so the layouts should be treated as indicative only

### **Option 1 On-line improvement (PCF Stage 1)**

- 13.2.30 There are no online roundabouts provided at either end of the Scheme, both ends of the Scheme are serviced via dual-to-dual connections into the existing A47 dual carriageway.
- 13.2.31 An extension of the existing Yarmouth Road is provided to the east of Blofield, connecting, via an over / under bridge, to an extension of existing Main Road in the close proximity to North Burlingham.
- 13.2.32 A new dumb bell junction is proposed to the eastern end of the Scheme, to the north and south of the existing A47. The southern roundabout connects Acle Road and Coxhill Road with an over / under bridge to a second roundabout connecting South Walshaw Road with Main Road and the A47. Both access to the A47 are via on / off slips.
- 13.2.33 Slow moving vehicles accessing the A47 via the British Sugar Factory south of Acle Road will now be able to access the A47 without the need to cross into live traffic in order to travel in the opposite direction.

### **Option 2 Off-line improvements (PCF Stage 1)**

- 13.2.34 There are no online roundabouts provided at either end of the Scheme, both ends of the Scheme are serviced via dual-to-dual connections into the existing A47 dual carriageway.
- 13.2.35 An extension of the existing Yarmouth Road is provided to the east of Blofield, connecting to part of the existing A47 single carriageway, via an over / under bridge, to the existing Main Road in the close proximity to North Burlingham.
- 13.2.36 A new dumb bell junction is proposed to the eastern end of the Scheme, to the north and south of the existing A47. The southern roundabout extends Coxhill Road with an over / under bridge to a second roundabout connecting South Walshaw Road with Main Road and the A47. Both access to the A47 are via on / off slips. Acle Road access to Coxhill Road is provided via a T-junction.
- 13.2.37 Slow moving vehicles accessing the A47 via the British Sugar Factory south of Acle Road will now be able to access the A47 without the need to cross into live traffic in order to travel in the opposite direction.

### **Option 7 & 8 Off-line improvements (PCF Stage 1)**

- 13.2.38 There are no online roundabouts provided at either end of the Scheme, both ends of the Scheme are serviced via dual-to-dual connections into the existing A47 dual carriageway.

13.2.39 An extension of the existing Yarmouth Road is provided to the east of Blofield, connecting to the exiting A47 single carriageway, via an over / under bridge. The existing carriageway connects to the new A47 dualled section via a new dumb bell junction at the eastern end of the Scheme, to the north and south of the existing A47. The southern roundabout connects Acle Road and Coxhill Road with an over / under bridge to a second roundabout connecting South Walshaw Road with Main Road and the A47. Both access to the A47 are via on / off slips.

13.2.40 Slow moving vehicles accessing the A47 via the British Sugar Factory south of Acle Road will now be able to access the A47 without the need to cross into live traffic in order to travel in the opposite direction.

### 13.3 Departures from Standards

#### Option 1 On-line improvement (PCF Stage 1)

13.3.1 At this PCF Stage 1 it was assumed that widening could be undertaken on-line while smoothing out the poor geometry of the existing, running slightly off-line to the west of The Old Post Office to avoid the worst of the existing horizontal radii. Departures from Standard could be avoided, but as the design develops and junction locations are confirmed then Departures may be introduced.

#### Option 2, 7 and 8 Off-line improvements (PCF Stage 1)

13.3.2 No Departures from Standard were anticipated at the PCF Stage1.

### 13.4 Side Roads, Access and Accommodation Works

13.4.1 Due to the relatively flat landscape of the area between Blofield and North Burlingham any A47 improvements either online or offline to the north or south would not be unduly influenced as to their location.

13.4.2 The assessment of access and accommodation works for the scheme is at an early, indicative, stage and will be assessed in more detail in future PCF Stages.

#### Option 1 Online Dualling (PCF Stage 1)

13.4.3 The online dualling of the A47 under this option will affect agricultural land north and south of the existing A47 trunk road. Excluding any possible mitigation measures the new alignment of the A47 will be on low embankment or in shallow cutting.

13.4.4 At the tie-in of the new / old A47 alignment the works will affect land in the High Noon Lane area. The land that may be affected is a private access road, adjacent agricultural land, part of a residential garden and part of a car dealership.

13.4.5 East of Blofield, the existing access between Yarmouth Road and the A47 will be retained but with a reconfigured layout. This reconfiguration may affect two residential properties on Yarmouth Road near the junction. From this reconfigured junction, a new link road will be constructed to connect with Main Road on the west side of North Burlingham, a distance of approximately 2200 metres. Initially, the link road will be located to the south of the new alignment before crossing over to the north, via a new bridge located approximately midway between High Noon Lane and the Plantation Farm access road. The alignment of Hemblington Road will be reconfigured to connect with the new link road. The land affected is predominately of agricultural use. However, arable plots, two access strips and part of the leisure / farm shop site adjacent to Yarmouth Road may be affected by the new link road.

- 13.4.6 North of the new A47 alignment, the farm access road and Dell Corner Lane will not have a direct connection to the new alignment. Also there will no direct access from the new eastbound A47 carriageway alignment to North Burlingham.
- 13.4.7 The farm access road and Dell Corner Lane will connect with the new access road running approximately parallel to the new A47 alignment that will run through and connect with Main Road at North Burlingham. Access to the new A47 alignment will be via Main Road and a new interchange constructed on the east side of the village. The land affected is predominately of agricultural use. However, the property known as The Old Post Office may be affected.
- 13.4.8 South of the new A47 alignment, Lingwood Road and Lingwood Lane will be stopped up and will not have direct access to the new A47 alignment. Access to the new A47 alignment will be via Church Road, School Road, Lodge Road and the new interchange near Acle Road, east of North Burlingham.
- 13.4.9 East of North Burlingham, Main Road will be realigned and extended to connect with South Walsham Road at a new junction. On the south side of the new A47 alignment, the junction of Acle Road and the B1140 (Coxhill Road) will be reconfigured. From these two new junctions realigned sections of South Walsham Road and Acle Road will connect directly to the new A47 alignment. To facilitate all traffic movements a new link road will be constructed between these two new junctions with a new bridge that will carry traffic over the new A47 alignment.
- 13.4.10 The land affected by the construction of the new interchange is predominately of agricultural use. However, the grounds of the property known as The Old College, a holiday rental property / camping site, part of a scrap dealership and part of a business centre site may be affected by the Main Road realignment. Also, the realignment of Acle Road and its revised connection to the A47 may affect the residential property known as The Coach House and The White House commercial site.
- 13.4.10 It is likely that redundant sections of existing carriageway will be utilised for local access, landscaping or returned to agriculture.

### **Option 2 Offline Dualling to the North of Blofield and to the south of North Burlingham (PCF Stage 1)**

- 13.4.11 Under this option agricultural land will be affected to the north of the existing A47 trunk road between Hemblington Road, east of Blofield and the west side of North Burlingham. From the west side of North Burlingham to Acle Road agricultural land to the south of the existing A47 will be affected. Excluding any possible mitigation measures the new alignment of the A47 will be on low embankment or in shallow cutting.
- 13.4.12 East of Blofield, the existing access between Yarmouth Road and the A47 will be retained but with a reconfigured layout. This reconfiguration may affect two residential properties on Yarmouth Road near the junction.
- 13.4.13 From this reconfigured junction, Blofield and North Burlingham will be connected by a new link road south of the new A47 alignment. This new link road will formed by a combination of new road works and utilising a retained section of the existing A47 carriageway. Near Blofield, Hemblington Road will be realigned to connect with this new link road. West of North Burlingham, a new underbridge will be constructed to run traffic beneath the new A47 alignment. This underbridge will connect the retained section of the A47 to Main Road at North Burlingham. The land affected is predominately of agricultural use. However, arable plots, two access strips and part of the leisure / farm shop site adjacent to Yarmouth Road, near Blofield, may be affected by the new link road.
- 13.4.14 To the north, the Plantation Farm access road and Dell Corner Lane will be severed by the new alignment. These roads will not have direct access to the new alignment. Dell Corner Lane will be able to access the new A47 alignment via Burlingham Road, Newport Road and

South Walsham Road. A new access track will run between High Noon Lane and Main Road at North Burlingham. The land affected will be of agricultural use.

- 13.4.15 The existing Lingwood Road / A47 junction will be retained as it is located within the section of the existing A47 that is to be retained as a local access road.
- 13.4.16 Lingwood Lane will be severed by the new A47 alignment and will not have direct access to the new alignment. Access to the new alignment will be via Acle Road and a new interchange east of North Burlingham.
- 13.4.17 Midway between Lingwood Lane and Acle Road a new bridge will be constructed over the new A47 alignment. This bridge, elevated above the adjacent ground, will connect with two new junctions either side of the new A47 alignment and will provide all traffic movements to and from the new A47. These new junctions will also connect with realigned sections of Main Road and South Walsham Road to the north and Acle Road / Coxhill Road to the south. The lands affected are predominately of agricultural use. However, the grounds of the property known as The Old College, a holiday rental property / camping site, a scrap dealership and a business centre may be affected by the Main Road realignment.
- 13.4.18 The existing junction of the A47 and Acle Road would be stopped up. Access to the new A47 alignment would be via the new junctions / bridge described above.
- 13.4.19 It is likely that redundant sections of existing carriageway will be utilised for local access, landscaping or returned to agriculture.

#### **Option 7 – Offline Dualling to the South (PCF Stage 1)**

- 13.4.20 The offline dualling of the A47 under this option will affect agricultural land to the south of the existing A47 trunk road. Excluding any possible mitigation measures the new alignment of the A47 will be on low embankment or in shallow cutting. Sections of the existing A47 will be retained as a local link road / access road.
- 13.4.21 At the tie in of the existing / new A47 an existing access road and a road access may be affected by the works.
- 13.4.22 East of Blofield, the existing access between Yarmouth Road and the A47 will be retained but with a reconfigured layout. This reconfiguration may affect two residential properties on Yarmouth Road near the junction.
- 13.4.23 From this reconfigured junction, Blofield and North Burlingham will be connected by a new link road. This new link road will be formed by a new section of highway, constructed south of the new A47 alignment and a new bridge just west of the Plantation Farm access road and retained section of the existing A47. A new junction will be constructed to connect Hemblington Road, near Blofield, with the new link road. The land affected is predominately of agricultural use. However, arable plots, two access strips and part of the leisure / farm shop site adjacent to Yarmouth Road may be affected by the new link road.
- 13.4.24 All existing junctions that connect to the retained section of the existing A47 will remain unchanged. Road users will be able to access the new A47 alignment via a new interchange located to the east of North Burlingham.
- 13.4.25 The new A47 alignment will sever Lingwood Road and Lingwood Lane and the roads will be stopped up. Road users south of the new alignment will be able to access the new A47 alignment via Church Road, School Road, Lodge Road and Acle Road that lead to a new interchange east of North Burlingham. North of the new alignment road users will be able to access the new A47 alignment via the retained section of the existing A47 and the new interchange east of North Burlingham.



- 13.4.26 Midway between Lingwood Lane and Acle Road a new bridge will be constructed over the new A47 alignment. This bridge, elevated above the adjacent ground, will connect with two new junctions, either side of the new alignment. This will provide all traffic movements to and from the new A47 alignment and the local network. The new junction on the north side will connect with the retained section of the existing A47 (link road) and a realigned sections of South Walsham Road. The new junction on the south side will have a connecting link road to a reconfigured junction of Acle Road / Coxhill Road. The lands affected are of predominately of agricultural use. However, the ground of the property known as The Old College, a holiday rental property / camping site, a scrap dealership and a business centre may be affected by the link to the retained section of the existing A47.
- 13.4.27 Access between North Burlingham and the new A47 alignment will be via the existing junction of Main Road / A47, on the west side of the village, and the new interchange. The existing access from Main Road to the A47, on the east side of the village will be stopped up.
- 13.4.28 The existing A47 / Acle Road junction will be stopped up. East Acle Road, the realignment of the A47 to tie in with the existing carriageway may affect agricultural land just outside of the existing highway boundary, over a distance of approximately 900 metres.
- 13.4.29 It is likely that redundant sections of existing carriageway will be utilised for local access, landscaping or returned to agriculture.

#### **Option 8 – Offline Dualling just to the South (PCF Stage 1)**

- 13.4.30 The offline dualling of the A47 under this option would place the new alignment approximately parallel to and up to 70 metres south of the existing alignment between Hemblington Road and Acle Road. Excluding any possible mitigation measures the new alignment of the A47 will be on low embankment or in shallow cutting. Sections of the existing A47 will be retained as a local link road / access road. This option will predominately affect agricultural land.
- 13.4.31 East of Blofield, the existing access between Yarmouth Road and the A47 will be retained but with a reconfigured layout. This reconfiguration may affect two residential properties on Yarmouth Road near the junction.
- 13.4.32 From this reconfigured junction, Blofield and North Burlingham will be connected by a new link road. This new link road will be formed by a new section of highway constructed south of the new A47 alignment. This, in turn, leads to a new bridge over the new alignment, midway between Hemblington Road and the Plantation Farm access road. From the new bridge, the link road will connect with the existing section of the A47 that is to be retained. Near Blofield, Hemblington Road will connect with the new link road. The land affected is predominately of agricultural use. However, arable plots, two access strips and part of the leisure / farm shop site adjacent to Yarmouth Road may be affected by the new link road.
- 13.4.33 All existing junctions that connect to the retained section of the existing A47 on the north side will remain unchanged. Road users will be able to access the new A47 alignment via a new interchange located to the east of North Burlingham.
- 13.4.34 The new A47 alignment will sever Lingwood Road and Lingwood Lane on the south of the existing A47. Their connections to the existing A47 will be stopped up. These roads will not have a direct access to the new alignment. Road users will be able to access the new A47 alignment via Church Road, School Road, Lodge Road and Acle Road that lead to the new interchange east of North Burlingham.
- 13.4.35 Midway between Lingwood Lane and Acle Road a new bridge will be constructed over the new A47 alignment. This bridge, elevated above the adjacent ground, will connect with two new junctions, either side of the new alignment. This will provide all traffic movements to and from the new A47 alignment and the local network. The new junction on the north side will connect with the retained section of the existing A47 (link road) and a realigned sections of South Walsham Road. The new junction on the south side will have a connecting link to a

reconfigured junction of Acle Road / Coxhill Road. The lands affected are of predominately of agricultural use. However, two residential properties adjacent to South Walsham Road may be affected by its realignment.

13.4.36 Access between North Burlingham and the new A47 alignment will be via the existing junction of Main Road / A47, on the west side of the village and the new interchange. The existing access from Main Road to the A47, on the east side of the village will be stopped up.

13.4.37 The existing junction of the A47 and Acle Road would be stopped up. Access to the new A47 alignment would be via the new interchange.

13.4.38 East of the existing Acle Road junction the realignment of the A47 to tie with the existing carriageway may affect agricultural land just outside of the existing highway boundary over a distance of approximately 900 metres.

13.4.39 It is likely that redundant sections of existing carriageway will be utilised for local access, landscaping or returned to agriculture.

## 13.5 NMU Provision

### Option 1 On-line improvement

13.5.1 The online improvement proposal would be to upgrade the existing single carriageway A47 to a two lane dual carriageway by primarily online widening, building a new carriageway to the south of the existing carriageway. Being on the line of and subsuming much of the existing A47 means that little of the existing road would be left to be used for local accesses and other provision would be required. The footpath that runs from The Old Post Office into North Burlingham could be recreated alongside a new side road running to the north of the existing alignment. Continuity of the PRow route requires further assessment in future PCF Stages, and if required, could be maintained by either a diversion or the provision of a footbridge over the new A47 highway

### Option 2 Off-line improvement

13.5.2 The proposed new dual carriageway would be constructed part offline to the north and part offline to the south of the existing A47. Being a reasonable distance offline either to the north or south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local accesses.

13.5.3 Further assessment is required in future PCF Stages, where the proposed alignment crosses the existing alignment, a diversion or an overbridge could be provided linking the retained section of the existing carriageway to be connected through to Main Road. This would accommodate diversions of both the footway from The Old Post Office and the PRow crossing the A47.

### Option 7 Offline improvement

13.5.4 The proposed new dual carriageway would be constructed offline up to 330m to the south of the existing A47. Being a reasonable distance offline to the south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local accesses.

13.5.5 The footpath that runs from The Old Post Office into North Burlingham would be unaffected and continuity of the PRow route requires further assessment in future PCF Stages, and if required, could be maintained by either a diversion or the provision of a footbridge over the new A47 highway.

### **Option 8 Offline improvement**

- 13.5.6 The proposed new dual carriageway would be constructed offline up to 70m to the south of the existing A47. Being a reasonable distance offline to the south for the whole route would allow a considerable length of the existing A47 carriageway to be retained and used for local accesses.
- 13.5.7 As with Option 7 the footpath that runs from The Old Post Office into North Burlingham would be unaffected and continuity of the PRoW route requires further assessment in future PCF Stages.

### **13.6 Drainage and Flooding**

For information on water courses, flood zones/plains, groundwater source protection zones, ponds and aquifers, see Chapter 4 (Environment including Environmental Status) and Chapter 16 (Environmental Assessment). Both temporary and permanent works have to ensure that the aquifer and extraction licenses (if any) are unaffected by the works and the EA's consent sought. The provision of treatment facilities in the form of oil interceptors and/or storage ponds etc. would reduce the potential for contamination by hydrocarbons.

#### **Option 1 - Online Dualling of the A47 (PCF Stage 1)**

- 13.6.1 The desk top searches did not indicate the presence of outfalls for the existing drainage system. These outfalls should be located during future site visits and investigations.
- 13.6.2 The proposed works for this option and particularly the construction of the new Link Roads and junctions, may involve the severing of any existing field drainage. These systems will have to be reconstructed with the agreement of field owners/occupiers. In any case, any substantial areas of field sloping towards the proposed carriageway will have to be drained by a system of ditches or filter drains in the vicinity of the new highway boundary.
- 13.6.3 The on line widening of the existing carriageway will necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as affected side roads. There would also be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.
- 13.6.4 Where the proposed carriageway is in greenfield areas (i.e. the Link Roads and roundabouts) it may be a requirement for the catchment discharge to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.
- 13.6.5 Depending on the suitability of the ground conditions, infiltration may be used as a form disposal of flows from the storage structures.
- 13.6.6 The carriageway subsurface would also be drained. In the case of a carriageway on embankment, the proposed carriageway sub surface would be drained via a system of fin or narrow filter drains, on the lower side of superelevated carriageways, or on both sides for cambered carriageways. In turn, these would discharge into the nearest piped network. In the case of a proposed carriageway in cutting, the subsurface as well as the sloped cutting would be drained via a system of filter drains placed in the verge. Depending on the topography of the surrounding land, filter drains may also be required to collect flows at the top of cuttings.

### **Option 2 – Offline Dualling to North and South (PCF Stage 1)**

- 13.6.7 The desk top searches did not indicate the presence of outfalls for the existing drainage system. These outfalls should be located during future site visits and investigations.
- 13.6.8 The proposed works for this option, may involve the severing of any existing field drainage. These systems will have to be reconstructed with the agreement of field owners/occupiers. In any case, any substantial areas of field sloping towards the proposed carriageway will have to be drained by a system of ditches or filter drains in the vicinity of the new highway boundary.
- 13.6.9 The on line widening of the existing carriageway at the tie in points, will necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as any side roads. There would also be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.
- 13.6.10 As most of the proposed route will be offline, it may be a requirement for the catchment discharges to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.
- 13.6.11 Depending on the suitability of the ground conditions, infiltration may be used as a form disposal of flows from the storage structures.
- 13.6.12 The carriageway subsurface would also be drained. In the case of a carriageway on embankment, the proposed carriageway sub surface would be drained via a system of fin or narrow filter drains, on the lower side of superelevated carriageways, or on both sides for cambered carriageways. In turn, these would discharge into the nearest piped network. In the case of a proposed carriageway in cutting, the subsurface as well as the sloped cutting would be drained via a system of filter drains placed in the verge. Depending on the topography of the surrounding land, filter drains may also be required to collect flows at the top of cuttings.

### **Option 7 – Offline Dualling up to 330m to South (PCF Stage 1)**

- 13.6.13 The desk top searches did not indicate the presence of outfalls for the existing drainage system. These outfalls should be located during future site visits and investigations.
- 13.6.14 The offline carriageway route for this option may involve the severing of any existing field drainage. These systems will have to be reconstructed with the agreement of field owners/occupiers. In any case, any substantial areas of field sloping towards the proposed carriageway will have to be drained by a system of ditches or filter drains in the vicinity of the new highway boundary.
- 13.6.15 The on line widening of the existing carriageway at the tie in points, will necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as any side roads. There would also be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.
- 13.6.16 As most of the proposed route will be offline, it may be a requirement for the catchment discharges to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.
- 13.6.17 Depending on the suitability of the ground conditions, infiltration may be used as a form disposal of flows from the storage structures.

13.6.18 The carriageway subsurface would also be drained. In the case of a carriageway on embankment, the proposed carriageway sub surface would be drained via a system of fin or narrow filter drains, on the lower side of superelevated carriageways, or on both sides for cambered carriageways. In turn, these would discharge into the nearest piped network. In the case of a proposed carriageway in cutting, the subsurface as well as the sloped cutting would be drained via a system of filter drains placed in the verge. Depending on the topography of the surrounding land, filter drains may also be required to collect flows at the top of cuttings.

### **Option 8 – Offline Dualling up to 70m South (PCF Stage 1)**

13.6.19 The desk top searches did not indicate the presence of outfalls for the existing drainage system. These outfalls should be located during future site visits and investigations.

13.6.20 The proposed works for this option, may involve the severing of any existing field drainage. These systems will have to be reconstructed with the agreement of field owners/occupiers. In any case, any substantial areas of field sloping towards the proposed carriageway will have to be drained by a system of ditches or filter drains.

13.6.21 The on line widening of the existing carriageway at the tie in points, will necessitate the abandonment of some of the existing drainage and replacement with new drainage features for that section of carriageway as well as any side roads. There would also be an increase in the contributing area. Storage would be provided to limit proposed flows to no more than existing peak flows.

13.6.22 As most of the proposed route will be offline, it may be a requirement for the catchment discharges to be limited to 'Greenfield' run off. This in turn is likely to require substantially sized storage in the form of balancing ponds or oversized pipes. Depending on a number of factors such as the traffic flow and catchment area, the ponds may also have to have treatment and accidental spillage containment facilities.

13.6.23 Depending on the suitability of the ground conditions, infiltration may be used as a form disposal of flows from the storage structures.

13.6.24 The carriageway subsurface would also be drained. In the case of a carriageway on embankment, the proposed carriageway sub surface would be drained via a system of fin or narrow filter drains, on the lower side of superelevated carriageways, or on both sides for cambered carriageways. In turn, these would discharge into the nearest piped network. In the case of a proposed carriageway in cutting, the subsurface as well as the sloped cutting would be drained via a system of filter drains placed in the verge.

13.6.25 Depending on the topography of the surrounding land, filter drains may also be required to collect flows at the top of cuttings.

## **13.7 Geotechnical Considerations**

13.7.1 The primary geological risk anticipated at this PCF Stage is a lack of ground investigation information within the study area. While the basic geological make up beneath the site is understood there is no detailed information available that could be used to assess the potential impact of geological features in any significant detail.

13.7.2 A broad level assessment of the currently available information has identified the following potential geological risks that would require further assessment:

- The available geological mapping indicates that the underlying superficial geology will be variable in nature. Settlements beneath earthworks and structures will need to be assessed to avoid unacceptable levels of differential settlement. Scheme specific ground investigations will be required to fully inform this assessment. Delineating the extents of

the alluvial materials known to exist will be particularly important. Settlement beneath any new road created for Options 2, 7 and 8 will need to be identified

- Risk of differential settlement at the interface between existing and proposed infrastructure, including embankments and structures. A better understanding of the proposals and the ground conditions will be required before this impact can be fully assessed. This risk is of more significance for Option 1 where expansion of the existing infrastructure is considered

13.7.3 The existing lack of site investigation information it is assumed that all four proposed options are likely to be exposed to similar anticipated geotechnical engineering risk. The geotechnical risk register and associated geotechnical hazard plan can be found in the Geotechnical Statement of Intent.

### Mining

13.7.4 The historic Burlingham St. Andrew Sand Pit is adjacent to the southern boundary of the existing A47 highway in the western half of the site. No evidence has been observed to identify the status of this historic pit. Work on Options 1 and 8 are likely to be affected by the location of this feature. If either of these options are to be progressed, with interaction with this particular risk, a thorough assessment of its dimensions and potential impact on the project will be required, which should include ground investigation.

13.7.5 Historic and future mining activities across the rest of the site pose minimal engineering concerns for the project.

## 13.8 Structures

### Option 1 (PCF Stage 1)

13.8.1 This option is the online improvement of the existing A47 in between Blofield and North Burlingham. The new structures required along with the location is found in the **Table 13-1** below

**Table 13-1 Option 1 New Structures Required**

S.No	Chainage (m)	Structure
1	1025 approx.	Single Carriageway Overbridge
2	2300 approx.	Footbridge
3	3775 approx	Single Carriageway Overbridge

#### Single Carriageway Overbridge (Chainage: approx. 1025m)

13.8.2 This single carriageway overbridge is built in order to enable ease access to either side of the A47. The bridge will be moderately skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

#### Footbridge (Chainage: approx. 2300m)

13.8.3 A footbridge is proposed to enable easy access for public across the either side of the A47. The footbridge is approximately 25 m long and 3.5m wide. The footbridge can be steel warren truss structure or a reinforced concrete structure supported by piled or raft foundations on either side of the structure based on geotechnical conditions.

**Single Carriageway Overbridge (Chainage: approx. 3775m)**

13.8.4 This single carriageway overbridge is built in order to Acle Road to S Walshaw Road across the A47. The bridge will be slightly skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

**Option 2 (PCF Stage 1)**

13.8.5 The proposed new dual carriageway would be constructed offline 50% to the south and 50% to the north of the existing A47. The new structures required along with the location is found in the **Table 13-2** below

**Table 13-2 Option 2 New Structures Required**

S.No	Chainage (m)	Structure
1	2600 approx.	Dual Carriageway Underbridge
2	3800 approx	Single Carriageway Overbridge

**Dual Carriageway Underbridge (Chainage: approx. 2600m)**

13.8.6 This dual carriageway underbridge is constructed to carry the proposed A47 across the existing main Road. The bridge will be moderately skewed with a length measuring approximately 10m and the width of the bridge will be approximately 25.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

**Single Carriageway Overbridge (Chainage: approx. 3800m)**

13.8.7 This single carriageway overbridge is built in order to enable ease access to either side of the A47. The bridge will be of length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m connecting the proposed dumbbell roundabouts. The bridge would be in the form of steel beams acting compositely with a reinforced concrete

13.8.8 deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

13.8.9 **Note:** In this option there is a possibility of having 3 culverts along the new A47, however the position and specifications of the culverts need to be verified with further site investigation and geotechnical conditions.

**Option 7 (PCF Stage 1)**

13.8.10 The proposed new dual carriageway would be constructed to the south of the existing A47. The new structures required along with the location is found in the **Table 13-3** below

**Table 13-3 Option 7 New Structures Required**

S.No	Chainage (m)	Structure
1	1380 approx.	Single Carriageway Overbridge
2	2625 approx.	Footbridge
3	3700 approx	Single Carriageway Overbridge

**Single Carriageway Overbridge (Chainage: approx. 1380m)**

13.8.11 This single carriageway overbridge is built in order to enable ease access to either side of the A47 connecting the Yarmouth Road to the Main Road. The bridge will be moderately skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

**Footbridge (Chainage: approx. 2625m)**

13.8.12 A footbridge is proposed to enable easy access for public across the either side of the A47. The footbridge is approximately 25 m long and 3.5m wide. The footbridge can be steel warren truss structure or a reinforced concrete structure supported by piled or raft foundations on either side of the structure based on geotechnical conditions.

**Single Carriageway Overbridge (Chainage: approx. 3700m)**

13.8.13 This single carriageway overbridge is built in order to connect Acle Road across the A47 to S Walshaw Road and the Main Road. The bridge will be slightly skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

13.8.14 **Note:** In this option there is a possibility of having 4 culverts along the new A47, however the position and specifications of the culverts need to be verified with further site investigation and geotechnical conditions.

**Option 8 (PCF Stage 1)**

13.8.15 The proposed new dual carriageway would be constructed just to the south of the existing A47. The new structures required along with the location is found in the **Table 13-4** below

**Table 13-4 Option 8 New Structures Required**

S.No	Chainage (m)	Structure
1	1150 approx.	Single Carriageway Overbridge
2	2600 approx.	Footbridge
3	3875 approx	Single Carriageway Overbridge

**Single Carriageway Overbridge (Chainage: approx. 1150m)**

13.8.16 This single carriageway overbridge is built in order to enable ease access to either side of the A47 connecting the Yarmouth Road to the Main Road. The bridge will be moderately skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

**Footbridge (Chainage: approx. 2600m)**

13.8.17 A footbridge is proposed to enable easy access for public across the either side of the A47. The footbridge is approximately 25 m long and 3.5m wide. The footbridge can be steel warren truss structure or a reinforced concrete structure supported by piled or raft foundations on either side of the structure based on geotechnical conditions.



### **Single Carriageway Overbridge (Chainage: approx. 3875m)**

13.8.18 This single carriageway overbridge is built in order to connect Acle Road across the A47 to S Walshaw Road and the Main Road. The bridge will be slightly skewed with a length measuring approximately 25.1m and the width of the bridge will be approximately 11.1m. The bridge would be in the form of steel beams acting compositely with a reinforced concrete deck slab on top, which would be supported on RC abutments at both ends. The foundations would be either piles or raft foundations depending on the existing ground conditions.

13.8.19 **Note:** In this option there is a possibility of having 4 culverts along the new A47, however the position and specifications of the culverts need to be verified with further site investigation and geotechnical conditions.

## **13.9 Public Utilities**

### **Option 1 Online Dualling of the A47 (PCF Stage 1)**

13.9.1 The Option 1 online improvement of A47 in the vicinity of Yarmouth Road/Hemblington Road would involve lowering and protection to, or diversionary works of a medium pressure gas main, water main, communications cables, overhead electricity cable in the verges of Yarmouth Road and the A47. Existing communications and overhead electrical cables crossing the A47 would need to be accommodated by either burying or providing protection to any future construction.

13.9.2 Online improvement of the A47 between Hemblington Road and Main Road would require substantial diversion work to a medium pressure gas main (approx. 1610m) and communications cables throughout the length of this section which would need to be repositioned laterally. There are overhead electricity cables and communications cables crossing the existing A47 which would need to be buried where they cross the new route.

13.9.3 Between Main Road and the eastern end of the scheme there would be a requirement for a significant amount of diversionary work involving the lateral repositioning of communications that run longitudinally for the total length of this section and cross the A47 at various locations to the west of Acle Lane. There is a number of existing overhead electrical cable crossings along this length which would need to be buried where they cross the proposed route.

13.9.4 Some works to existing statutory undertaker's equipment will be required at local roads generally at locations where new road junctions need to be installed to facilitate access to A47 improvements. This would include the requirement to divert or protect a medium pressure gas main to the south of the A47/Acle Road junction that would be affected by an online improvement.

### **Option 2 Offline Dualling to North and South (PCF Stage 1)**

13.9.5 The Option 2 offline improvement to the north and south of A47 in the vicinity of Yarmouth Road/Hemblington Road would involve lowering and protection to, or diversionary works of a medium pressure gas main, water main, communications cables and overhead electricity cables in the verges of Yarmouth Road and the A47. Existing underground communications and overhead electrical cables crossing the A47 would need to be accommodated by burying or providing protection to any future construction.

13.9.6 Offline improvement of the A47 to the north between Hemblington Road and Main Road would require little diversionary works as the majority of the existing utilities run along or slightly to the south of the existing A47 corridor. There are overhead electricity cables and underground communications cables crossing the existing A47 which would need to be buried under the new route.

- 13.9.7 Between Main Road and South Walshaw Road little diversionary work would be required apart from where the route crosses the existing A47. Here communication cables and water mains cross that route and would need to be diverted /protected. A significant amount of diversionary works would be required to the east of South Walshaw Road to communications underground and overhead apparatus that run eastwards to the west of Acle Lane and cross the existing A47 at various locations. There is a number of existing overhead electrical cable crossings along this length of this Option which would need to be buried where they cross the new route.
- 13.9.8 Some works to existing statutory undertaker's equipment will be required at local roads, generally at locations where new road junctions need to be installed to facilitate access to A47 improvements. This would include the requirement to divert or protect a medium pressure gas main to the south of the A47/Acle Road junction that would be affected by this offline improvement.

### **Option 7 – Offline Dualling up to 330m South (PCF Stage 1)**

- 13.9.9 The Option 7 offline improvement to the south of the A47 in the vicinity of Yarmouth Road/Hemblington Road would involve lowering and protection to, or diversionary works of a medium pressure gas main, water main, communications cables and overhead electricity cable in the verges of Yarmouth Road and the A47. Existing underground communications and overhead electrical cables crossing the A47 would need to be accommodated by either lowering or providing protection to any future construction.
- 13.9.10 Offline improvement of the A47 to the south between Hemblington Road and South Walshaw Road would require relatively little diversionary works as the majority of the existing utilities run along the of the existing A47. This section of the route does however cross a medium pressure gas main in two locations. This may require upgrading of the gas main and the possible provision of a cover slab cover. There are overhead electricity cables and underground communication cables crossing the existing A47 which should be buried under the new route.
- 13.9.11 A large amount of diversionary works would be required to the east of South Walshaw Road to communications underground and overhead apparatus that run eastwards to the west of Acle Lane crossing the existing A47 at various locations. There is a number of existing overhead electrical cable crossings along this length which would need to be buried where they cross the route.
- 13.9.12 Some works to existing statutory undertaker's equipment will be required at local roads, generally at locations where new road junctions need to be installed to facilitate access to A47 improvements. This would include the requirement to divert or protect a medium pressure gas main to the south of the A47/Acle Road junction that would be affected by this offline improvement.

### **Option 8 Offline Dualling up to 70m South (PCF Stage 1)**

- 13.9.13 The Option 8 offline improvement to the south of the A47 in the vicinity of Yarmouth Road/Hemblington Road would involve lowering and protection to or diversionary works of a medium pressure gas main, water main, communications cables and overhead electricity cables in the verges of Yarmouth Road and the A47. Existing underground communications and overhead electrical cables crossing the A47 would need to be accommodated by burying or providing protection to any future construction.
- 13.9.14 Offline improvement of the A47 to the south between Hemblington Road and South Walshaw Road would require significant diversionary works. Although the majority of existing utilities here are in the existing A47 corridor to the north of this Option and may not be generally affected, between Lingwood Road and 150m west of Lingwood Lane an existing medium pressure gas main is located under the route and would need to be diverted/upgraded. There

are overhead electricity cables and underground communications crossing the existing A47 which would need to be buried where they cross the route.

13.9.15 A large amount of diversionary works would be required to the east of South Walsham Road to communications underground and overhead apparatus that run eastwards to the west of Acle Lane crossing the existing A47 at various locations. There is a number of existing overhead electrical cable crossings along this length which would need to be buried where they cross the route.

13.9.16 Some works to existing statutory undertaker's equipment will be required at local roads, generally at locations where new road junctions need to be installed to facilitate access to A47 improvements. This would include the requirement to divert or protect a medium pressure gas main to the south of the A47/Acle Road junction that would be affected by the scheme.

### **13.10 Topography, Land Use, Property and Industry**

13.10.1 All the Options put forward for consideration affect the local land around Blofield and North Burlingham. Any land required is currently used as agricultural farm land, which may, to differing extents, be required for land take.

13.10.2 The above will impact upon land use and industry in the local area.

13.10.3 As detailed in Chapter 13.4, property access may be affected by all Options put forward, but it is not envisaged at this Stage property would be required for demolition.

13.10.4 The topography in the area is flat, as described in Chapter 3, therefore it is not anticipated that any section of proposed new road will change the existing land.

### **13.11 Buildability**

#### **Option 1 Online Dualling of the A47 (PCF Stage 1)**

13.11.1 This Option would constitute the greatest challenge regarding Buildability and would also cause maximum disruption to the general public for reasons indicated below:

13.11.2 Permanent traffic management measures would be required throughout the length of the scheme to keep traffic segregated from the construction works. This is likely to take the form of single carriageway running of the existing A47 with narrow lanes and is likely to cause some disruption to the public during the period that the traffic management is in place.

13.11.3 The tie-ins at either end of the scheme where the improvement connects into the existing A47 carriageway would possibly be constructed either under temporary traffic signals, temporary diversion works or possibly contraflow.

13.11.4 Existing utilities run along the existing A47 corridor and extensive diversionary work would be required to statutory undertakers' equipment to facilitate the construction of the new improvement. A medium pressure gas main runs under approximately 40% of the route and will require significant treatment/protection.

13.11.5 The combination of the provision of permanent traffic management and the requirement to facilitate statutory undertakers' diversionary works would inevitably result in reduced working space in which to carry out the improvement works.

13.11.6 Direct access to the village of Burlingham and to land on either side of the existing A47 that will be severed during construction is required. Provision of access to these locations would

be either by incorporating access into the traffic management arrangements or by the provision of temporary works to facilitate access.

13.11.7 A number of bridges will be constructed over the line of the proposed route which would require the live carriageway to be closed for a period of time to allow the bridge decks to be installed. This work would be carried out at off-peak times but is still likely to cause major inconvenience to the public and require the installation of long diversion routes during the closure of the A47.

### **Option 2 Offline Dualling to North and South (PCF Stage 1)**

13.11.8 This Option would have a moderate impact regarding Buildability of the scheme and would also cause some disruption to the general public for reasons indicated below:

13.11.9 The tie-ins at either end of the scheme, where the improvement connects into the existing A47 carriageway, would possibly be constructed under temporary traffic signals, temporary diversion works or possibly contraflow. The construction of the tie-ins may cause some disruption to the travelling public. A temporary diversion may also be required to connect the existing A47 past the site of the proposed underbridge to be built over the existing A47 to the west of Burlingham.

13.11.10 The existing utilities run along the existing A47 corridor over the length of the scheme. The main interface between the existing utilities where diversionary works and protection are most likely to be required, are at the tie-ins at either end of the scheme where this option crosses the existing A47 corridor just to the west of the village of Burlingham, and at the new dumbbell junction at the east of the scheme where the new slip roads and connection road cross existing utilities.

13.11.11 Direct access to the village of Burlingham would be maintained from the existing A47 throughout the construction period. Provision would need to be made to access land severed by the construction works north of the improvement to the west of Burlingham and to land south of the improvement to the east of Burlingham.

13.11.12 Two bridges would be constructed on the line of this option. The first is an underbridge where the route passes over the existing A47. Here a temporary diversion could be provided around this bridge which would have the effect of constructing the bridge offline thus negating the need to close the A47 to facilitate the installation of the bridge deck. The second bridge is an over bridge connecting the dumbbell roundabouts at the junction to the east of this option. This bridge can be constructed totally offline so would have little effect on the A47 traffic.

### **Option 7 – Offline Dualling up to 330m South (PCF Stage 1)**

13.11.13 This Option would have the lowest impact regarding Buildability of the scheme and would cause some slight disruption to the general public for reasons indicated below:

13.11.14 This option can be constructed almost totally offline. This means that for the majority of the time the works can be carried out with only minor traffic management measures required apart from at the tie-ins where more extensive traffic management would be needed.

13.11.15 The tie-ins at either end of the scheme where the improvement connects into the existing A47 carriageway would possibly be constructed under temporary traffic signals, temporary diversion works or possibly contraflow. The construction of the tie-ins may cause some disruption to the travelling public.

13.11.16 The existing utilities run along the existing A47 corridor for the extent of the scheme. As such they should have relatively little impact on the majority of the road construction. The main interface between the existing utilities where diversionary works and protection are most likely to be required are at the tie-ins at either end of the scheme, at the new dumbbell

junction at the east of the scheme where the new slip roads and connection road cross existing utilities. Existing electricity cables cross the route at various locations along the site and where this occurs these existing electrical crossings would be buried under the route.

13.11.17 Direct access to the village of Burlingham would be maintained from the existing A47 throughout the construction period as would access to properties and land adjacent to the existing A47. Provision would need to be made to access land severed by the construction works to the south of the improvement works.

13.11.18 Three bridges over the line of the route would be constructed on the line of this option. All three bridges can be constructed offline so would have little or no impacted on the travelling public

### **Option 8 Offline Dualling up to 70m South (PCF Stage 1)**

13.11.19 This Option would have the low impact regarding Buildability of the scheme and would cause some slight disruption to the general public for the reasons given below:

13.11.20 This option can be constructed almost totally offline. This means that for the majority of the works can be carried out with only minor traffic management measures required apart from at the tie-ins where more extensive traffic management would be needed.

13.11.21 The tie-ins at either end of the scheme where the improvement connects into the existing A47 carriageway would possibly be constructed under temporary traffic signals, temporary diversion works or possibly contraflow. The construction of the tie-ins may cause some disruption to the travelling public.

13.11.22 The existing utilities run along the existing A47 corridor over the extent of the scheme. As such they will have relatively little impact on the majority of the road construction. The main interface between the existing utilities where diversionary and protection works are most likely to be required are at the tie-ins at either end of the scheme, at the new dumbbell junction at the east of the scheme where the new slip roads and connection road cross existing utilities. An existing medium pressure gas main runs under approximately 25% of the length of the route to the east of the village of Burlingham and diversionary/protection works would be required prior to construction. Existing electricity cables cross the route at various locations along the site and where this occurs these existing electrical crossings would be buried under the route.

13.11.23 Direct access to the village of Burlingham would be maintained from the existing A47 throughout the construction period as would access to properties and land adjacent to the existing A47. Provision would need to be made to access land severed by the construction works to the south of the improvement works.

13.11.24 Three bridges over the line of the route would be constructed offline. All three can be constructed offline so would have little or no impacted on the travelling public.

### **13.12 Effective Construction Management – Construction (Design and Management) Regulations 2015**

13.12.1 The Construction (Design and Management Regulations) 2015 requires the client to formally appoint a Principal Designer (where it is reasonably foreseeable that more than one contractor will be working on a project at any one time) who essentially have responsibility to plan, manage and monitor the pre-construction phase and co-ordinate matters relating to health and safety during the pre-construction phase.

13.12.2 AECOM were appointed as Principal Designer (PD) on the A47 Programme during PCF Stage 1.

13.12.3 During PCF Stage 1, Amey undertook the following tasks as part of its duties under the CDM regulations:

- CDM audit
- Design review PCF Stage 1

13.12.4 The outcomes of the audit were issued to the Project and Programme Director, with corrective measures being actioned by the appropriate Design Discipline Lead.

13.12.5 The design reviews were conducted by the PD with the appropriate Design Discipline Lead and Amey Project Manager. As a result of the design reviews the project team undertook to amend the design to incorporate the recommended actions.

13.12.6 This information is updated for PCF Stage 2 in Chapter 23.

## **14 Operational, Technology and Maintenance Assessment of Sifted Options**

### **14.1 Operational Assessment**

14.1.1 The Blofield to North Burlingham section of the A47 serves as a key local route for local traffic into and out of Norwich as well as part of the strategic highway network from Norwich to Great Yarmouth and beyond, and is a major trunk road on the strategic road network.

14.1.2 The road currently operates as a single carriageway link with local roads linking in along the route

14.1.3 All Options for the proposed dualling scheme will operate as a dual 2 lane all purpose highway.

14.1.4 The side road strategy is not developed at PCF Stage 1 but once dualled there will be a reduced number of junctions onto and off the section of road and due to the operating regime of modern dual carriageway standard there will be no direct right turn off or on to the dual carriage way.

### **14.2 Technology Assessment**

14.2.1 As detailed in Chapter 3.12 there is limited technology in this section of the A47.

14.2.2 Any Online Dualling would look to replace technology where required and incorporate into the Online Option.

14.2.3 Any Offline Dualling may require additional technology to support the operation of the road. At this PCF Stage 1 no consideration has been given to this and will be reviewed in future PCF Stages.

### **14.3 Maintenance Assessment**

14.3.1 Maintenance considerations will be developed further as the scheme progresses through to the next stage. A Maintenance Repair Strategy Statement (MRSS) has been produced in PCF Stage 2, document reference number A47IMPS2-AMY-BB-ZZ-DO-J-0030 which gives further information.

## 15 Safety Assessment of Sifted Options

### 15.1 Introduction

15.1.1 This section discusses the consideration of safety in the design considerations and how these align with the Highway's England RIS and Delivery Plan.

### 15.2 Summary of Safety Assessment

15.2.1 The safety of the road user has been considered to a level appropriate to this stage in the design process. As discussed in Chapter 13 above, at present neither a NMU survey nor Road Safety Audit (RSA) has been completed and so the movements of NMU's are not yet fully known. These surveys will be conducted during later PCF stages to inform and develop the designs.

15.2.2 As described in Chapter 3.4, there were 33 reported incidents in the last 5 years, which included 1 fatal. The impact of the design on accident figures is discussed further in Chapter 29.

15.2.3 It is anticipated that improvements to the length of the A47 will improve the accident rate.

15.2.4 User safety will be further developed as the design evolves and develops in later PCF Stages. This will include signage, road marking and roadside barriers appropriate for the user and scheme conditions.

#### **Highways England Delivery Plan 2015-2020: A safe and serviceable network**

15.2.1 The Highways England Delivery Plan 2015-2020 sets out the following safety measures that will result in noticeable improvements for customers and will contribute significantly to achieving the 40% reduction in KSIs. A commentary is provided below about how the options identified align with these measures.

#### **Upgrades to junctions and removing some of the worst bottlenecks**

15.2.2 All the options identified seek to upgrade the junction with Cantley Lane Junction to improve the safety issues surrounding slow moving traffic entering the A47 currently from the British Sugar Factory located to the south.

#### **Developing higher standard A roads, to be known as 'Expressways'**

15.2.3 The RIS sets out its vision of the network toward 2040. The A47 Blofield to North Burlingham is not identified in the "current, planned and potential Expressways" category, although there is an aspiration to upgrade the A47 route to 'Expressway Standards'.

15.2.4 Should the Expressway network be expanded to include the A47 Blofield to North Burlingham the key relevant criteria to these schemes is "Junctions which are largely or entirely grade separated, so traffic on the main road can pass over or under roundabouts without stopping." Options proposed could include grade separation if required review against this criterion.

#### **Upgrading central barriers**

15.2.5 The existing highway layout does not include a central reserve barrier along the single carriageway section, however, barrier exists at each end of the existing section whereby the route is dual carriageway. Minimising vehicle conflicts and providing appropriate segregation



will be a factor as the scheme develops. All of the Options, if required, will tie in to the existing / upgraded central reservation barrier.

### **Providing safer verges with improved run off protection**

- 15.2.6 Providing safer verges with improved run off protection and safer street furniture is a detailed consideration which will be incorporated during the subsequent PCF Stages.

### **Improved road signing and markings**

- 15.2.7 Providing improved road signing and markings is a detailed consideration which will be incorporated during the subsequent PCF Stages.

### **Upgrading lay-bys**

- 15.2.8 There is currently 1no layby at A47 Blofield to North Burlingham. Consideration will be given at a later PCF Stage whether there would be a benefit in including any improvements in the scheme.

### **Developing and deploying technology to prevent, detect and monitor incidents.**

- 15.2.9 It is not considered that the current scheme scope does not necessitate the introduction of technology to prevent, detect and monitor incidents.
- 15.2.10 There is minimal technology located at the site presently.

### **Using designated safety funding to deliver targeted safety improvements.**

- 15.2.11 Opportunities for use of designated safety funding to deliver targeted safety improvements will be explored in the Value Management Workshop to be held with the Buildability Contractors and detailed in the Value Management Workshop Report and the measures identified will be developed in future PCF Stages.

## 16 Environmental Assessment of Sifted Options

### 16.1 Introduction

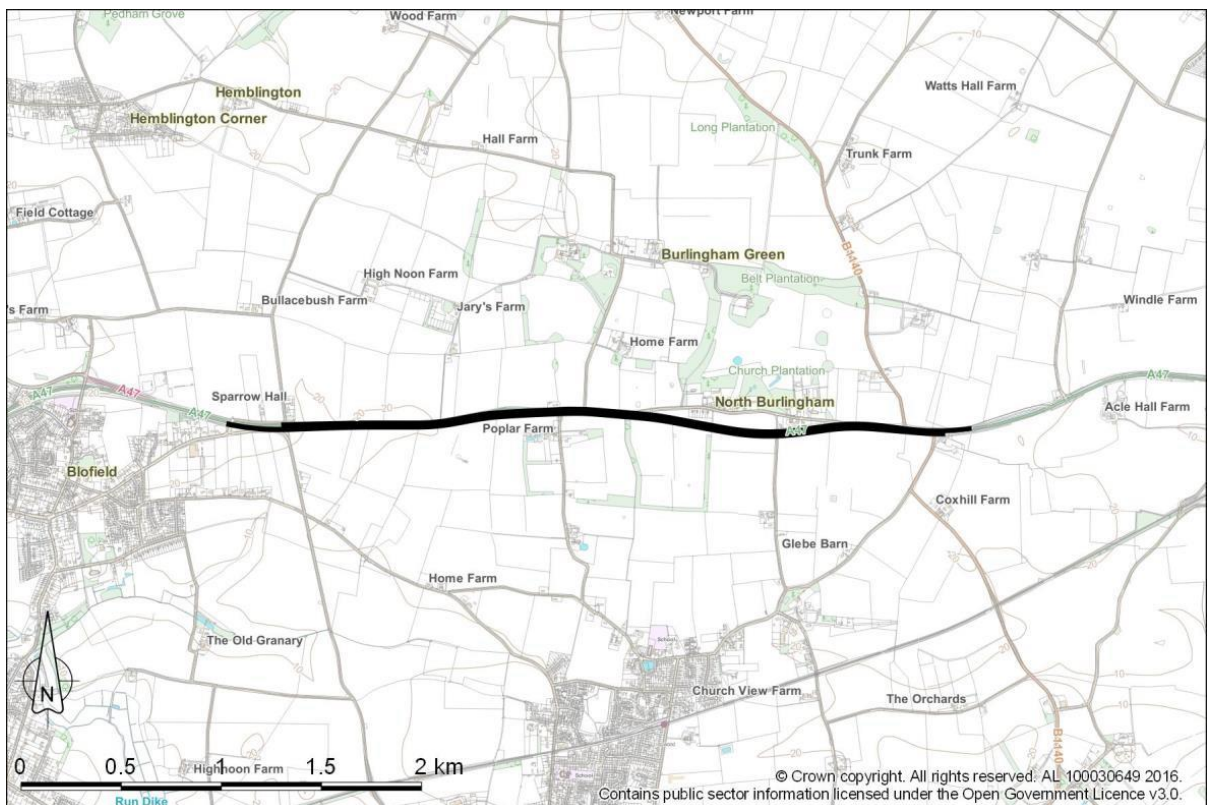
16.1.1 Chapter 11 describes the options sifting process and identified that options 1, 2, 7 and 8 will be taken forward into PCF Stage 2 for further assessment. The following sections provide an initial environmental assessment of these four options in relation to each of the environmental topics described in Chapter 4.

16.1.2 At this stage, much of the assessment that has been carried out is qualitative in nature which is appropriate to this stage of scheme development.

### 16.2 Option 1

16.2.1 Option 1 is shown in Figure 16-1. Option 1 will be online dualling, with the single carriageway section between Blofield and North Burlingham improved to dual carriageway standard, with appropriate junction improvements. Improvements to the existing alignment will make it necessary for the alignment in some sections to move away from the existing highway corridor. It will be necessary to acquire land along the route to accommodate the improvement

**Figure 16-1: Option 1 online dualling of the existing A47 route**



### Air Quality

16.2.2 With Option 1 the alignment of the road will be widened slightly, primarily on the south side. The option will also incorporate suitable junction improvements. This will move the road slightly closer to receptors along the existing A47 road, on Lingwood Lane, Lingwood Road and slightly further away from the houses along Main Road in North Burlingham. For those

receptors that have the road closer to them, there will be a consequent decrease in local air quality.

- 16.2.3 Overall, the dualling of the A47 should lead to improvements in the local air quality and reduced greenhouse gas emissions as a result of improvements to traffic flow, reductions in low speed traffic and more efficient fuel use.
- 16.2.4 There are no Air Quality Management Areas (AQMAs) recorded within the study area. Option 1 is not expected to adversely impact on any AQMAs nor result in the exceedance of air quality objectives.
- 16.2.5 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. With proper mitigation, the risks of construction dust can be significantly reduced.
- 16.2.6 At this stage, it is considered that the impacts on air quality from Option 1 are **neutral**

#### **Mitigation**

- 16.2.7 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of the road further away from sensitive receptors, or reviewing speed limits to improve emissions from vehicles.
- 16.2.8 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

#### **Cultural Heritage**

- 16.2.9 There are 23 listed buildings within the study area. The closest of which include the Church of St Andrew Grade I Listed Building and the Church of St Peter Grade II Listed Building located on Main Road in North Burlingham. Option 1 is not anticipated to have any significant impact on any listed buildings.
- 16.2.10 There are recorded archaeological sites along the A47 which include the site of a sand pit, cropmarks, The Old Post Office and Late Mesolithic, Neolithic/Bronze Age, medieval and post-medieval find spots. Option 1 is expected to result in the disturbance and/or loss of these recorded archaeological sites.
- 16.2.11 Given the high number of assets present in the area, there is potential for the widening to affect subsurface remains and archaeological features.
- 16.2.12 At this stage, impacts on cultural heritage from Option 1 are considered to be **minor adverse**.

#### **Mitigation**

- 16.2.13 It is likely that archaeological mitigation measures can be put in place through a Written Scheme of Investigation to reduce the impact on the historic environment. Mitigation measures may include, but not be limited to, geophysical survey, field walking, evaluation excavation and landscape screening.

#### **Landscape and Visual**

- 16.2.14 Option 1 is unlikely to change the regional or local landscape character with the pattern, scale, appearance and tranquillity of the landscape remaining unaffected.

16.2.15 The landscape in the vicinity of the A47 is representative of the wider landscape of the Norfolk Broads with large, arable fields with hedgerow boundaries. Option 1 will result in the loss of roadside trees and hedgerows to accommodate the widening, which will affect the local land cover. The creation of new junctions and access roads will result in new features in the landscape on a local scale. These may also affect views from residential properties.

16.2.16 Visual receptors along the A47 and local minor roads may experience a change in views due to the loss of screening vegetation. Replacement planting along the widened A47 may take over 15 years to mature and provide the same level of screening.

16.2.17 At this stage, the impacts on landscape and visual receptors are considered to be minor adverse.

### **Mitigation**

16.2.18 Road design should seek to integrate the new route into the landscape as far as possible. Potential mitigation could consist of screen planting to limit views from receptors along the A47 and provide integration with the landscape. However, it may take over 15 years for planting to mature sufficiently to provide the same level of screening.

### **Nature Conservation and Biodiversity**

16.2.19 Option 1 will widen the alignment of the existing A47 road slightly (primarily on the south side). The minor alterations to the route alignment will not result in any impacts on designated sites or priority habitats.

16.2.20 This option has potential to encroach upon the Defra Farm Conservation and Countryside Stewardship Area at Poplar Farm. However the scheme is not expected to result in the loss of any planted woodland areas.

16.2.21 Habitats in the vicinity of the A47 include arable fields and hedgerows with mature trees. The online dualling and the creation of local access roads and junctions will result in the loss of the roadside trees and hedgerows and arable farmland.

16.2.22 The loss of hedgerows and trees will result in habitat loss for birds and bats, as well as affecting commuter routes for bats. The creation of new junctions can result in severance of habitats as well as habitat loss and disturbance.

16.2.23 Preliminary surveys for the project identified badger activity along the A47 with an active outlier sett next to the carriageway. The widening has potential to adversely impact this sett, causing disturbance and potentially closure of the sett under licence.

16.2.24 During construction, there may be direct and indirect effects on species and habitats from noise, pollution, lighting and increased human disturbance. These effects are generally temporary but can be significant.

16.2.25 At this stage, impacts on nature conservation from Option 1 are considered to be minor adverse.

### **Mitigation**

16.2.26 Options to avoid/reduce/mitigate/compensate for any potential adverse effects on designated sites, and protected/notable habitats and species should be undertaken as the scheme evolves. Standard mitigation measures are also to be considered which include for example pollution prevention control measures; standard control measures to control dust from construction activities; preconstruction surveys and production of a Construction Environmental Management Plan (CEMP).

16.2.27 Additional mitigation measures to also consider during the scheme design, construction and operation include; retention of habitats and soft landscaping that would benefit flora and fauna and meet the objectives of local and HE BAPs, off-site mitigation and enhancement areas (where this cannot be met within the scheme boundary), enhancing the wildlife corridor and ecosystem functioning of the verges. Mammal fencing and underpasses to minimise operational effects on mammals, e.g. badger and otter should be considered in conjunction with on-going monitoring surveys.

16.2.28 Opportunities to provide biodiversity enhancements could be explored as the project progresses.

16.2.29 Further baseline surveys are required at Stage 2 to fully inform mitigation strategies. Consultation will also be required with ecological stakeholders on the mitigation proposed.

### **Noise and Vibration**

16.2.30 Option 1 comprises the widening of the existing road alignment. This option is anticipated to encroach closer to the residential, community and commercial receptors along the A47 road and move the route away from receptors in North Burlingham. It is anticipated that any changes in noise levels would not be perceptible provided no significant changes in traffic occur on the main roads.

16.2.31 There are four Noise Important Areas located along the A47 within the study area designated due to their high levels of traffic noise (ID nos. 5206, 5207, 5208 and 5209). NIA ID nos. 5207, 5208 and 5209 are located adjacent to the online road alignment of Option 1. The NIA at the Old Post Office, north of the Lingwood Road/A47 junction will be affected by Option 1 moving the alignment slightly further away from this receptor, but the increased speed of traffic along the A47 as a result of the dualling is unlikely to result in the improvement in noise levels.

16.2.32 The provision of a local access road connecting Blofield to North Burlingham may increase noise levels along Main Road, and the junction at the eastern extents of the option, may result in increased noise levels to receptors at Acle Road.

16.2.33 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.2.34 At this stage, impacts on noise and vibration from Option 1 are considered to be minor adverse.

### **Mitigation**

16.2.35 Mitigation measures could be developed to reduce noise impacts, which may include:

- Maximising the distance between realigned section of road and receptors.
- Minimising changes in traffic on existing roads due to the scheme.
- Earth bunds/noise barriers to screen receptors. Where there is sufficient land available,
- Earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of the new/aligned sections of road into the landscape.
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective.
- Noise insulation of individual properties to protect the internal noise environment.

16.2.36 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

### **Road Drainage and Water Environment**

16.2.37 Option 1 is primarily online. Thus it is considered that the option will have a minimal impact on the road drainage and water environment.

16.2.38 There are no rivers or streams located within the footprint of Option 1 that would be affected. There are some small field drains and ponds located along the A47 that may be affected by the widening.

16.2.39 The option footprint is not affected by flooding thus it is considered that the option will have no impact on flood risk.

16.2.40 There is a major aquifer underlying the scheme footprint (Broadland Rivers Chalk and Crag Unit) and its groundwater vulnerability is classified as intermediate to high as the soils overlying it have an intermediate to high leaching potential. Thus Option 1 has the potential to adversely impact the principal aquifer during the construction and operational phases as a result of accidental spillages/pollution events and changes to road drainage. The groundwater within the western extents of the study area is considered to be particularly sensitive to change as it is located in a Groundwater Source Protection Zone.

16.2.41 At this stage, impacts on the water environment from Option 1 are considered to be neutral.

### **Mitigation**

16.2.42 Mitigation measures to protect groundwater during construction include adherence to pollution prevention guidelines and best practice. The procedures for managing effects on the water environment will be defined in a Construction Environmental Management Plan and will comply with current planning policies and regulations.

### **People and Communities**

16.2.43 There are recreational paths and public rights of way (PRoWs) along either side of the A47. Option 1 would affect the Burlingham community woodland and paths and a bridleway located to the south of the A47 near Poplar Farm. The option would also affect a footpath (FP3) that runs from Lingwood to Burlingham Green, which crosses over the A47 just west of North Burlingham.

16.2.44 The dualling will improve traffic flow and result in less congestion, having a beneficial effect on vehicle travellers. The removal of the roadside hedges will result in more open views across the landscape for travellers; however the views will become more enclosed as replanting matures.

16.2.45 The online dualling of the carriageway will increase local severance as NMU and vehicle access to community facilities on the opposite side of the A47 (such as the religious premises, health care facilities and schools) will be restricted.

16.2.46 During construction, as a consequence of the online nature of the option, road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion and route uncertainty, particularly during peak hours. However, these impacts will be temporary.

16.2.47 Traveller speeds and journey times will be impacted by construction works and this will consequently impact upon fear of accidents. Construction traffic leaving the construction site and entering the road network has the potential to deposit mud and debris onto road surfaces. Spray rising from moving traffic has the potential to land on vehicle windscreens and reduce

driver vision potentially increasing the fear of accidents. Changes to traffic management measures during the construction phase may also generate confusion leading to a fear of accidents.

16.2.48 Option 1 will require land take for the widening as well as for the access roads and new junctions. The land take will mainly comprise arable land. The area of land to be acquired as part of Option 1 is minor, relative to Options 2, 7 and 8.

16.2.49 At this stage impacts on people and communities are assessed to be minor adverse from Option 1.

### **Mitigation**

16.2.50 Impacts to PRowS could be mitigated through the introduction of new NMU routes throughout the site connecting the settlements. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility along the A47.

16.2.51 Mitigation or compensatory measures will need to be developed for the loss of agricultural land, which could include a range of measures from providing alternative means of access to financial compensation.

16.2.52 Mitigation measures should also include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with HE and other appropriate stakeholders. The appointed contractor will adhere to current best practice techniques during the construction phrase. Appropriate landscape planting will be implemented to minimise visual impacts.

### **Geology, Soils and Materials**

16.2.53 The online dualling and the creation of new junctions will result in the loss of agricultural soils, which have been designated as Grade 1 and 2 (excellent-good) by Natural England.

16.2.54 Option 1 is expected to create a minimal volume of waste soils and would require a minimal volume of imported materials due to the online nature of the scheme. There is potential for retention and use on site of excavated materials pending appropriate testing for contaminants and geotechnical suitability. Unsuitable materials will require appropriate off site waste management.

16.2.55 It is considered that option 1 could result in adverse contaminated land impacts as a result of accidental spillages/pollution events during the construction and/or operational phases.

16.2.56 Impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical and geochemical conditions beneath the site.

16.2.57 At this stage, impacts on geology, soils and materials are considered to be minor adverse.

### **Mitigation**

16.2.58 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.

16.2.59 Maximising the reuse of materials won on site such through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume

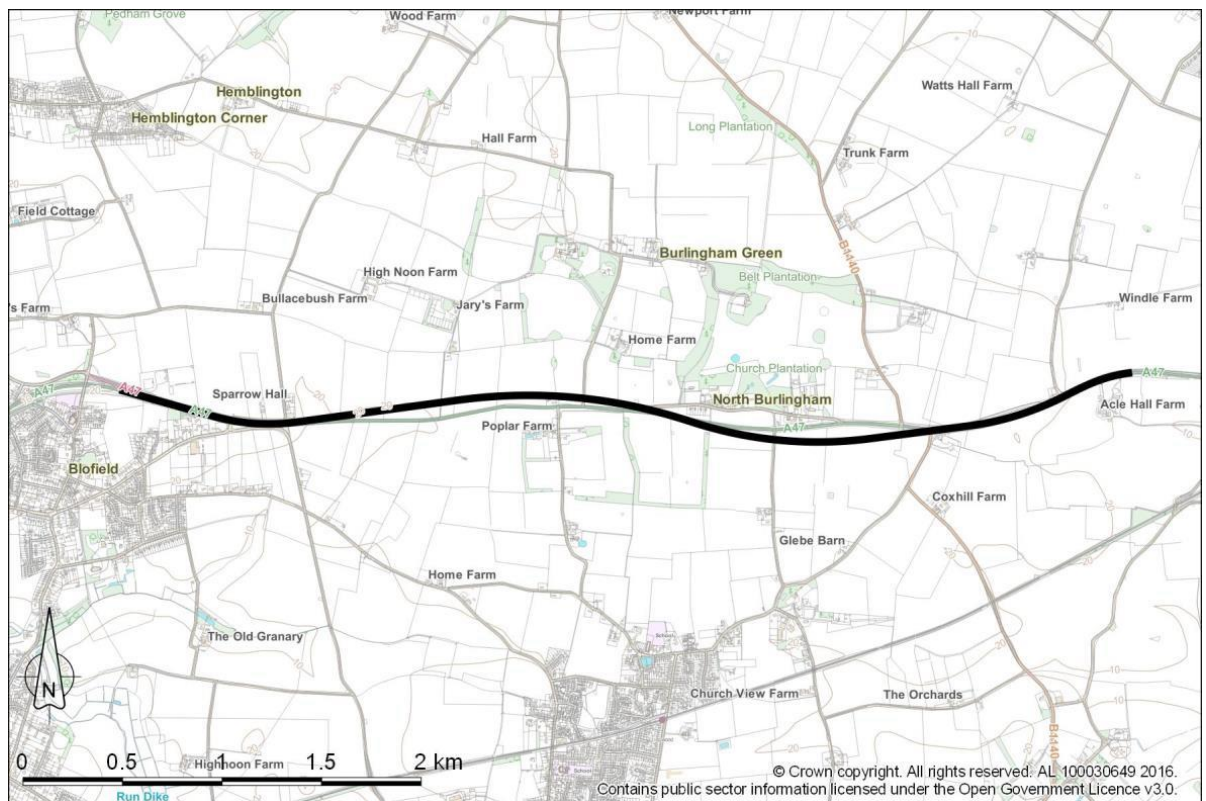
of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

16.2.60 Where contamination is identified or suspected, appropriate sampling, analysis and risk assessment be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors

### 16.3 Option 2

16.3.1 Option 2 is an offline dualling to the north of Blofield and the south of North Burlingham with appropriate junction improvements. The proposed route of the option is effectively a new highway corridor and it would be necessary to acquire land along the route to accommodate the improvement. Option 2 is shown in Figure 16-2.

**Figure 16-2: Option 2 Offline dualling to the north of Blofield and to the south of North Burlingham**



### Air Quality

16.3.2 Option 2 is very close to the existing alignment of the A47, thus the impacts on air quality from this option will be similar to Options 1 and 8.

16.3.3 Option 2 will move the route slightly further away from the receptors at Poplar Farm and from properties adjacent to the existing A47 alignment. Option 2 is expected to have slight beneficial impacts on air quality at these receptors as their exposure to traffic is expected to decrease.

16.3.4 Overall, the dualling of the A47 should lead to improvements in the local air quality and reduced greenhouse gas emissions as a result of improvements to traffic flow, reductions in low speed traffic and more efficient fuel use.



- 16.3.5 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. With proper mitigation the risks of construction dust can be significantly reduced.
- 16.3.6 There are no Air Quality Management Areas (AQMAs) recorded within the study area. Thus option 2 is not expected to adversely impact on any AQMAs nor result in the exceedance of air quality objectives
- 16.3.7 At this stage, it is considered that the impacts on air quality from Option 2 are neutral.

#### **Mitigation**

- 16.3.8 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.
- 16.3.9 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

#### **Cultural Heritage**

- 16.3.10 Option 2 will shift the road alignment away from the listed buildings in North Burlingham thus it is not expected to have any significant impact on them.
- 16.3.11 The northern offline section of Option 2 will impact a number of cropmark features in the fields which it passes through. These cropmarks are thought to be Bronze Age to Roman in age and consist of enclosures and field boundaries. The southern offline section of this option also has potential to adversely affect prehistoric, medieval and post-medieval finds,
- 16.3.12 Given the high number of assets present in the area, there is potential for Option 2 to affect subsurface remains and archaeological features.
- 16.3.13 At this stage, impacts on cultural heritage from Option 2 are considered to be minor adverse.

#### **Mitigation**

- 16.3.14 It is likely that archaeological mitigation measures can be put in place through a Written Scheme of Investigation to reduce the impact on the historic environment. Mitigation measures may include but not be limited to geophysical survey, field walking, excavation evaluation and landscape screening.

#### **Landscape and Visual**

- 16.3.15 Option 2 will shift the route alignment slightly offline to the north and to the south of the existing A47 route alignment. Thus Option 2 is anticipated to have similar impacts on the landscape and visual receptors as Options 1 and 8.
- 16.3.16 The landscape in the vicinity of the A47 is representative of the wider landscape of the Norfolk Broads with large, arable fields with hedgerow boundaries. Option 2 will introduce offline sections and widen online sections which will result in the loss of landscape features (such as hedgerows, mature trees and plantation woodland) and it will affect the local land cover. The creation of new junctions and access roads will result in the introduction of new features into the landscape on a local scale. The loss of visual screening and the introduction of new landscape features may affect views from residential properties.

16.3.17 Visual receptors along the A47 and local minor roads may experience a change in views due to the loss of screening vegetation. Replacement planting along the widened A47 may take over 15 years to mature and provide the same level of screening.

16.3.18 At this stage, the impacts on landscape and visual receptors from Option 2 are considered to be minor adverse.

#### **Mitigation**

16.3.19 Road design should seek to integrate the new route into the landscape as far as possible. Potential mitigation could consist of screen planting to limit views from receptors along the A47 and provide integration with the landscape. However, it may take over 15 years for planting to mature sufficiently to provide the same level of screening.

#### **Nature Conservation and Biodiversity**

16.3.20 As with Option 1, Option 2 will not result in any impacts on designated sites or priority habitats.

16.3.21 Option 2 has potential to encroach upon the Defra Farm Conservation and Countryside Stewardship Area at Poplar Farm. However the scheme is not expected to result in the loss of any planted woodland areas.

16.3.22 This option will result in the loss of the areas of arable farmland, roadside hedgerows and trees. The loss of these habitats has the potential to result in the displacement of birds and bats and in the disturbance of commuting and foraging routes for bats. The introduction of offline sections has the potential to result in the severance of ecological territories.

16.3.23 Preliminary surveys for the project identified badger activity along the A47 with an active outlier sett next to the carriageway. The widening has potential to adversely impact this sett, causing disturbance and potentially closure of the sett under licence.

16.3.24 During construction there may be direct and indirect effects on species and habitats from noise, pollution, lighting and increased human disturbance. These effects are generally temporary but can be significant.

16.3.25 At this stage, impacts on nature conservation and biodiversity from option 2 are assessed to be minor adverse.

#### **Mitigation**

16.3.26 During construction standard mitigation measures are to be considered which include, pollution prevention measures, standard control measures to control dust from construction activities, preconstruction surveys, timing of works and an production of Construction Environmental Management Plan.

16.3.27 Additional mitigation measures to also consider during the scheme design, construction and operation include; retention of habitats and soft landscaping that would benefit flora and fauna and meet the objectives of local and HE BAPs, off-site mitigation and enhancement areas (where this cannot be met within the scheme boundary), enhancing the wildlife corridor and ecosystem functioning of the verges. Mammal fencing and underpasses to minimise operational effects on mammals, e.g. badger and otter should be considered in conjunction with on-going monitoring surveys.

16.3.28 Opportunities to provide biodiversity enhancements could be explored as the project progresses.

16.3.29 Further baseline surveys are required at Stage 2 to fully inform mitigation strategies. Consultation will also be required with ecological stakeholders on the mitigation proposed.

## Noise and Vibration

16.3.30 As noted for air quality, Option 2 moves the route further away from the residential, commercial and community receptors along the existing A47 road alignment and at Poplar Farm. Option 2 is expected to have slight beneficial impacts on the noise and vibration levels at these receptors as their exposure to traffic is expected to decrease.

16.3.31 This option will move the noise source from the A47 to the rear of the property at the NIA at the Old Post Office. The scheme is not anticipated to result in any perceptible changes in noise levels at the NIA provided no significant changes in traffic occur on the main roads.

16.3.32 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.3.33 At this stage impacts from Option 2 are assessed to be largely neutral with minor beneficial for some receptors.

### Mitigation

16.3.34 Mitigation measures could be developed to reduce noise impacts, which may include:

- Maximising the distance between realigned section of road and receptors.
- Minimising changes in traffic on existing roads due to the scheme.
- Earth bunds/noise barriers to screen receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of the new/aligned sections of road into the landscape.
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective.
- Noise insulation of individual properties to protect the internal noise environment.

16.3.35 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

## Road Drainage and Water Environment

16.3.36 Impacts on the road drainage and water environment from Option 2 will be similar to Option 1. Although Option 2 will have no impacts on rivers or stream it may have some impacts on small field drains and ponds located along the A47. Changes in road drainage have potential to improve water quality in the vicinity of the project.

16.3.37 The option footprint is not affected by flooding thus it is considered that the option will have no impact on flood risk.

16.3.38 There is a major aquifer underlying the scheme footprint which is affected by intermediate to high groundwater vulnerability and leaching potential. Thus Option 2 has the potential to adversely impact the principal aquifer during the construction and operational phases as a result of accidental spillages/pollution events and changes to road drainage. The groundwater within the western extents of the study area is particularly sensitive to change as it is located in a Groundwater Source Protection Zone.

16.3.39 At this stage the impact is assessed to be neutral.

### **Mitigation**

16.3.40 Mitigation measures to protect groundwater during construction include adherence to pollution prevention guidelines and best practice. The procedures for managing effects on the water environment will be defined in a Construction Environmental Management Plan and will comply with current planning policies and regulations.

### **People and Communities**

16.3.41 Option 2 will have a similar impact on the local PRow and community pathways as Option 1. Option 2 has potential to affect the Burlingham community woodland and paths and a bridleway located to the south of the A47 near Poplar Farm. The option would also affect a footpath (FP3) that runs from Lingwood to Burlingham Green, which crosses over the A47 just west of North Burlingham.

16.3.42 The dualling will improve traffic flow and result in less congestion, having a beneficial effect on vehicle travellers. The removal of the roadside hedges will result in more open views across the landscape for travellers; however the views will become more enclosed as replanting matures.

16.3.43 The retention of the existing A47 as a local access route between Blofield and North Burlingham will help alleviate community severance. However the offline dual carriageway will result in local severance as NMU and vehicle access to community facilities on the opposite side of the A47 (such as the religious premises, health care facilities and schools) will be restricted.

16.3.44 During construction, road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion and route uncertainty and decrease traveller speeds and journey times. Construction traffic leaving the construction site and entering the road network has the potential to deposit mud and debris onto road surfaces. Spray rising from moving traffic has the potential to land on vehicle windscreens and reduce driver vision potentially increasing the fear of accidents. Changes to traffic management measures during the construction phase may also generate confusion leading to a fear of accidents. However, these impacts will be temporary.

16.3.45 Option 2 will require the acquisition of arable land to accommodate the scheme. The area of landtake will be considerably larger than Option 1 as it has large offline sections.

16.3.46 At this stage impacts on people and communities is assessed to be minor adverse.

### **Mitigation**

16.3.47 Impacts to PRowS could be mitigated through the introduction of new NMU routes throughout the site connecting the settlements. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility along the A47.

16.3.48 Mitigation measures should also include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with HE and other appropriate stakeholders. The appointed contractor will adhere to current best practice techniques during the construction phrase. Appropriate landscape planting will be implemented to minimise visual impacts.

### **Geology, Soils and Materials**

16.3.49 Option 2 will result in the greater loss of agricultural soils which have been designated as Grade 1 and 2 (excellent-good) by Natural England, relative to Option 1.

- 16.3.50 This option will create more substantial volumes of waste soils and will require greater volumes of imported materials than option 1 as it is primarily offline. There is potential for the excavated materials to be retained and used on site pending appropriate testing for contaminants and geotechnical suitability. The unsuitable materials will have slight adverse impacts on waste management sites.
- 16.3.51 The scheme has the potential to result in adverse contaminated land impacts as a result of accidental spillages/pollution events during the construction and/or operational phases.
- 16.3.52 Impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site.
- 16.3.53 At this stage, impacts on geology, soils and materials are assessed to be minor adverse.

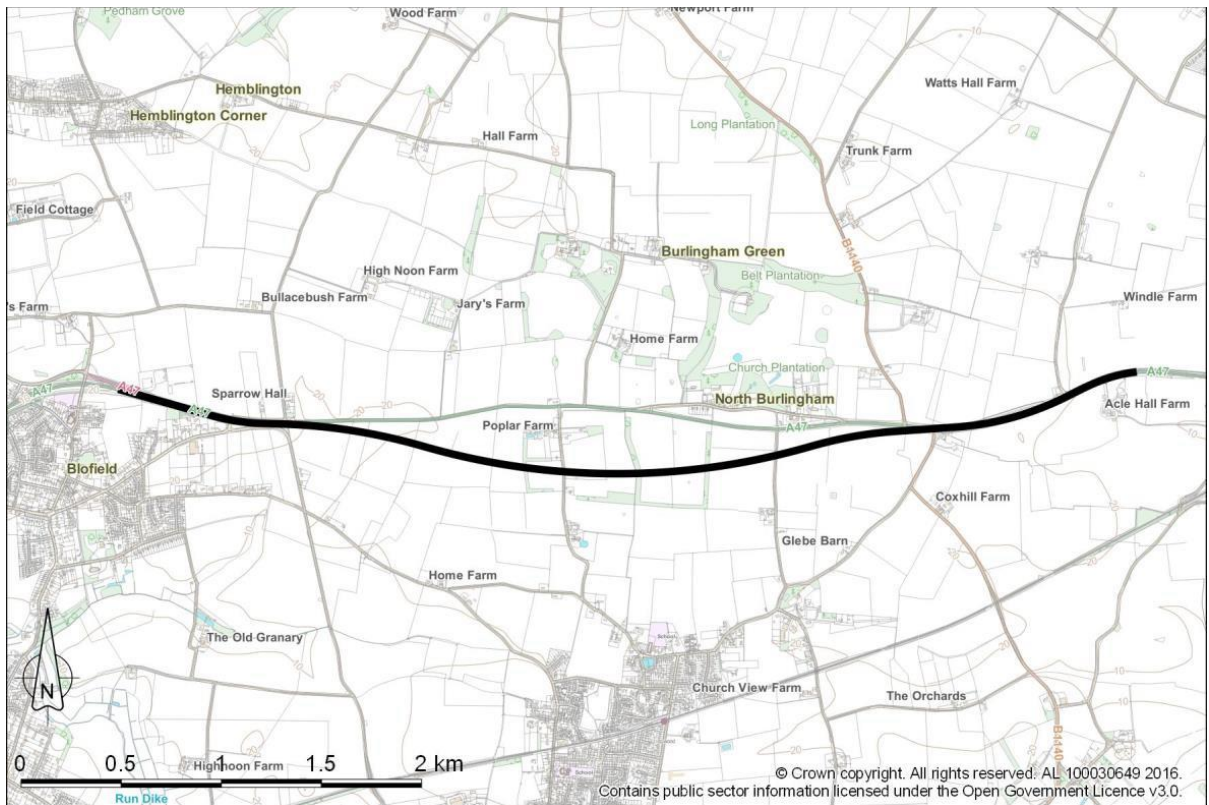
### **Mitigation**

- 16.3.54 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.
- 16.3.55 Maximising the reuse of materials won on site such through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.
- 16.3.56 Where contamination is identified or suspected, appropriate sampling, analysis and risk assessment be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.
- 16.3.57 Construction works should be in compliance with the guidance provided in the BS 3882:2015 'British Standard Specification for Topsoil' (2015) – sourcing suitable topsoil, handling topsoil in appropriate manner (weather, machinery), avoiding stockpiling where possible. Where possible, the excavated soils should be reused on site to minimise the amount of material to be imported. Additional guidance can be found within DEFRA's 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites', 2009.

## **16.4 Option 7**

- 16.4.1 Option 7 is an offline dualling to the south of the existing A47. The road will be to current dual carriageway standards with appropriate junction improvements. As the alignment is effectively a new highway corridor, it is necessary to acquire land to accommodate the improvement. Where the existing A47 would be unaffected by the new dual carriageway, it will be retained and become part of the local road network. Option 7 is shown on Figure 16-3 below.

**Figure 16-3: Option 7 offline dualling to the south of the existing A47**



### **Air Quality**

- 16.4.2 Option 7 will shift the route closer to rural properties along Lingwood Road and Lingwood Lane. This is likely to result in a decline in air quality at these properties due to greater exposure to traffic. However this impact will be localised and it is not anticipated that this will result in the exceedance of air quality objectives at these properties.
- 16.4.3 Option 7 will move the route alignment away from the properties located adjacent to the existing A47 road. As a result the localised air quality at these receptors is anticipated to improve.
- 16.4.4 The dualling of the A47 is not expected to result in a significant change in traffic volumes, but improved flows can lead to a reduction in greenhouse gas emissions due to more efficient fuel usage.
- 16.4.5 There are no Air Quality Management Areas (AQMAs) recorded within the study area. Option 7 is not expected to adversely impact on any AQMAs nor result in the exceedance of air quality objectives.
- 16.4.6 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. With proper mitigation the risks of construction dust can be significantly reduced.
- 16.4.7 At this stage, it is assessed that impacts on air quality from Option 7 will be neutral.

### **Mitigation**

- 16.4.8 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from

vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.

- 16.4.9 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

### **Cultural Heritage**

- 16.4.10 Option 7 moves the route away from the Church of St Andrew Grade I Listed Building (NMR No. 1051522) and the Church of St Peter Grade II Listed Building (NMR No. 1304547) and closer to the location of several listed buildings in Lingwood and Blofield, including the Church of St Peter Grade I listed building (NMR 1051521), This option may potentially affect the settings of the listed buildings it moves closer to.
- 16.4.11 This option has the potential to directly affect recorded heritage assets. The route traverses an area where prehistoric, medieval and post medieval artefacts have been found as well as an area with cropmarks of enclosures and field boundaries.
- 16.4.12 Given the high number of assets present in the area, there is a potential for the widening to affect unrecorded remains and archaeological features.
- 16.4.13 At this stage, impacts on cultural heritage features from Option 7 are assessed to be minor adverse.

### **Mitigation**

- 16.4.14 It is likely that archaeological mitigation measures can be put in place through a Written Scheme of Investigation to reduce the impact on the historic environment. Mitigation measures may include but not be limited to geophysical survey, field walking, excavation evaluation and landscape screening.

### **Landscape and Visual**

- 16.4.15 Option 7 is likely to have a more adverse impact on the local landscape than options 1 and 2, as it is more offline and cuts through an area of flat farmland. Although the design of the road can be such that it follows natural contours where possible and planting can be used to provide screening, it is likely to be a highly intrusive feature in the local landscape.
- 16.4.16 The impact on visual receptors is also likely to be adverse, as it introduces views of a busy road and associated traffic to a number of scattered properties along Lingwood Road and Lingwood Lane that currently only have a view of a minor road with low traffic volumes.
- 16.4.17 At this stage, the impact on landscape and visual receptors from Option 7 is assessed to be moderate adverse.

### **Mitigation**

- 16.4.18 Road design should seek to integrate the new route into the landscape as far as possible. Potential mitigation could consist of screen planting to limit views from receptors along the A47 and provide integration with the landscape. However, it may take over 15 years for planting to mature sufficiently to provide the same level of screening.

## Nature Conservation and Biodiversity

- 16.4.19 Option 7 will shift the alignment of the existing A47 road in a southern direction. Although the option is the furthest offline, this option will not result in any impacts on designated sites or priority habitats.
- 16.4.20 Option 7 will result in the loss of planted woodland areas within the Defra Farm Conservation and Countryside Stewardship Area at Poplar Farm.
- 16.4.21 In terms of habitats affected, impacts from Option 7 will be similar to those for Options 1 and 2. Option 7 will result in the loss of the areas of arable farmland, broadleaved plantation woodland, grassland and scattered trees which form roadside hedgerows.
- 16.4.22 The loss of woodland and hedgerow habitats has the potential to result in the displacement of birds and bats and in the disturbance of commuting and foraging routes for bats. The introduction of offline sections also has the potential to result in the severance of ecological territories.
- 16.4.23 Preliminary surveys for the project identified badger activity along the A47 with an active outlier sett next to the carriageway. The change in alignment has potential to adversely impact this sett, causing disturbance and severing it from other setts in the vicinity, resulting in increased risk of collision between traffic and badgers moving through their territories.
- 16.4.24 During construction there may be direct and indirect effects on species and habitats from noise, pollution, lighting and increased human disturbance. These effects are generally temporary but can be significant.
- 16.4.25 At this stage of assessment, the impact on nature conservation and biodiversity is assessed to be moderate adverse.

## Mitigation

- 16.4.26 During construction standard mitigation measures are to be considered which include pollution prevention measures, standard control measures to control dust from construction activities, preconstruction surveys, timing of works and production of a Construction Environmental Management Plan.
- 16.4.27 Additional mitigation measures to also consider during the scheme design, construction and operation include; retention of habitats and soft landscaping that would benefit flora and fauna and meet the objectives of local and HE BAPs, off-site mitigation and enhancement areas (where this cannot be met within the scheme boundary), enhancing the wildlife corridor and ecosystem functioning of the verges. Mammal fencing and underpasses to minimise operational effects on mammals, e.g. badger and otter should be considered in conjunction with on-going monitoring surveys.
- 16.4.28 Opportunities to provide biodiversity enhancements could be explored as the project progresses.
- 16.4.29 Further baseline surveys are required at Stage 2 to fully inform mitigation strategies. Consultation will also be required with ecological stakeholders on the mitigation proposed.

## Noise and Vibration

- 16.4.30 Option 7 will move the route alignment away from the properties along the existing A47 road alignment. However the option will also result in increased noise and vibration levels at receptors along Lingwood Road and Lingwood Lane. Overall, more receptors are likely to experience a decrease in noise levels than an increase thus it is considered that the scheme will have a slight beneficial effect on noise and vibration receptors.



16.4.31 This option will also shift the road alignment away from the NIA at the Old Post Office. The change in the alignment may lead to an improvement in noise levels at the NIA.

16.4.32 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.4.33 At this stage of assessment, Option 7 is assessed to have a minor beneficial impact on noise receptors overall. However, individual noise receptors have potential to experience potentially significant increases in noise.

#### **Mitigation**

16.4.34 Mitigation measures could be developed to reduce noise impacts, which may include:

- Maximising the distance between realigned section of road and receptors.
- Minimising changes in traffic on existing roads due to the scheme.
- Earth bunds/noise barriers to screen receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of the new/aligned sections of road into the landscape.
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective.
- Noise insulation of individual properties to protect the internal noise environment.

16.4.35 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

#### **Road Drainage and Water Environment**

16.4.36 Impacts from Option 7 on the water environment will be similar to those for Options 1 and 2. Although Option 7 is a more offline route, there are limited water features that are likely to be directly affected such as drainage ditches and ponds. Changes in the road drainage have potential to improve water quality in the vicinity of the project.

16.4.37 The option footprint is not affected by flooding thus it is considered that the option will have no impact on flood risk.

16.4.38 There is a major aquifer underlying the scheme footprint which is affected by intermediate to high groundwater vulnerability and leaching potential. Thus Option 7 has the potential to adversely impact the principal aquifer during the construction and operational phases as a result of accidental spillages/pollution events and changes to road drainage. The groundwater within the western extents of the study area is particularly sensitive to change as it is located in a Groundwater Source Protection Zone.

16.4.39 At this stage of assessment, the impact on road drainage and the water environment from Option 7 is assessed to be neutral.

#### **Mitigation**

16.4.40 Mitigation measures to protect groundwater during construction include adherence to pollution prevention guidelines and best practice. The procedures for managing effects on the water environment will be defined in a Construction Environmental Management Plan and will comply with current planning policies and regulations.

## People and Communities

- 16.4.41 Option 7 will result in the loss of Burlingham community woodland areas and the severance of community walks (bridleway and footpath) located east of Poplar Farm. This option will also result in the severance of two PRowS, including a bridleway east of Poplar Farm and a footpath which runs from Lingwood to Burlingham Green. This will result in severance of a pedestrian route and cause disruption to recreational walkers during construction.
- 16.4.42 The dualling will improve traffic flow and result in less congestion, having a beneficial effect on vehicle travellers. The removal of the roadside hedges will result in more open views across the landscape for travellers; however the views will become more enclosed as replanting matures.
- 16.4.43 The retention of the existing A47 route as a local access road between Blofield and North Burlingham will ensure connectivity between community facilities is maintained. However the offline dual carriageway will result in local severance of recreational walks and PRowS
- 16.4.44 During construction, road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion and route uncertainty and decrease traveller speeds and journey times. Construction traffic leaving the construction site and entering the road network has the potential to deposit mud and debris onto road surfaces and to increase road spray. The poor road conditions in addition to the road layout during the construction phase could increase the fear of accidents. However, these impacts will be temporary.
- 16.4.45 Option 7 will require the acquisition of arable land to accommodate the scheme. The scheme may sever access to agricultural fields and result in some fields becoming too small to be used for arable farming purposes.
- 16.4.46 At this stage, impacts on people and communities from Option 7 are assessed to be moderate adverse.

## Mitigation

- 16.4.47 Impacts to PRowS could be mitigated through the introduction of new NMU routes throughout the site connecting the settlements. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility along the A47. Methods of preventing severance of the PRow such as overbridges or underpasses will be considered as the scheme progresses through detailed design.
- 16.4.48 Mitigation measures should also include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with HE and other appropriate stakeholders. The appointed contractor will adhere to current best practice techniques during the construction phrase. Appropriate landscape planting will be implemented to minimise visual impacts.

## Geology, Soils and Materials

- 16.4.49 Option 7 will result in the greater loss of agricultural soils which have been designated as Grade 1 and 2 (excellent-good) by Natural England, relative to Options 1, 2 and 8.
- 16.4.50 This option will create more substantial volumes of waste soils and will require greater volumes of imported materials than Options 1, 2 and 8 as the alignment is further offline. There is potential for the excavated materials to be retained and used on site pending appropriate testing for contaminants and geotechnical suitability. The unsuitable materials will have adverse impacts on waste management sites.

- 16.4.51 The scheme has the potential to result in adverse contaminated land impacts as a result of accidental spillages/pollution events during the construction and/or operational phases.
- 16.4.52 Impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site.
- 16.4.53 At this stage, the impacts on geology, soils and materials from Option 7 are assessed to be minor adverse.

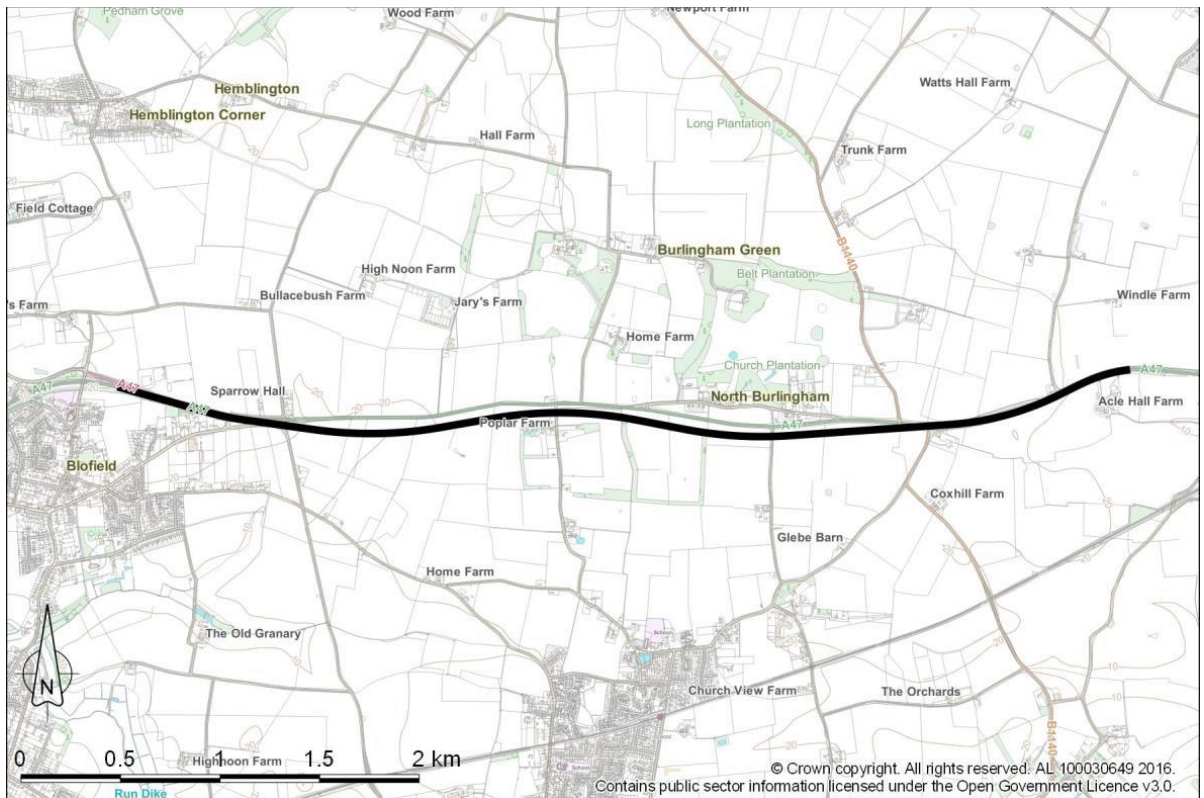
### **Mitigation**

- 16.4.54 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.
- 16.4.55 Maximising the reuse of materials won on site such through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.
- 16.4.56 Where contamination is identified or suspected, appropriate sampling, analysis and risk assessment be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.
- 16.4.57 Construction works should be in compliance with the guidance provided in the BS 3882:2015 'British Standard Specification for Topsoil' (2015) – sourcing suitable topsoil, handling topsoil in appropriate manner (weather, machinery), avoiding stockpiling where possible. Where possible, the excavated soils should be reused on site to minimise the amount of material to be imported. Additional guidance can be found within DEFRA's 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites', 2009.

## **16.5 Option 8**

- 16.5.1 Option 8 is an offline dualling to the south of the existing A47, although closer to the current alignment than Option 7. The carriageway will be to current dualling standards with appropriate junction improvements. It will be necessary to acquire land to accommodate the improvements. Where the existing A47 is unaffected by the new dual carriageway, it will be retained and become part of the local road network. Option 8 is shown on Figure 16-4 below

**Figure 16-4: Option 8 offline dualling to the south of the existing A47**



## Air Quality

- 16.5.2 Option 8 is very close to the existing alignment of the A47, thus the impacts on air quality from this option will be similar to Options 1 and 2.
- 16.5.3 Option 8 will move the A47 immediately south of the receptors adjacent to the existing A47 road alignment and away from receptors in North Burlingham. The change of alignment may result in slight beneficial impacts for some of these receptors.
- 16.5.4 Option 8 will also move the A47 route closer to receptors at Poplar Farm and along Lingwood Lane and Lingwood Road. These receptors may experience a consequent decrease in local air quality.
- 16.5.5 Overall, the dualling of the A47 should lead to improvements in the local air quality and reduced greenhouse gas emissions as a result of improvements to traffic flow, reductions in low speed traffic and more efficient fuel use.
- 16.5.6 There are no Air Quality Management Areas (AQMA) recorded within the study area. Option 8 is not expected to adversely impact on any AQMA nor result in the exceedance of air quality objectives.
- 16.5.7 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. With proper mitigation the risks of construction dust can be significantly reduced.
- 16.5.8 At this stage, it is assessed that the impact on air quality from Option 8 will be neutral.

### **Mitigation**

- 16.5.9 If significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of the road further away from sensitive receptors, or reviewing speed limits to improve emissions from vehicles.
- 16.5.10 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

### **Cultural Heritage**

- 16.5.11 This option moves the A47 slightly further away from the Church of St Andrew Grade I and the Church of St Peter Grade II Listed Buildings.
- 16.5.12 Although it is very close to the existing alignment, Option 8 is mostly offline and has the potential to affect features close to the road. Impacts from this option will be similar to those for Options 1 and 2. Option 8 has the potential to disturb the site of a sand pit as well as cropmarks, The Old Post Office, Poplar Farm, The White House, a 20th Century milestone, and subsurface remains.
- 16.5.13 Given the high number of assets present in the area, there is potential for the widening to affect subsurface remains and archaeological features.
- 16.5.14 At this stage, it is assessed that the impact on cultural heritage from Option 8 will be minor adverse.

### **Mitigation**

- 16.5.15 It is likely that archaeological mitigation measures can be put in place through a Written Scheme of Investigation to reduce the impact on the historic environment. Mitigation measures may include, but not be limited to, geophysical survey, field walking, excavation evaluation and landscape screening.

### **Landscape and Visual**

- 16.5.16 Impacts on landscape and visual receptors from Option 8 will be similar to those from Options 1 and 2 as the road alignment will be only slightly offline.
- 16.5.17 Option 8 will introduce offline sections and widen online sections which will result in the loss of landscape features (such as hedgerows, mature trees and plantation woodland) and it will affect the local landcover. The creation of new junctions and access roads will result in the introduction of new features into the landscape on a local scale. There is potential for more of an effect at the eastern extents of the option due to the larger junction with Acle Road and South Walsham Road.
- 16.5.18 The loss of visual screening and the introduction of new landscape features may affect views from residential properties. Visual receptors along the A47 and local minor roads and to the south of the existing road alignment may experience a change in views due to the loss of screening vegetation. Replacement planting along the widened A47 may take over 15 years to mature and provide the same level of screening.
- 16.5.19 At this stage, the impacts on landscape and visual receptors are considered to be minor adverse in the short term.

### **Mitigation**

16.5.20 Road design should seek to integrate the new route into the landscape as far as possible. Potential mitigation could consist of screen planting to limit views from receptors along the A47 and provide integration with the landscape. However, it may take over 15 years for planting to mature sufficiently to provide the same level of screening.

### **Nature Conservation and Biodiversity**

16.5.21 Impacts from Option 8 on biodiversity will be similar to those for Options 1 and 2. Although this route is offline, it is very close to the existing alignment and the potential for encountering/affecting wildlife close to the road is low.

16.5.22 Preliminary surveys for the project identified badger activity along the A47 with an active outlier sett next to the carriageway. The dualling has potential to adversely impact this sett, causing disturbance and potentially closure of the sett under licence.

16.5.23 The loss of hedgerows and trees will result in habitat loss for birds and bats, as well as affecting commuting and foraging routes for bats. The creation of new junctions has the potential to result in the severance of ecological territories.

16.5.24 During construction there may be direct and indirect effects on species and habitats from noise, pollution, lighting and increased human disturbance. These effects are generally temporary but can be significant.

16.5.25 At this stage it is assessed that impacts on nature conservation and biodiversity will be minor adverse.

### **Mitigation**

16.5.26 During construction standard mitigation measures are to be considered which include, pollution prevention measures, standard control measures to control dust from construction activities, preconstruction surveys, timing of works and production of a Construction Environmental Management Plan.

16.5.27 Additional mitigation measures to also consider during the scheme design, construction and operation include; retention of habitats and soft landscaping that would benefit flora and fauna and meet the objectives of local and HE BAPs, off-site mitigation and enhancement areas (where this cannot be met within the scheme boundary), enhancing the wildlife corridor and ecosystem functioning of the verges. Mammal fencing and underpasses to minimise operational effects on mammals, e.g. badger and otter should be considered in conjunction with on-going monitoring surveys.

16.5.28 Opportunities to provide biodiversity enhancements could be explored as the project progresses.

16.5.29 Further baseline surveys are required at Stage 2 to fully inform mitigation strategies. Consultation will also be required with ecological stakeholders on the mitigation proposed.

### **Noise and Vibration**

16.5.30 Option 8 will have similar noise and vibration impacts as Options 2 and 7 as it will shift the route further from properties in North Burlingham. However this option will also move the road alignment closer to receptors at Poplar Farm. Overall, more receptors are likely to experience a decrease in noise levels than an increase thus it is considered that the scheme will have slight benefits on some receptors.

16.5.31 Option 8 will move the A47 slightly further away from the NIA at the Old Post Office, however the small change in alignment is unlikely to result in a significant change in noise levels.

16.5.32 No details of the construction works required for this option are currently available. However, there is the potential for significant noise effects at the closest receptors to the works, in particular if night time works are required. Vibration effects could only occur if works such as impact piling or vibratory ground improvement are required.

16.5.33 At this stage, impacts on noise and vibration from Option 8 are assessed to be neutral.

#### **Mitigation**

16.5.34 Mitigation measures could be developed to reduce noise impacts, which may include:

- Maximising the distance between realigned section of road and receptors.
- Minimising changes in traffic on existing roads due to the scheme.
- Earth bunds/noise barriers to screen receptors. Where there is sufficient land available, earth bunds/noise barriers can be designed in consultation with the landscape design to help integrate the route of the new/aligned sections of road into the landscape.
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective.
- Noise insulation of individual properties to protect the internal noise environment.

16.5.35 Construction works should be carried out in accordance with BS 5228 'Noise Control on Construction and Open Sites' to mitigate temporary noise impacts.

#### **Road Drainage and Water Environment**

16.5.36 Impacts on the water environment from Option 8 will be similar to those from Options 1 and 2. The route is located very close to the existing A47 and there are no surface watercourses likely to be affected. Option 8 may have some impacts on small field drains and ponds located along the A47. Changes in road drainage have potential to improve water quality in the vicinity of the project.

16.5.37 The option footprint is not affected by flooding thus it is considered that the option will have no impact on flood risk.

16.5.38 Option 8 has the potential to impact on the major aquifer underlying the scheme footprint as a result of accidental spillages/pollution events and changes to road drainage. The aquifer is considered susceptible to pollutants as it affected by intermediate to high groundwater vulnerability and leaching potential and the western extents of the study area are located in a Groundwater Source Protection Zone.

16.5.39 At this stage, impacts are assessed to be neutral

#### **Mitigation**

16.5.40 Mitigation measures to protect groundwater during construction include adherence to pollution prevention guidelines and best practice. The procedures for managing effects on the water environment will be defined in a Construction Environmental Management Plan and will comply with current planning policies and regulations.

#### **People and Communities**

16.5.41 Option 8 will have a similar impact on the local PRoW and community pathways as Option 7. Option 8 will result in the loss of areas of Burlingham community woodland and the severance of community walks (bridleway and footpath) located east of Poplar Farm. This option will also result in the severance of a PRoW footpath which runs from Lingwood to Burlingham Green.

This will result in severance of a pedestrian route and cause disruption to recreational walkers during construction.

16.5.42 The dualling will improve traffic flow and result in less congestion, having a beneficial effect on vehicle travellers. The removal of the roadside hedges will result in more open views across the landscape for travellers; however the views will become more enclosed as replanting matures.

16.5.43 The retention of the existing A47 route as a local access road between Blofield and North Burlingham will ensure connectivity between community facilities is maintained. However the offline dual carriageway will result in local severance of PRowWs.

16.5.44 During construction, road users will experience the effects of temporary lane or road closures, diversion routes and the presence of construction traffic on minor roads. Lane restrictions in certain areas during construction may increase congestion and route uncertainty and decrease traveller speeds and journey times.

16.5.45 Construction traffic leaving the construction site and entering the road network has the potential to deposit mud and debris onto road surfaces and to increase road spray. The poor road conditions in addition to the road layout during the construction phase could increase the fear of accidents. However these impacts will be temporary.

16.5.46 Option 8 will require the acquisition of arable land to accommodate the scheme. The scheme may sever access to some agricultural fields affecting their productivity.

16.5.47 At this stage of the assessment, impacts on people and communities from Option 8 are assessed to be minor adverse.

### **Mitigation**

16.5.48 Impacts to PRowWs could be mitigated through the introduction of new NMU routes throughout the site connecting the settlements. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility along the A47.

16.5.49 Mitigation measures should also include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with HE and other appropriate stakeholders. The appointed contractor will adhere to current best practice techniques during the construction phase. Appropriate landscape planting will be implemented to minimise visual impacts.

### **Geology, Soils and Materials**

16.5.50 Option 8 will result in the greater loss of agricultural soils which have been designated as Grade 1 and 2 (excellent-good) by Natural England, relative to Option 1.

16.5.51 This option will create more substantial volumes of waste soils and will require greater volumes of imported materials than Option 1 as it is primarily offline. There is potential for the excavated materials to be retained and used on site pending appropriate testing for contaminants and geotechnical suitability. The unsuitable materials will have slight adverse impacts on waste management sites.

16.5.52 The scheme has the potential to result in adverse contaminated land impacts as a result of accidental spillages/pollution events during the construction and/or operational phases.

16.5.53 Impacts on geology, geomorphology, hydrogeology and groundwater are uncertain at this stage as ground conditions for earthworks are not currently understood. Investigations should confirm the suitability of the ground conditions including the geotechnical, geochemical conditions beneath the site.



16.5.54 At this stage of the assessment, impacts on geology, soils and materials from Option 8 are assessed to be minor adverse.

### **Mitigation**

16.5.55 The principal mitigation measures to prevent adverse effects on soils and geology during the works would be to ensure appropriate and thorough ground investigations have been conducted and good site practice and management in line with the current legislation are carried out. Best practice techniques should be utilised in order to reduce risks from contaminated materials, reduce the quantity of raw materials and material wastage needed to complete the scheme.

16.5.56 Maximising the reuse of materials won on site such through the use of a Materials Management Plan (MMP) or Soils Resource Plan (SRP) will lead to a reduction in the volume of materials used on site. A watching brief for contaminated materials should be maintained during construction works, particularly excavation.

16.5.57 Where contamination is identified or suspected, appropriate sampling, analyse and risk assessment be undertaken and suitable measures (for containment, storage, handling and off site waste management) put in place to disrupt any existing pollutant linkages and prevent the creation of additional pollutant linkages to potential sensitive receptors.

16.5.58 Construction works should be in compliance with the guidance provided in the BS 3882:2015 'British Standard Specification for Topsoil' (2015) – sourcing suitable topsoil, handling topsoil in appropriate manner (weather, machinery), avoiding stockpiling where possible. Where possible, the excavated soils should be reused on site to minimise the amount of material to be imported. Additional guidance can be found within DEFRA's 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites', 2009.

## 17 Detailed Cost Estimate of Sifted Options

### 17.1 Introduction

17.1.1 As a project develops through the PCF Stages the scheme costs are estimated based on the level of detail available at that time. For PCF Stage 1 an estimate is being undertaken for each of the options which were taken forward for further assessment following the options review meeting, described in Chapter 11. The estimates are produced to demonstrate the affordability of the project. The Options Estimates were used in the decision-making process to determine whether the scheme progressed into PCF Stage 2.

17.1.2 At the end of PCF Stage 1, only one Options Estimate was produced (for Option 8) by the Highways England Commercial team. Option 8 was selected as being viable to be put forward into PCF Stage 2 based on the option being offline along the whole length of the route hence would be less disruptive during construction.

17.1.3 Therefore, the most viable option was chosen for costing which was Option 8, based on the limited information available at that time (no new structures or bridge widening included in this option design).

### 17.2 Options Estimate

17.2.1 The Options Estimates for the sifted options had not been produced by Highways England Commercial team at the end of the PCF Stage 1. However it was intended that all options would have an Options Estimate prior to the PCF Stage 2 Consultation and reported via an addendum to the report.

17.2.2 The Options Estimate for the scheme, prepared in accordance with the Highways England Commercial Cost Estimation Manual, produces a three point range estimate that identifies:

- The minimum;
- The most likely; and
- The maximum cost.

17.2.3 The Options Estimate include a consideration of uncertainties associated with the scheme via an assessment of risk. Project risks have been identified and recorded within the scheme risk register. The risk register has been considered in the three point range estimate.

### 17.3 Review of the Estimate

17.3.1 The estimate has been reviewed in accordance with the Highways England Cost Estimating Manual. The reviews include independent peer reviews, Estimating Manager reviews and a review by the Head of Cost Planning.

17.3.2 In addition to these reviews, the estimate was presented to the project team for their input and confirmation of correct approach and assumptions.

### 17.4 Summary of Estimate

17.4.1 **Table 17-1** below presents the range cost estimates for the only option to be costed (option 8) as described in Chapter 9.

Table 17-1 – Blofield to North Burlingham Cost Estimates

Option	Range Min (£M)	Most Likely (£M)	Range Max (£M)
8	93.8	126.9	181.7

17.4.2 The Range Estimates for the Proposed Scheme at PCF Stage 0, derived from the Order of Magnitude Estimate, were as detailed in **Table 17-2** below:

**Table 17-2 – October 2015 Order of Magnitude Estimate**

Representative Scheme	Range Min (£M)	Most Likely (£M)	Range Max (£M)
Outturn Costs (Oct 15)	76.944	90.974	111.189

17.4.3 The outturn range estimate prepared for the 2014 route Feasibility Study (published in February 2015) reported a range estimate of £50M to £100M

## 17.5 Option Estimate (Option 8)

17.5.1 As noted in Table 17-2 above at the end of PCF Stage 1, a cost estimate for option 8 was the only cost estimate that has been produced and signed off by Highways England Commercial and the Project Manager.

17.5.2 Approximate relative estimates for Options 1, 2 and 7 were derived from the Option 8 estimate which was produced by Highways England Commercial. The estimates used the Option 8 data and cost estimate provided by Highways England was used as a base to provide approximate estimates for the remaining options. **Table 17-3** below presents a summary of the appraisal for all the options including an assessment of the key differences which are reflected by the variance in cost between the options.

17.5.3 Those key differences include factors such as scheme length, online/offline, construction period, traffic management, landtake, volume of earthworks and treatments required, accommodation works required, number of structures, de-trunking required and statutory undertaker costs. In each instance the differences in the schemes were appraised and assessed to calculate the likely cost variance.

17.5.4 It had been assumed that the percentage split of overall costs over time for each category of expenditure (Preparation, Supervision, Works and Land) was the same as that for option 8.

**Table 17-3: Derivation of scheme costs**

	Estimate Status	Relative estimate based on most like Option 8	% (Option 8 100%)	Key Differences / Comparators to Option 8
Option 1	Approximate estimate based on most likely (Option 8) below, adjusted for appraised key scheme differences	108,253,084	1.05	Slightly Short Length No requirement for Detrunking Works Significantly more Traffic Management Similar Structures More Statutory Undertakers Similar Earthworks Slightly less Land Cost
Option 2	Approximate estimate based on most likely (Option 8) below, adjusted for appraised key scheme differences	101,125,298	0.98	Slightly Longer Length Similar Traffic Management Similar Structures Slightly Less Statutory Undertakers Similar Earthworks Higher Land Cost
Option 7	Approximate estimate based on most likely (Option 8) below, adjusted for appraised key scheme differences	98,202,261	0.95	Slightly Longer Length Similar Traffic Management Similar Structures Slightly Less Statutory Undertakers Similar Earthworks Slightly less Land Cost
Option 8	Estimate Most Likely received from HE Commercial	102,980,139	1	Base position

## 18 Economic Assessment of Sifted Options

### 18.1 Introduction

18.1.1 This section describes the economic appraisal process of the sifted options

18.1.2 As noted in Chapter 12 the modelling work to update and validate the NATS model was not complete at the end of PCF Stage 1. To inform the PCF Stage 1 Stage Gate Review in November 2016 and the Investment Decision Committee (IDC) meeting in December 2016 a separate “Transportation and Economic PCF Stage 1 Products” Technical Note was prepared.

18.1.3 The Value for Money assessment in the Technical Note was based on a spreadsheet transportation assessment of the options similar to the assessment undertaken in PCF Stage 0+, the methodology for the transportation assessment is outlined in Chapter 12.

18.1.4 The methodology for the economic assessment undertaken in PCF Stage 1 is described in the sections below.

### 18.2 Economic Assessment Methodology

18.2.1 User benefits of the scheme were assessed using TUBA 1.9.7, with costs provided by the Highways England Commercial team. Costs have only been provided by the Commercial team for option 8. The costs used in the assessment of the other options have been developed by scheme consultants derived from the Commercial team estimate.

18.2.2 The assessment includes accident benefits as calculated in Stage 0+. Accident benefits were calculated using COBALT version 2013.02.

18.2.3 The only differentiation between the options in the assessment is the length of the scheme and the associated journey times. The number of trips is assumed to be constant between the do minimum scenario and each of the do something options.

18.2.4 Journey time reliability, wider impacts and social and distributional impacts have only been considered qualitatively as part of the assessment.

18.2.5 The economic appraisal process followed WebTAG guidance and assumptions, where practical, for the assessment. For the economic appraisal TUBA 1.9.7 has been used. The key input data relate to traffic volumes, journey times, and distances.

18.2.6 Traffic volumes and journey times have been taken from the modelling undertaken. The distances of each do-something option have been taken from the long section plans produced by the engineering team. Default journey purposes and vehicle split/user classes from WebTAG have been used.

18.2.7 The economic assessment reported here has two elements. The first is an estimation of costs and benefits associated with the representative scheme (do-something) compared to the existing conditions (do-nothing). This element considers the user benefits of savings in travel time and vehicle operating costs against the costs of implementing the scheme and is given a monetary value in present values discounted to 2010, in 2010 prices. Discount rates are based on Table A1.1.1 of WebTAG November 2014, and apply 3.5% per annum for up to 30 years from current year and 3.0% from 31 to 60 years. The second element of the economic assessment considers the use benefit of the improvement to journey time reliability, and regeneration impacts of the scheme which are described qualitatively below.

### 18.3 Travel Time and Vehicle Operating Costs

18.3.1 The user benefits of the scheme are the savings in travel time and vehicle operating cost, accrued over 60 years following the assumed opening of the scheme in 2021. Journey time savings and changes in vehicle operating costs have been calculated for the representative scheme, compared to the Do-Nothing, using TUBA 1.9.7.

18.3.2 The User Benefits to travel time and vehicle operating costs, in present values discounted to 2010, in 2010 prices, are shown in the Economics Summary Tables below.

### 18.4 Accidents

18.4.1 The benefit from a reduction in collisions has been calculated using Cobalt v2013\_02. Collisions have been assessed using a combined link and junction based assessment. In the Do Minimum, link type 8 has been assumed which represents a single carriageway A road designed to modern standards. In the Do Something, link type 10 has been assumed which represents a dual carriageway with two lanes in each direction designed to modern standards.

18.4.2 The results are included in **Table 18.3** below.

### 18.5 Other Benefits

18.5.1 Other benefits such as regeneration effects have not been monetised at this stage, relying on the regional growth scenario to determine the level of regeneration expected for the scheme. It is recognised that there is the potential for benefits to be derived from the scheme, including:

- Expected journey time benefits for business users will help support planned residential and employment regeneration in the Norwich Area;
- Improvements in journey times will improve access to services in Norwich from the areas local to the scheme;
- Benefits in journey time savings will improve resilience and reliability which directly affect journey quality, predominantly associated with traveller stress; and
- Benefits in journey time savings will result in fuel efficiencies for all users.

18.5.2 An assessment of wider economic benefits has not been carried out.

18.5.3 An assessment of greenhouse gases has not been carried out.

18.5.4 There are a number of local development projects which have been put forward to local planning authorities via Local Development Order (LDO) Application and responses to call for sites from Breckland, Broadland and South Norfolk District Councils, which are likely to positively impact the economic scheme.

### 18.6 Journey Time Reliability

18.6.1 Journey time reliability is typically impacted by two main sources: incidents and congestion. Incidents are those which reduce or stop carriageway capacity, typically accidents or vehicle breakdowns. Congestion effects journey time reliability when the flow exceeds capacity and a break down in the flow occurs. Anecdotal evidence suggests that journey time reliability on the A47 is also affected by the presence of agricultural vehicles and limited safe overtaking opportunities.

18.6.2 Dualling the A47 would address the two main typical sources impacting journey time reliability; the A47 would be more resilient to incidents and the increased capacity would reduce the incidence of congestion causing a break down in flow. The effect of the presence of agricultural vehicles would be reduced by providing a second lane which other vehicles could use to overtake.

## 18.7 Option Estimate

18.7.1 The Options estimates used in the economic assessment are described in Chapter 17. Highways England Commercial Team providing a signed off and validated Option Estimate for Option 8 with associated re based input data for use in the economics assessment. The costs for the other options 1,2, and 7 used in the economics assessment being calculated on a prorate basis from the relative cost estimates presented in Table 17-3 of Chapter 17.

## 18.8 Economic Summary Tables

**Table 18-1: Transport Economic Efficiency (TEE)**

<b>Non-Business: Commuting <u>User benefits</u></b>	<b>Value (in £Ms)</b>			
	<b>Option 1</b>	<b>Option 2</b>	<b>Option 7</b>	<b>Option 8</b>
Travel Time	27.696	34.869	34.837	34.946
Vehicle Operating Costs	-1.029	0.299	0.263	0.329
<b>NET NON-BUSINESS BENEFITS: COMMUTING (1a)</b>	26.667	35.168	35.100	35.275
<b>Non-Business: Other <u>User benefits</u></b>				
Travel Time	70.217	90.315	90.227	90.523
Vehicle Operating Costs	-2.355	0.380	0.305	0.441
<b>NET NON-BUSINESS BENEFITS: COMMUTING (1b)</b>	67.862	90.695	90.531	90.964
<b>Business <u>User benefits</u></b>				
Travel Time	124.755	158.029	157.876	158.406
Vehicle Operating Costs	-1.359	3.356	3.208	3.456
<b>NET BUSINESS IMPACT (5)</b>	123.396	161.385	161.084	161.862
<b>TOTAL</b>				
<b>Present Value of Transport Economic Efficiency Benefits (TEE) (6) = (1a) + (1b) + (5)</b>	217.925	287.248	286.715	288.101

**Table 18-2: Public Account**

<b><u>Central Government Funding:</u></b> <b><u>Transport</u></b>	<b>Value (in £Ms)</b>			
	<b>Option 1</b>	<b>Option 2</b>	<b>Option 7</b>	<b>Option 8</b>
Investment Costs	89.221	83.346	80.937	84.875
<b><u>Central Government Funding:</u></b> <b><u>Non-Transport</u></b>				
Indirect Tax Revenues	-2.414	-0.485	-0.572	-0.439
<b>TOTAL</b>				
<b>Broad Transport Budget</b>	89.221	83.346	80.937	84.875
<b>Wider Public Finances</b>	-2.414	-0.485	--0.572	-0.439

**Table 18-3: Economic Summary**

<b><u>Economic Summary</u></b>	<b>Value (in £Ms)</b>			
	<b>Option 1</b>	<b>Option 2</b>	<b>Option 7</b>	<b>Option 8</b>
TEE Benefits (e)	217.925	287.248	286.715	288.101
Accident Benefits (j)	8.911	8.911	8.911	8.911
<b>Total Present Value of Benefits (PVB) (k) = (e) + (j)</b>	226.836	296.159	295.626	297.012
<b>Total Present Value of Costs (PVC) = (i)</b>	89.221	83.346	80.937	84.875
<b>Net Present Value (NPV) = (k) – (i)</b>	137.615	212.813	214.689	212.137
<b>Benefit to Cost Ratio (BCR) = (k) / (i)</b>	2.54	3.55	3.65	3.50

## 18.9 Value for Money

18.9.1 Value for Money assessments are produced to support scheme and programme decisions, whereby the performance of the scheme, utilising the BCR can be appraised on a common scale. That scale is defined as follows:

**Table 18-4: Value for Money Categories**

<b>Rating</b>	<b>BCR</b>
Poor	< 1.0
Low	> 1.0 and < 1.5
Medium	> 1.5 and < 2.0
High	> 2.0 and < 4.0
Very High	> 4.0



18.9.2 The calculated BCR at this time suggested that the scheme had a HIGH value for money according to the Value for Money categories.

## 19 Assessment Summary of Sifted Options

### 19.1 Introduction

19.1.1 At the end of PCF Stage 1, the reporting process was drawn to an early conclusion in order to meet project governance timescales and to maintain project programme. Therefore, completion of assessment summary and comparison of the options was deferred and it was agreed that it would be undertaken early in PCF Stage 2. At the end of PCF Stage 1, it was intended that once the option estimates were available and the transportation modelling was completed that the Assessment Summary and Technical Appraisal Report would be completed. Events in PCF Stage 2 superseded this approach (see Chapters 20 & 21).

### 19.2 Appraisal Summary Table (ASTs)

19.2.1 As explained in Chapter 12 and 13, to inform the PCF Stage 1 Stage Gate Review in November 2016 and the Investment Decision Committee (IDC) meeting in December 2016 a “Transportation and Economic PCF Stage 1 Products” Technical Note was prepared including an Appraisal Summary Table (AST) for Option 8.

19.2.2 The PCF Stage 1 AST for Option 8 is included in **Appendix K**.

### 19.3 Engagement with Public Bodies

19.3.1 A summary of completed stakeholder engagement is detailed below.

19.3.2 For details of stakeholder engagements completed during PCF Stage 2, please refer to Chapter 32.

#### **Norfolk County Council (NCC)**

19.3.3 To date there have been a number of liaison meetings with NCC. These have focused on keeping NCC updated on progress and programme for the overall A47 programme, discussions and handover of model data of NATS model and discussion around the options being considered for the scheme. The following meetings have been held:

- 4th November 2015 – Initial discussions regarding PCF Stage 1
- 17th November 2015 – Initial discussion regarding NATS model
- 15th December 2015 – Lessons Learnt from Norwich Northern Distributer Road DCO
- 28th January 2016 – Detailed discussion NATS model and NDR programme
- 11th April 2016 - Initial discussion regarding programme for Western Link Road
- 4th May 2016 – Initial Options review meeting
- 27th July 2016 – Progress update and options review
- 13th October 2016 – A47 Programme update to NCC elected members and officers

### **Broadland District Council**

19.3.4 The following meetings have been held with the Planning Officers of Broadland District Council to discuss planning proposals in the area of the scheme and in particular the LDO for the Greater Norwich Food Enterprise Zone (GNFEZ):

- 24th May 2016 – Initial discussions regarding Planning in Broadland area
- 18th August 2016 – Discussion with regard to GNFEZ LDO and call for sites

### **Environmental Bodies**

19.3.5 A meeting was held on 31 August 2016 with the Environment Agency, Natural England and Historic England where an introduction and update on all the 6 schemes in the A47 Programme was completed.

### **Other Public Bodies**

#### **The Planning Inspectorate (PINS)**

19.3.6 Meetings have been held with PINS to discuss the relevant planning conditions that need to be taken into consideration for all the A47 Schemes.

- April 2016
- June 2016
- July 2016

#### **A47 Alliance**

19.3.7 A meeting was held with the A47 Alliance on 26 January and 12 July 2016 when discussions were held regarding the A47 Programme and schemes contained in this including Blofield to North Burlingham.

#### **Members of Parliament**

19.3.8 There have been a number of meetings with Members of Parliament where details of the A47 Schemes have been discussed.

- January 2016
- 07 July 2016

## 20 Stage 1 Conclusions and Transition to Stage 2

### 20.1 Stage 1 Conclusions

20.1.1 The PCF Stage 1 work confirmed the transport problem as being Blofield to North Burlingham is currently operating at over capacity. By 2036 this problem will be further exacerbated by the potential future developments in the area which are noted within the Broadland District Council Local Plan. The potential increase in traffic flow will potentially lead to increased congestion

20.1.2 In seeking to resolve the transport problem a number of potential options were developed and have been considered in the first part of this report (Chapters 1 -19).

20.1.3 Option 1, 2, 7 and Option 8 all resolve the transport problem in so much that they will increase the capacity between Blofield and North Burlingham and should allow for a safer, swifter movement of traffic through the junction

20.1.4 PCF Stage 1 economics do not yet exist to support or reject any of the Options on the grounds of benefit cost ratio.

20.1.5 Equally there were number of areas identified for improvement that will needed to be resolved as the Scheme moved forward in to PCF Stages 2, they include:

- The options taken forward to PCF Stage 2 will be developed in more detail in order to make a recommendation on the preferred route.
- More detailed environmental investigations to enable completion of an Environmental Impact Assessment and an Environmental Statement giving greater understanding of the impacts on the sites in the area.
- Affordability and Value Management. A Value Management exercise was to be carried out Early in PCF Stage 2 including input from buildability contractors. The outputs to be detailed in a Value Management Workshop Report, document reference A47IMPS2-AMY-BB-ZZ-DO-J0041. Further value management interventions will be carried out as the Scheme progresses to reduce the value of future Options Estimates.
- Topographical survey data to be obtained to enable a greater understanding of the topography of the area and link in with the construction process.
- Ground Investigation data to be obtained to assess the local ground conditions and to inform potential geotechnical solutions.
- More detailed investigations and recommendations regarding NMU provisions at junctions.
- Buildability of the options and understanding the arrangements in regards to Traffic Management required during construction to minimise disruption.

### 20.2 Transition to PCF Stage 2

20.2.1 As explained in the Introduction Chapter 1, in order to meet a March 2020 start on site date the programme dictated that PCF Stage 1 could not extend beyond November 2016 in order to allow adequate time for future stages. At the end of each PCF Stage Highways England holds a Stage Gate review to enable the progress of the scheme to be reviewed, known as a Stage Gate Assessment Review (SGAR). This review allows Highways England to ensure

that they are satisfied that the project is progressing in an appropriate manner to meet their overall objectives.

20.2.2 The SGAR review provides basic assurance that:

- The stage is complete and is within tolerance
- The project control framework (PCF) has been followed
- The project is ready to proceed to the next stage, subject to investment authorisation

20.2.3 As detailed at the start of the assessment Chapters 17, 18 and 19, at the time of SGAR 1 (end of PCF Stage 1), only one option estimate was available from HE commercial. It was therefore not possible for the detailed technical assessments to be completed for all four options and reported for the end of PCF Stage 1, however they were completed early in stage 2 and validated, with costs estimates undertaken in June and October 2017.

20.2.4 In order to allow the Scheme to be reviewed at the SGAR, the assessments were concluded based on comparative cost estimates and updated local transport modelling which was reported to the SGAR by the production of a Technical Note, this was on the understanding that detailed estimates for the 4 options and the strategic modelling would be completed in PCF Stage 2. This would allow the TAR to be completed and reported within the Scheme Assessment Report (SAR), this document, in PCF Stage 2.

20.2.5 A positive (green) status was received at the SGAR in November 2016 based on the submitted material which meant the Scheme could proceed to PCF Stage 2, subject to the confirmation of funding for PCF Stage 2 from the Investment Decision Committee (IDC) held in December 2016.

20.2.6 The IDC gave a qualified approval for the scheme to progress into PCF Stage 2. On the basis that the estimate produced in PCF Stage 1 for Option 8 was well in excess of the RIS budget, the IDC required a review of the affordability and value for money of the scheme early in PCF Stage 2. This would result in a Go/No Go decision at a Project Review meeting in February 2017 to confirm compliance with the RIS commitments in regard to scope, time and budget.

20.2.7 At the end of PCF Stage 1, Highways England Investment Committee indicated that the scheme would progress to PCF Stage 2 with the caveat that at the start of PCF Stage 2 a review of the affordability and value for money of the scheme was undertaken to demonstrate that a scheme could be delivered within the budget which was likely to achieve a BCR in excess of 1.5. The results of the review were presented to the Investment Committee and signed off prior to public consultation launch.

20.2.8 A process of value management and an affordability review was therefore undertaken. This allowed a review of the construction cost estimates provided by Highways England Commercial, to re-engineer the outline design to reduce the construction costs of the project with the aim of bringing the scheme costs within budget

20.2.9 Chapter 21 presents the Value Management Deep Dive undertaken as a result of the IDC request at the start of PCF Stage 2. Further detail is contained in the PCF Product Value Management Workshop Report, document reference A47IMPS2-AMY-BB-ZZ-DO-J0041.

## 21 Scheme Value Management Deep Dive

### 21.1 Introduction

21.1.1 This section describes the process that was undertaken early in PCF Stage 2 to review the design and resulting cost estimates to ensure that a viable and affordable scheme could be promoted and progress through PCF Stage 2. Further information is detailed in the PCF Product Value Management Workshop Report, document reference A47 IMPS2-AMY-BB-ZZ-DO-J0041.

### 21.2 PCF Stage 1 Cost Estimates

21.2.1 To produce an estimate for the review, the PCF Stage 1 estimate was used as a basis. The estimate was then adjusted for the changes from the Value Engineering initiatives and any assumptions and high level engineering judgments made, were recorded in the report. This was undertaken for a single option (see below) with the agreed assumption that the outcomes from the Value Management Deep Dive could be applied in equal measure to all options. A summary of the cost estimates provided is detailed in **Table 21-1** below.

**Table 21-1 – PCF Stage 1 Comparison to Feasibility Stage Cost Estimate**

Stage	Range MIN (£M)	Most Likely (£M)	Range MAX (£M)
Range Estimate undertaken in November 2016 (PCF Stage 1)	93.799	126.924	181.695

21.2.2 The PCF Stage 1 range estimate undertaken gave a most likely outturn cost of £126.924M which was in excess of the Feasibility Study of October 2015 range estimate of £54M - £80M.

21.2.3 At the end of PCF Stage 1, Highways England Investment Decision Committee (IDC) indicated that the scheme should progress to PCF Stage 2 with the caveat that at the start of PCF Stage 2, a review of the affordability and value for money of the scheme was undertaken to demonstrate that the scheme could be delivered within the budget and was likely to achieve a BCR in excess of 1.5. The results of the review were to be presented to the IDC for sign off prior to non-statutory public consultation launch. Full details on the Value Management Deep Dive process is detailed in the PCF Product 'Value Management Workshop Report', document reference A47 IMPS2-AMY-BB-ZZ-DO-J0041

### 21.3 Summary of Value Management Deep Dive Process

21.3.1 The Value Management Deep Dive process followed a series of Value Management (VM) workshops which started with a review of the high-level breakdown of the estimate prepared in PCF Stage 1 and a review of the scheme to determine where potential savings could be made.

21.3.2 A series of VM workshops were held between Amey, Highways England and Taylor Woodrow for all schemes to review and develop the value management option and achieve the required cost reduction. These are detailed in **Table 21-2** below.

**Table 21-2: VM Workshop Dates**

Value Management Workshop Date	Attendees
04/01/2017	Amey/Highways England
10/01/2017	
18/01/2017	
25/01/2017	Amey/Highways England/Taylor Woodrow
02/02/2017	
08/02/2017	

21.3.3 To produce an estimate for the review, the PCF Stage 1 estimate was used as a basis. The estimate was then adjusted for the changes from the Value Management initiative based on a series of assumptions and high level engineering judgements. More detail on the process is provided in the PCF Stage 2 Product, Value Management Workshop Report, document reference A47IMPS2-AMY-GJ-ZZ-DO-J0041 and summarised below.

21.3.4 The areas identified which offered potential cost savings were as follows:

- Review of the base estimate scope of works – review and proposal to change vertical alignment, technology requirements, junction requirements, earthworks solutions, length of scheme and construction durations. In particular this included:
  - Bridgeworks associated with the grade separated junction were removed by providing an “at grade” roundabout junction solution at the Eastern end of the scheme
  - Small roundabout at Acle removed
  - Review of earthworks in association with the removal of the grade separated junction and the removal of disposal items, alteration to disposal and import items to reflect reuse of materials on site
- Review of the PCF Stage Gate programme – proposal to condense the timeframe for completing milestones
- Review of project risk registers – current risks against the proposed changes
- Other Savings - Consequential reductions in direct costs leading to savings in NR VAT, Inflation, Unscheduled Items, Risk and Contractors Costs.

21.3.5 For the purposes of the estimate, it was agreed that Cost Planning would complete their assessment of costs using the same tools and processes that were in place at the time of the officially released estimates, to enable like-for-like comparisons across the outputs.

21.3.6 The results from the value management exercise are presented in the **Table 21-3** below:

**Table 21-3: Cost Estimates for Value Management Solution**

Released Most Likely Outturn PCF Stage1 Estimate(£M)	Value Engineered Most Likely Outturn Estimate(£M)	Potential Most Likely Costs Savings from VE Works (£M)
126.92	83.40	28.0 (±25%)

## 21.4 Review Outcomes and Impact on Previous Assessments

- 21.4.1 An unassured assessment of the BCR based on a limited assessment of the change in benefits from the feasibility assessment was undertaken to support the Value Management Deep Dive. The unassured BCR calculated indicated that the scheme would be likely to outturn a medium value for money.
- 21.4.2 The Value Management Deep Dive provided sufficient evidence to the Investment Committee to demonstrate that the scheme should be taken through the non-statutory public consultation and the options further assessed during PCF Stage 2 despite the outturn estimate being in excess of the range reported in the Feasibility Study (Chapter 21.2.2 above).
- 21.4.3 The potential changes to the options from the Value Management Deep Dive process have not changed the assessments undertaken during the initial sifting process described in the SAR. The changes made at Value Management Deep Dive review have not changed the option alignments of the routes.
- 21.4.4 The high-level assessments showed that the revised option met the criteria set out in the RIS, appeared to be economically viable and solved the transport problem.

## 21.5 Options for Stage 2 Assessment

- 21.5.1 The principles from the value management exercise were used to update the option layouts for the three route options to allow fully assured estimates to be developed for each of the options. These option layouts show indicative junctions and side road arrangements for estimating and route assessment purposes only. The side road and junction strategy will be developed in PCF Stage 3 during preliminary design.







## 22 Option Renumbering for Consultation

### 22.1 Option Numbers for Assessment and Consultation

22.1.1 For simplicity in gathering public comment and for presentation at public consultation it was decided that the 4 options to be taken forward should be renumbered 1 to 4.

22.1.2 The Options were renumbered as shown in **Table 22-1** below

**Table 22-1: Route options renumbering**

Option Number at Stage 1	Option Number at consultation	Route Plan (see Chapter 9)
Option 1	Option 1	 <p>PLAN - OPTION 1</p>
Option 2	Option 2	 <p>PLAN - OPTION 2</p>
Option 4	Option 3	 <p>PLAN - OPTION 3</p>
Option 8	Option 4	 <p>PLAN - OPTION 4</p>

## 23 Engineering Overview of Affordable Options

### 23.1 Introduction

23.1.1 The following sections describe the engineering features assessment and key comparison between the 4 options following on from the Scheme Affordability Review carried out and described in Chapter 21 and public consultation responses.

23.1.2 The alignments for the 4 Options, have not changed from PCF Stage 1 however the indicative side road and junction layout strategies have changed. This indicative side road and junction layout has been included to allow Highways England Commercial team to price the options. Junction strategy and side road strategy are not fully developed and will not be considered until later PCF Stages so the layouts should be treated as indicative only.

23.1.3 The Option layouts for options 1, 2, 3 and 4 with indicative junction and side road layouts are included in **Appendix L**. These layouts were used for route assessment purposes in the transportation and environmental assessments detailed in subsequent sections of this report.

23.1.4 The four indicative route options layouts were:

- Option 1 an online dualling following the existing A47 route;
- Option 2 an offline dualling to the north of the existing A47 for the western part of the route and to the south of the existing for the eastern part of the route;
- Option 3 an offline dualling to the south of the existing A47 route;
- Option 4 an offline dualling to the south of the existing A47 route but closer than Option 3;

### 23.2 Highways Alignment

23.2.1 The Highways Alignment has not changed since PCF Stage 1 – please see Chapter 13.2 for details.

### 23.3 Junctions along the Route

23.3.1 The Junction and side road strategy will be completed in later PCF Stages following preferred route announcement.

23.3.2 As outlined in Chapter 21 the indicative junction strategy was reviewed in order to demonstrate a viable and affordable scheme was achievable. As a result the indicative junction strategy for estimating, is currently to provide a new at grade roundabout junction at the eastern end of the new route and minor alterations to the existing junction at the western end. The position and connectivity is clearly different for each of the 4 route options as follows.

#### Option 1 – indicative junctions

23.3.3 There will be 2 main junctions situated on the A47 located at either end of the scheme.

23.3.4 The first is a junction at the western end of the scheme which previously allowed westbound traffic to exit and enter the A47 westbound carriageway by means of left in and left out manoeuvres. Currently A47 eastbound traffic exits the A47 at this junction by turning right

and crossing the dual carriageway and central reserve into the existing junction. Traffic wishing to travel on the A47 eastbound from Yarmouth Road would cross the westbound carriageway and central reserve before turning right onto the A47 eastbound carriageway. This option will prevent any future turning movements between the Yarmouth Road and the A47 eastbound carriageway therefore A47 westbound traffic only will be able to utilise this junction in the future. Access to and from the A47 to High Noon Lane will be prevented.

- 23.3.5 The second junction is at the eastern end of the scheme and comprises a new at grade roundabout located on the A47 with connections to South Walsham Road to the north and to Acle Road to the south.
- 23.3.6 Access to the A47 eastbound carriageway from Blofield would be achieved either by using the A47 eastbound entry slip road to the north of Blofield accessed via North Street and Plantation Road or by travelling east along Yarmouth Road passing over the proposed A47 and going through the village of Burlingham before reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.
- 23.3.7 Severance of the existing A47 junctions at Lingwood Lane and Lingwood Road means that to access the A47 westbound carriageway traffic would have to travel west along Lingwood Road before heading north along Hemblington Road. At the new junction with Yarmouth Road traffic would travel west and access the A47 via the revised junction. Traffic wishing to travel eastbound on the A47 as a result of the severance of the existing junctions at Lingwood Road and Lingwood Lane would travel to the new roundabout located on the A47 at the junction with Acle Road at the eastern end of the scheme.
- 23.3.8 As a result of the stopping up of the accesses to and from the A47 from High Noon Lane traffic coming from north of the proposed A47 would access the A47 eastbound carriageway by travelling west via Bullacebush Lane and Plantation Lane and entering the A47 eastbound carriageway via the eastbound entry slip road situated to the north of Blofield. Traffic wishing to access the A47 from the north of the A47 and wishing to travel west would either travel west and access the A47 eastbound carriageway via the eastbound entry slip road at Blofield and continue east on the A47 to the new roundabout at South Walsham Road where it would do a 180o U turn before following the A47 westbound carriageway. Alternatively, traffic may travel west via Bullacebush Lane and Plantation Lane and continue south along North Street until reaching the junction with Yarmouth Road. Here the traffic would turn right and travel west along the Yarmouth Road accessing the A47 at the roundabout at Cucumber Lane.
- 23.3.9 At this stage no assessment has been made regarding upgrading requirements for local roads.

### **Option 2 – indicative junctions**

- 23.3.10 There will be 2 main junctions situated on the A47 located at either end of the scheme.
- 23.3.11 The first is a junction at the western end of the scheme which previously allowed westbound traffic to exit and enter the A47 westbound carriageway by means of left in and left out manoeuvres. Currently A47 eastbound traffic exits the A47 by turning right and crossing the dual carriageway and central reserve into the existing junction. Traffic wishing to travel on the A47 eastbound from Yarmouth Road would cross the westbound carriageway and central reserve before turning right onto the A47 eastbound carriageway. This option will prevent any future turning movements between the Yarmouth Road and the A47 eastbound carriageway therefore A47 westbound traffic only will be able to utilise this junction in the future. Access to and from the A47 to High Noon Lane will be prevented.
- 23.3.12 The second junction is at the eastern end of the scheme and comprises a new at grade roundabout located on the A47 with connections to South Walsham Road to the north and to Acle Road to the south.

- 23.3.13 Access to the A47 eastbound carriageway from Blofield would be achieved either by using the A47 eastbound entry slip road to the north of Blofield accessed via North Street and Plantation Road or by travelling east along Yarmouth Road passing over the proposed A47 and going through the village of Burlingham before reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.
- 23.3.14 Severance of the existing A47 junction at Lingwood Lane would mean that to access the A47 westbound carriageway traffic would have to travel west along Lingwood Road before heading north along Hemblington Road. At the new junction with Yarmouth Road traffic would travel west along the diverted section of Yarmouth Road and access the A47 via the revised junction. Traffic wishing to travel eastbound on the A47 as a result of the severance of the existing junction at Lingwood Lane would travel to the new roundabout located at the junction with Acle Road at the eastern end of the scheme where the A47 can be accessed.
- 23.3.15 Traffic wishing to travel east on the A47 from Lingwood Road would turn right at its junction with the old A47 and travel east passing over the new A47 and travel through the village of Burlingham before reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme. Traffic wishing to travel west on the A47 from Lingwood Road would turn left at the junction with the old A47 and travel west accessing the A47 via the revised junction at the western end of the scheme.
- 23.3.16 As a result of the stopping up of the accesses to and from the A47 from High Noon Lane traffic coming from north of the proposed A47 would access the A47 eastbound carriageway by travelling west via Bullacebush Lane and Plantation Lane to the A47 eastbound entry slip road situated to the north of Blofield. Traffic wishing to access the A47 westbound from the north would either travel west via Bullacebush Lane and Plantation Lane and access the A47 eastbound carriageway via the eastbound entry slip road at Blofield and continue east on the A47 to the new roundabout at South Walsham Road where it would do a 180o U turn before following the A47 westbound carriageway. Alternatively traffic coming from the north of the proposed A47 wishing to travel west on the A47 may travel west via Bullacebush Lane and Plantation Lane and continue south along North Street until reaching the junction with Yarmouth Road. Here the traffic would turn right and travel west along the Yarmouth Road accessing the A47 at the roundabout at Cucumber Lane.
- 23.3.17 At this stage no assessment has been made regarding upgrading requirements for local roads.

### **Option 3 – indicative junctions**

- 23.3.18 There will be 2 main junctions situated on the A47 located at either end of the scheme.
- 23.3.19 The first is a junction at the western end of the scheme which previously allowed westbound traffic to exit and enter the A47 westbound carriageway by means of left in and left out manoeuvres. Currently A47 eastbound traffic exits the A47 at this junction by turning right and crossing the dual carriageway central reserve into the existing junction. Traffic wishing to travel on the A47 eastbound from Yarmouth Road would cross the westbound carriageway and central reserve before turning right onto the A47 eastbound carriageway. This option will prevent any future turning movements between the Yarmouth Road and the A47 eastbound carriageway therefore A47 westbound traffic only will be able to utilise this junction in the future. Access to and from the A47 to High Noon Lane will be prevented.
- 23.3.20 The second junction is at the eastern end of the scheme and comprises a new at grade roundabout roundabout located on the A47 with connections to South Walsham Road to the north and to Acle Road to the south.
- 23.3.21 Access to the A47 eastbound carriageway from Blofield would be achieved either by using the A47 eastbound entry slip road to the north of Blofield accessed via North Street and

Plantation Road or by travelling east along Yarmouth Road passing over the proposed A47 and continuing along the old A47 before reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.

23.3.22 Severance of the existing A47 junctions at Lingwood Lane and Lingwood Road would mean that to access the A47 westbound carriageway traffic would need to travel west along Lingwood Road before heading north along Hemblington Road. At the new junction with Yarmouth Road traffic would travel west along the diverted section of Yarmouth Road and access the A47 via the revised junction. Traffic wishing to travel eastbound on the A47 as a result of the severance of the existing junctions at Lingwood Road and Lingwood Lane would travel to the new roundabout located at the junction with Acle Road at the eastern end of the scheme.

23.3.23 Traffic wishing to access the A47 from the north can still to access the old A47 (Yarmouth Road) via High Noon Lane, although a short diversion of High Noon Lane would be required to achieve this. On travelling along the old A47 traffic would reach a T junction with the diverted section of the Yarmouth Road. At the T junction traffic would turn left and travel along the old A47 until reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.

23.3.24 At this stage no assessment has been made regarding upgrading requirements for local roads.

#### **Option 4 – indicative junctions**

23.3.25 There will be 2 main junctions situated on the A47 located at either end of the scheme.

23.3.26 The first is a junction at the western end of the scheme which previously allowed A47 westbound traffic to exit and enter the westbound carriageway by means of a left in and left out manoeuvres. Eastbound traffic previously would exit the A47 by turning right and crossing the dual carriageway central reserve into the existing junction. Traffic wishing to travel eastbound from Yarmouth Road would cross the westbound carriageway and central reserve before turning right onto the eastbound carriageway. This option will prevent any future turning movements between the Yarmouth Road and the A47 eastbound carriageway therefore A47 westbound traffic only will be able to utilise this junction in the future. Access to and from the A47 to High Noon Lane will be prevented.

23.3.27 The second junction is at the eastern end of the scheme and comprises a new at grade roundabout located on the A47 with connections to South Walsham Road to the north and to Acle Road to the south.

23.3.28 Access to the A47 eastbound carriageway from Blofield would now be achieved either by using the eastbound entry slip road accessed via North Street and Plantation Road to the north of Blofield or by travelling east along Yarmouth Road passing over the proposed A47 and continuing along the old A47 until reaching the T junction at South Walsham Road. On reaching T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.

23.3.29 Traffic wishing to access the westbound carriageway from Blofield will still be allowed access as currently via the Yarmouth Road Junction.

23.3.30 Severance of the existing A47 junctions at Lingwood Lane and Lingwood Road means that to access the A47 westbound carriageway traffic would need to travel west along Lingwood Road before turning north along Hemblington Road. At the new junction with Yarmouth Road traffic would travel west and access the A47 via the revised junction. Traffic wishing to travel eastbound on the A47 as a result of the severance of the existing junctions at Lingwood Road

and Lingwood Lane would travel to the new roundabout located at the junction with Acle Road at the eastern end of the scheme.

23.3.31 Traffic wishing to access the A47 from the north would still be allowed to access the old A47 (Yarmouth Road) via High Noon Lane. On travelling along the old A47 traffic would reach a T junction with the diverted section of the Yarmouth Road. At the T junction traffic would turn left and travel along the old A47 until reaching the T junction at South Walsham Road. At the T junction traffic would turn right and travel south accessing the A47 via the new roundabout at the eastern end of the scheme.

23.3.32 At this stage no assessment has been made regarding upgrading requirements for local roads.

## 23.4 Departures from Standards

23.4.1 The Option layouts currently developed do not include any departures from standards, it should be noted that once the design is further developed some of the current relaxations from standards identified may become departures from standards. Further review of departures from standards will be undertaken as the design develops in later PCF Stages.

## 23.5 NMU Provision

23.5.1 Proposed NMU access has been discussed in Chapter 13.4 for the four options. An NMU context report has been prepared in PCF Stage 2, document A47 IMPS2-AMY-BB-ZZ-DO-J0059. The findings from this Report will be used at PCF Stage 3 to inform and develop the preliminary design of the scheme.

23.5.2 This report has established the background information on current and potential NMU issues related to the scheme. Based on the review of the current NMU provision, desire lines and potential use.

23.5.3 The report recommends;

- maintaining PRowS within the study area where possible, and providing suitable NMU crossing facilities where PRowS are crossed by the new A47 alignment with minimal diversion again where possible.
- If an offline option is selected, ensure the legacy A47 roadway is suitable for the use of NMUs,
- Provide NMU facilities at new junctions if appropriate.
- NMU audits to be carried out at the end of each PCF stage.

## 23.6 Drainage and Flooding

### General

23.6.1 The drainage section in Chapter 13.6 provide a commentary on drainage and flooding for the 4 options, a 'positive drainage' system including kerbs and gullies was identified and costed in the PCF Stage 1 estimate. At the start of PCF Stage 2, alternative methods of draining the carriageway were investigated as potential value engineering opportunities.

23.6.2 An alternative 'over the edge drainage' system was included in the PCF Stage 2 drainage strategy assumptions made in preparation of the PCF Stage 2 estimate. An 'over the edge drainage' system would allow the water from the carriageway to flow over the carriageway

edge and directly into perforated (carrier/filter) drains or swales or ditches in the verges and central reserves. This would eliminate the requirements for gullies, kerbs, channels associated with positive drainage.

23.6.3 The drainage strategy and the type of drainage for each section of the new road will be reviewed in PCF Stage 3 as the detail of the drainage system is developed as part of the preliminary design.

23.6.4 Drainage surveys will be carried out in PCF Stage 3.

23.6.5 Environment Agency needs to be consulted in PCF Stage 3 with regards to the need for a Flood Risk Assessment.

## 23.7 Geotechnical Considerations

23.7.1 A Preliminary Sources Study Report (PSSR) was produced in PCF Stage 2 document reference A47IMPS2-AME-BB-ZZ-DO-J0049

23.7.2 The primary geological risk anticipated at this stage is the lack of ground investigation information within the study area and this is included in the PSSR. While the basic geological make up beneath the site is understood there is no detailed information available that could be used to assess the potential impact of geological features in any significant detail.

23.7.3 Ground investigations will be carried out early in PCF Stage 3 – preliminary design.

## 23.8 Structures– High Level Structures Strategy

23.8.1 The structures identified for each option at PCF Stage 1 are described in Chapter 13.8. Following the Value Management Deep Dive and the removal of the grade separation at junctions. The culverts listed in the tables will be required to convey watercourses below the new dual carriageway.

23.8.2 A structures options report and an Approval In Principal for each structure needed for the scheme will be prepared in PCF Stage 3 as the preliminary design is developed.

## 23.9 Public Utilities

23.9.1 There has been no substantive change in regard to public utilities. Details for each option can be found in Chapter 13.

23.9.2 Further statutory undertaker's requests would be made in PCF Stage 3 and future stages to check for detailed positions of utilities and to obtain more accurate estimates for utility diversions.

## 23.10 Topography, land Use, Property and Industry

23.10.1 There has been no substantive change in regard to topography, land use, property and industry. Details for each option can be found in Chapter 13.

23.10.2 Topography surveys will be carried out in PCF Stage 3.

## 23.11 Buildability

23.11.1 There has been no substantive change in regard to Buildability. Details for each option can be found in Chapter 13.

## 23.12 Effective Construction Management – Construction (Design and Management) Regulations 2015 – PCF Stage 2

23.12.1 Amey were appointed as PD, by Highways England, for PCF Stage 2 to plan, manage, monitor and co-ordinate health and safety in the pre-construction phase of the project. The PD therefore:

- sought to ensure that the Design Risk Register identified, eliminated and controlled the foreseeable risks. All identified risks were captured and recorded in the project risk register.
- ensured that designers carried out their duties, by means of design reviews, meetings, and assessments on PCF Stage 2 drawings (route options).
- prepared and provided relevant information to other duty holders (e.g. Principal Contractor) such as the Pre-construction Information documents (see PCF Product Pre-Construction Information, document reference A47IMPS2-AMY-BB-ZZ-DO-J-0019). Data was obtained from existing asset information databases and residual risk data bases (asbestos register for example) as well as data gathered from site surveys and ground investigations which could be used by the principal contractor to help them plan, manage, monitor and co-ordinate health and safety in the construction phase.

23.12.2 Amey were also appointed as Designer, by Highways England, for PCF Stage 2. As Designer, the main responsibilities included the preparation/modification of designs to eliminate, reduce or control the foreseeable risks that may arise during, design, construction and the maintenance of the constructed schemes. This was achieved through the following tasks:

- CDM audits followed by CDM workshops
- CDM compliance workshop
- Design reviews, with changes captured on the design review form and translated in to the Pre-construction information where necessary

## 23.13 Operational, Technology, Safety and Maintenance Assessment

23.13.1 The information contained in this section updates the information from Chapters 14 and 15 of this report.

### **Operational Assessment**

23.13.2 The operational assessment described in Chapter 14.1.3 is still applicable to Option 1 and there have been no changes to the design that affects the operation described.

### **Technology Assessment**

23.13.3 The Technology described in Chapter 14.2 of this report has not been developed any further at this time and is therefore still applicable to PCF Stage 2.

### **Maintenance Assessment**

23.13.4 Maintenance considerations have been detailed in the PCF Stage 2 Maintenance and Repair Strategy Statement PCF Product, document reference A47IMPS2-AMY-BB-ZZ-DO-J0030.



### **Safety Assessment**

23.13.5 The safety of the road user has been considered to a level appropriate to this stage in the design process. Neither a NMU survey nor Road Safety Audit (RSA) has been completed and so specific safety concerns have not been developed any further during PCF Stage 2. These surveys will be conducted during later PCF stages to inform and develop the design.

23.13.6 Further consideration has been given to the safety of the design and is detailed in the PCF Stage 2 Safety Plan Product, document reference number A47IMPS2-AMY-BB-ZZ-DO-J-0008.

## 24 Non-Statutory Public Consultation

### 24.1 Introduction

24.1.1 This section describes the process for non-statutory Public Consultation that was completed for the scheme including a brief analysis of the results.

24.1.2 The purpose of the Public Consultation was to seek views on the outline proposals from the general public, Statutory Consultees, including local authorities, and other interested bodies.

24.1.3 The Public Consultation period was from 13th March 2017 to 21st April 2017.

24.1.4 The responses received are briefly analysed within this report but it should be read in conjunction with the Report on Public Consultation (document reference A47IMPS2-AMY-BB-ZZ-DR-J-0007) which contains more detailed analysis of the results. This formed part of a submission to the Secretary of State for Transport, to enable a decision to be made on the option to be taken forward.

### Scheme Objectives and Proposals

24.1.5 HE's Strategic Business Plan sets out the objectives of the proposed A47 Blofield to North Burlingham Dualling scheme as:

- **Supporting Economic Growth** - Contributing to sustainable economic growth by supporting employment and residential development opportunities. The scheme aims to reduce congestion-related delay, improve journey time reliability and increase the overall capacity of the A47.
- **A Safe and Serviceable Network** - Improving road safety for all road users through being designed to modern highway standards appropriate for a strategic road.
- **A More Free-Flowing Network** - Increasing the resilience of the road in coping with incidents such as collisions, breakdowns, maintenance and extreme weather. The improved route between Blofield and North Burlingham will be more reliable, reducing journey times and providing capacity for future traffic growth.
- **Improved Environment** - Protecting the environment by minimising adverse impacts and where possible deliver enhancements by improving the environmental impact of transport on those living along the existing A47 and by minimising the impact of new infrastructure on the natural and built environment.
- **An Accessible and Integrated Network** - Ensuring the proposals take into account local communities and access to the road network, providing a safer route between communities for cyclists, walkers, equestrians and other non-motorist groups.
- **Value for Money** - Ensuring that the scheme is affordable and delivers good value for money.

### Proposed Options

24.1.1 There were 4 route options developed for consultation.

- Option 1 - Dualling the existing A47 online

- Option 2 - Building a new dual carriageway to the north and to the south of the existing A47.
- Option 3 - Building a new dual carriageway to the south of the existing A47.
- Option 4 - Building a new dual carriageway to the south of the existing A47, but closer to the existing A47 than Option 3.

24.1.2 Where the proposals include building a new road, the existing carriageway would be retained for access to fields, farms, properties and for non-motorists.

24.1.3 There were a number of potential alternative options considered as part of the scheme development process during 2016. These options did not perform well against the objectives therefore were not progressed any further. (see Chapters 9, 10 and 11)

24.1.4 This section provides an overview of the public consultation. There is a separate more comprehensive report on the consultation process which has been produced as part of PCF Stage 2 entitled "A47 Blofield to North Burlingham Public Consultation Report June 2017".

## 24.2 Public Information Process

24.2.1 Following the early PCF Stage 2 Value Management Deep Dive review (see Chapter 21), four options would be pursued during PCF Stage 2 and presented to the public at the Public Information Events (PIE).

24.2.2 The material described in Chapters 24.3 and 24.4 of this report was developed in conjunction to ensure the relevant stakeholders were given the appropriate level of information.

24.2.3 Research in to suitable venues and discussions with key local stakeholders was completed to ensure the most appropriate venues and locations were chosen to hold the events.

24.2.4 Key team members from Highways England and its partners were identified and briefed prior to the consultation period regarding all six A47 schemes to ensure continuity and depth of information was to the correct standard.

24.2.5 Feedback from the events was gathered during the events themselves, but attendees and respondents were encouraged to complete the provided questionnaires either online or via a hard copy that could be posted to Highways England.

24.2.6 The feedback was then analysed by an external third party, Dialogue by Design and further reviewed and analysed by Highways England and Amey. This feedback informed the Preferred Route Announcement (PRA) and continued development of the design later in PCF Stage 2.

## 24.3 Public Information Materials

### Brochure and Questionnaire

24.3.1 A copy of the Public Consultation brochure is included in Appendix A of the Report on Public Consultation. (Ref A47 IMPS2-AMY-BB-ZZ-DR-J007).

24.3.2 The brochure included:

- Information on the scheme proposals
- Details of the exhibition dates and venues

- Contact details to enable comments to be made. These consisted of postal address, email and website address, and telephone number.

24.3.3 A separate questionnaire document for respondents to complete and return to the Highways England was prepared

24.3.4 The questionnaire included questions asked to gain information such as type and location of user, frequency and purpose of use, and to obtain feedback on the options shown. Information and analysis of the questionnaire responses received is provided in the following Sections. Respondents were also invited to make additional comments if they wished to do so.

24.3.5 The consultation brochure and questionnaire were distributed to the general public at the Public Information Events (PIEs) which were held between 29 March 2017 and 1 April 2017 in Lingwood and Blofield.

24.3.6 Brochures and questionnaires were also deposited at The Forum in the centre of Norwich.

### **Non-Technical Summary**

24.3.7 As part of the supporting information for the consultation a Non-Technical Summary Report was prepared and made available to the general public on Highways England's scheme website. This document provided background information on the scheme development prior to the consultation and included details of the alternative options considered along with the reasoning for their rejection.

24.3.8 A copy of the Non-Technical Summary Report can be found in **Appendix M**.

### **Advertising**

24.3.9 The Public Consultation Exhibition was advertised as follows:

- The Public Consultation Exhibition was advertised as follows:
- Highways England website for the A47 Improvement:

<http://www.highways.gov.uk/a47Improvement>

- Highways England press notice (published on 15 March 2017):

<https://www.gov.uk/government/news/have-your-say-on-plans-to-dual-and-improve-junctions-on-the-a47>

- Invitation to local MPs, local councillors and other key stakeholders to attend a preview of the Exhibition before it opened to the public, sent on 02 March 2017;
- Advertisements in local newspapers ('EDP', 'Norwich Evening News', 'Diss Wymondham & Attleborough Mercury', 'Norwich Extra') on 16 March 2017;
- Interviews on local television news and radio;
- Notices posted at strategic locations around the Blofield, North Burlingham and Lingwood area before the Exhibition;
- Leaflet drops were undertaken around Blofield and North Burlingham;
- Notices posted at the exhibition venue on the days of the exhibition;

- A 'static' advertisement was set up at the Forum in central Norwich
- Details on those invited to the preview event and the distribution of the advertising leaflet and further details on the advertising of the Public Consultation Exhibitions are included in the "Public Consultation Report"

24.3.10 Some of the local parish councils also advertised the consultations via their websites.

24.3.11 The public and other stakeholders were asked to provide feedback on the information presented in the brochure and at the public consultation events via the questionnaire which was available online and in hard copy at the public information exhibitions.

## 24.4 Public Information Exhibition

24.4.1 The Public Information Exhibitions (PIEs) were held on 29, 31 March and 1 April 2017. Details are shown in **Table 24-1**, including the number of visitors that attended. The exhibition was attended by staff from Highways England and its consulting engineers Amey, who were available to answer questions on the proposals from members of the public.

24.4.2 The venues were selected with the aim of providing the optimum opportunity for members of the public across the area to attend, as well as offering the most suitable facilities locally to hold such an exhibition.

24.4.3 The PIEs presented the scheme proposals on display boards, with a combination of drawings and descriptive text.

24.4.4 Copies of the brochure and questionnaire were available at the exhibitions. Members of the public were advised that they could complete a hard copy of the questionnaire and post it back the HE using the Freepost envelope provided or complete the questionnaire online at the website detailed in the brochure.

24.4.5 Several respondents comment on the public information exhibitions that were held in relation to the consultation. Most of these respondents expressed concern that they were not able to obtain information from the representatives present at the events and a small number comment that Highways England representatives did not answer questions regarding junctions at either end of the proposed dual carriageway.

24.4.6 A few respondents comment that concerns about non-motorised user access across the A47 were not addressed at the exhibition that they attended. One respondent says their question about the impacts of the improvements on the Blofield allotments was not answered either.

## 24.5 Display Materials

24.5.1 Copies of the presentation pull-ups that were displayed at the exhibitions are included in Appendix D of the Report on Public Consultation. The display material contained information about the scheme and the issues surrounding it. The display material included the following:

- Welcome board (including an introduction to the scheme);
- A47 Blofield to North Burlingham (including details of why the scheme is needed);
- Objectives of the scheme;
- Proposed option 1 (with an illustrative layout drawing of the proposed option);
- Proposed option 2 (with an illustrative layout drawing of the proposed option);

- Proposed option 3 (with an illustrative layout drawing of the proposed option);
- Proposed option 4 (with an illustrative layout drawing of the proposed option);
- Environmental constraints plan;
- What happens next? (with board details of the overall scheme programme);
- How to respond? (with details of the various methods for completing the questionnaire).

24.5.2 An additional ‘static’ panel was set up at The Forum in central Norwich during the course of the consultation period. The panel provided details of the proposed Public Information Exhibition events along with details of how to access the consultation material and respond to the questionnaire. Copies of the brochure and questionnaire were also made available at this event for the general public to pick-up.

### Meetings with affected parties

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

## 24.6 Numbers of Attendees and Responses Received

24.6.1 The total number of visitors that attended the exhibition are detailed in Table 24-1 below.

**Table 24-1: Public Information Exhibitions Details**

Venue	Date	Opening Times	Number of Visitors
The Forum Millennium Plain Norwich NR2 1TF	Tue 14 Mar	9am – 5pm MPs, Councillor and stakeholder Preview	Not recorded
Lingwood Village Hall	Wed 29 Mar	3pm – 8pm	154
Blofield Courthouse	Fri 31 Mar	10am – 5pm	94
Lingwood Village Hall	Sat 1 Apr	10am – 2pm	75

## 25 Assessment of Consultation Responses

### 25.1 Introduction

25.1.1 Feedback from consultations was collated and analysed by Dialogue by Design – a company that specialises in bespoke public and stakeholder engagement and consultation services. Further detail can be found in the Report for Public Consultation. Ref A47-IMPS2-Amy-BB-ZZ-DR-J0007.

25.1.2 Dialogue by Design received feedback via:

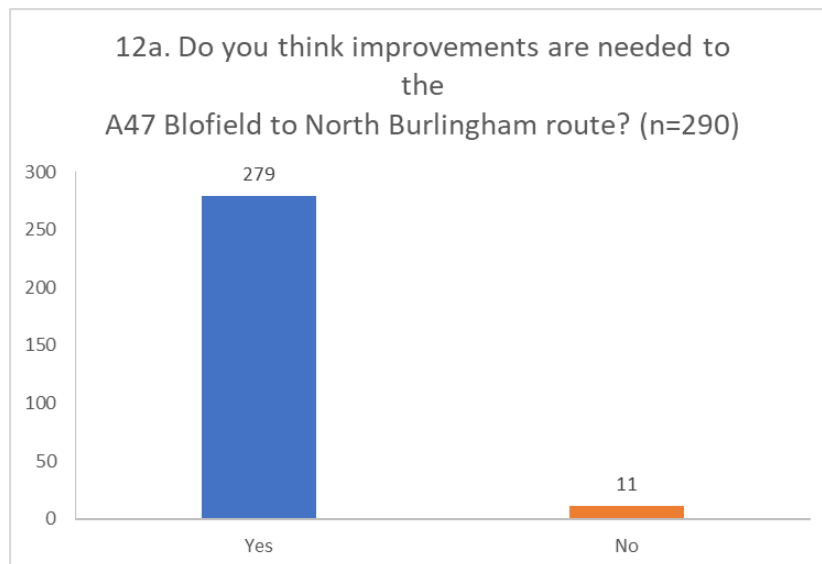
- Completed Questionnaires sent by post
- Completed Questionnaire online via Highways England website
- Email responses via Highways England inboxes.

25.1.3 A high-level summary of the Public Consultation Report is provided below.

### 25.2 Key Response Statistics

25.2.1 Respondents were asked to select whether they agree or disagree that improvements were needed to the A47 Blofield to North Burlingham route and these responses are shown in **Table 25.1** below:

**Table 25.1 - Chart 5: Proximity to the A47 Blofield to North Burlingham route**



25.2.2 The large majority of the 290 respondents who responded to this question agree that improvements are needed to the A47 Blofield to North Burlingham route with 279 selecting yes compared to 11 who selected no.

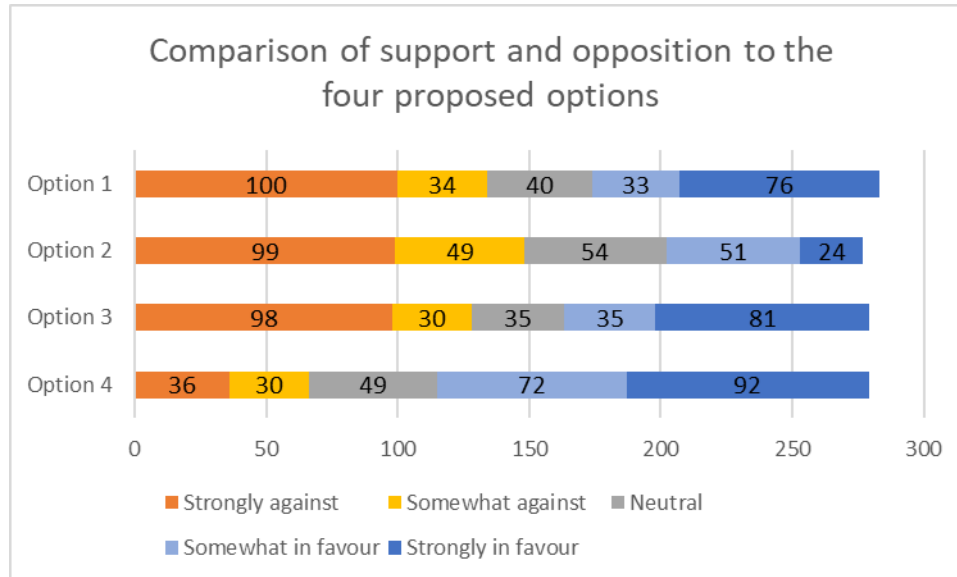
#### Responses to Option Preference

25.2.3 Respondents were then asked to summarise their reasons for their response. These are discussed in Chapter 31 which summarises the views of the 283 respondents who answered

as well as respondents who provided comments on the need for improvements within their answers to other questions in the consultation.

25.2.4 **Table 25-2** below summaries the responses to questions 13 to 16 which ask respondents to express their views and preferences for the four options presented for public consultation

**Table 25-2 - Chart 12: Comparison of support and opposition of the proposed options**



25.2.5 Looking at the responses to the closed questions (13a, 14a, 15a and 16a), Option 4 received the highest amount of support with 92 strongly in favour and 72 somewhat in favour. 66 said they were strongly against or somewhat against Option 4 compared to 134 against Option 1, 148 against Option 2 and 128 against Option 3. Options 1 and 3 have very similar levels of support and opposition amongst respondents compared to Option 2 which has the lowest amount of support (24 strongly in favour).

25.2.6 The main reason respondents gave for selecting Option 1 was that it mostly followed the existing road and reduced the need for land take which would save time and money and reduce the environmental impact compared to other options. Respondents who oppose Option 1 say that it will lengthen local journeys forcing long detours and will encourage an increase in traffic. They also comment that disruption to journeys during construction will be more significant than for other options.

25.2.7 Support for Option 2, 3 and 4 comes from those who believe that it will be beneficial to local residents and businesses of Lingwood and Burlingham for the existing A47 to remain in situ as a local access road.

25.2.8 Respondents specifically supported the route for Option 2 as it follows closely to the existing route and therefore would have minimal impacts on the communities in Lingwood and Blofield. Those opposing Option 2 are concerned that the route will cut Burlingham Green from Lingwood and North Burlingham, and that it would not address issues posed by the current route. They also comment on the level of disruption to the existing A47 during the construction period.

25.2.9 Support specifically for Option 3 comes from those who believe that it would provide local access along the old A47 for residents in North Burlingham and that disruption during construction would be minimal. Those opposing this option comment that this southern route impacts negatively on properties and farmland by running too close to Lingwood and in some cases requiring demolition.



25.2.10 Those specifically supporting Option 4 comment that it is the most straightforward option as it runs the closest to the existing route while causing the least disruption to the existing road. Respondents comment that it would be the least environmentally destructive taking the least green belt land and impacting fewer properties. Those opposing this route raise concerns that it may affect local access points and may experience complications during construction.

25.2.11 A total of 237 respondents express support for improving provision for pedestrians, cyclists and other users whilst 43 say improvements are not needed. Those who support provisions for NMUs comment that it is currently unsafe for them to cross or access the A47 and that this needs to be improved. Respondents mention the need for safe access to Burlingham Woodland for pedestrians and cyclists. Comments on which option would provide the best provisions for NMUs are mixed, with some saying Option 3 would be best and others preferring Option 4. Respondents express concern about the impacts of Options 1 and 2 on equestrians.

25.2.12 Respondents express concern about the lack of information and details in the brochure. They make request for more information and a plea for carrying on engagement with stakeholders. In particular, respondents comment that information about the junctions and the areas surrounding them is missing and needs further clarifying.

## 25.3 Key Stakeholder Responses

### Norfolk County Council

25.3.1 Norfolk County Council supports the scheme and make comments about the individual options but does not express opinion on Route Option Preference.

25.3.2 This road forms the major strategic east west link connecting Norfolk to the Midlands and the north of England. It passes through major settlements within the county including Norwich, Great Yarmouth and King's Lynn. Major investment is required to overcome current and predicted future traffic problems, and to ensure that the road supports the economic potential of the area. This potential includes major growth in the key settlements along the road, comprising both jobs and housing.

25.3.3 The proposed improvements are fundamental upgrades that we have sought for decades. Previous cuts to government programmes has seen virtually no investment (planned or delivered) in Norfolk for over a decade. These improvements are vital and the county council would be concerned if there were any threat to their delivery; in principle we want to see them delivered at the earliest opportunity.

25.3.4 The county council leads the A47 Alliance, which supports full dualling of the road with grade separation. The investment as part of the Roads Investment Strategy 1 will be a step towards achieving this goal, following many years of little or no investment into the A47. Norfolk County Council supports delivery of the proposals at the earliest opportunity

25.3.5 As stated, Norfolk County Council supported full dualling of the A47 with appropriate grade-separation and in principle supports the proposals subject to the more detailed comments set out below: The county council would like to work closely on further development of the schemes to ensure that they are developed to take into account, amongst other things, local issues, impacts on local networks, and improvement of the strategic function of the trunk road.

- Norfolk County Council fully support dualling this section of road to overcome the current and likely future issues; in particular congestion and safety.
- The county council supports full dualling of the A47 with grade-separation at the junctions. We would therefore support the junctions at either end of the scheme being

grade-separated. This would improve the strategic flow along the A47, as well as overcome safety issues, which are particularly prevalent at the B1140 junction

- We would want to work further with Highways England to understand the implications on the county's network and work through any issues arising. In particular these issues would include, but not be limited to:
- Form of junctions shown at either end of the proposal and how these would provide access to communities such North Burlingham
- How the scheme affects nearby A47 junctions, in particular Cucumber Lane and at Acle
- Proposals to maintain or otherwise rights of way across the proposed improvement
- Mitigating any impacts on traffic arising through construction. In this respect one of the off-line options might be the preferred solution
- Ambition to provide a safe foot and cycle crossing over the A47 between Lingwood and North Burlingham (TG369098). This will provide walking and cycling opportunities in the area for leisure and commuting, as well as the increasing awareness of local green spaces and attractions by improving Green Infrastructure links. Considering the level of growth to the east of Norwich, particularly the Blofield area, there are currently no formalised walking and cycle links across the A47 and to the north. The crossing will form a crucial link between settlements either side of the A47. It would also integrate the Burlingham Trails network north and south of the A47, providing safe crossing point of the A47.

### **Broadland District Council**

25.3.6 Broadland District Council strongly supported Highways England's proposal to improve the A47. The council are committed to ensuring that the route options carried forward are wholly in line with the best interests of local residents, businesses and communities. This current section of the existing A47 suffers from frequent congestion and road traffic accidents. It is also the main route for road users destined for Great Yarmouth and a large part of the Norfolk Broads and north Norfolk coast.

25.3.7 The Council has reservations regarding any online improvement of this stretch of the A47 due to the localised disruption during the construction. It is difficult to favour one of the three offline routes proposed over the others as there is limited difference between them. However option 3 appears to be the best option proposed.

### **Acle Parish Council / Beighton Parish Council**

25.3.8 The councillors had no strong views on which option was preferable but they did understand and support the wishes of North Burlingham residents that the dualled route should be as far as possible from their community, so Option 3 would be preferable.

25.3.9 The proposal for the junction at the B1140 at the White House is of great importance to the parish as we have previously been told that a new junction at that location would require The Windle to be closed. This would result a large increase in traffic from Upton to pass through Acle, much of it heavy farm traffic and HGVs.

### **Blofield Parish Council Planning Group**

25.3.10 The planning group would recommend Option 4 as a preferred route.

- To support the views of Lingwood Parish Council

- The 'old' A47 road could still be used for local traffic and could provide alternative access to the dualled A47 if the junction at the Blofield end of the A47 was designed in such a manner.

25.3.11 Blofield Parish Council's primary concern is around the junction near Blofield and the impact of traffic flows through Blofield village.

25.3.12 We would therefore request that the design of the junction accommodate an alternative flow for traffic travelling from Blofield Heath (to the North) or surrounding villages from the South / East to reach Norwich without having to enter Blofield through The Street or Yarmouth Road for onward travel to the Cucumber Lane roundabout.

25.3.13 The desired junction design from a Parish viewpoint would be a roundabout at the east end of Blofield.

### **Great Yarmouth Borough Council**

25.3.14 Although beyond the borough boundary, this section of the A47 forms a key strategic link between the urban settlements of Great Yarmouth and Norwich (and beyond). As such, Members of Great Yarmouth Borough Council wish to formally respond to the consultation by supporting the dualing of the Blofield to North Burlingham section of the A47 at the earliest opportunity, as it better connects the east coast.

### **Lingwood and Burlingham Parish Council**

25.3.15 The new routes are in close proximity to stables and paddocks and the Burlingham Woodland walks, bridleways and cycleways both North and South of the route, with cycleways being planned from Acle through North Burlingham to Blofield and Brundall and possibly connecting to the Norwich network, safe access to these from Lingwood is needed. Many Parishioners commute from Lingwood to North Burlingham and vice versa, whilst crossing now is dangerous it is not impossible but will be once the Road is a dual carriageway. These rural Communities which are part of one Parish need to be able to access each other safely.

### **Lingwood Parochial Church Council**

25.3.16 Lingwood PCC are concerned that the Option 3 proposal will bring the dual carriageway considerably nearer St Peter's Church and will adversely affect the setting of the 13th Century Grade I Listed building.

25.3.17 The PCC are particularly concerned that the church and churchyard should remain places of peace, tranquillity and contemplation and feel that Option 3 will adversely affect this.

25.3.18 Whilst your proposals state that the dual carriageway will cut through open farmland the PCC also consider that it will be close to the newly planted Peter's Wood and would also be extremely close to, if not actually cutting through, the Lingwood Community Woodland area which has abundant wildlife including Yellowhammers (which are on the Red List of the RSPB and the BTO).

### **Rambler Association**

25.3.19 This is a daily rush hour bottle neck, The White House junction is a regular accident black spot,

25.3.20 There is no continuous safe pedestrian pavement between Blofield and Acle.

25.3.21 There is also no safe cycle route for parents with young children.

25.3.22 North Burlingham does not have a bus service. Though this is possible from Blofield to Acle, it is impossible in the other direction.

25.3.23 With the opening of the NDR sugar beet HGV's could be using the A47. instead of the north section of the B1140. However HGV's returning to the NDR via the Postwick interchange will have to go round that lopsided mini roundabout to the Park & Ride. [Perhaps money should be better spent sorting out this roundabout!]

25.3.24 The proposed Blofield Junction should be developed as a full grade separated junction.

25.3.25 The Blofield Heath to Norwich route passes though the by-directional single carriage way obstructed by parked cars from the school, library, residence and shoppers. Drivers are known to use the Acle bound slip road to 'U turn' via the Yarmouth Road Junction.

25.3.26 The Cucumber Lane roundabout is like playing Russian Roulette to get out of especially in rush hour.

25.3.27 The White House junction was proposed as grade separated via a bridge. However an elongated roundabout similar to the one at Colney Heath on the A414 could be considered.

25.3.28 Without better indication of your proposals for the junctions it is difficult to come to a firm conclusion as to best route.

25.3.29 **Table 25-3** below summarises option preference of key stakeholders.

**Table 25-3 Key Stakeholder Option Preference**

Response from	Opinion on need for improvements	View on Option 1	View on Option 2	View on Option 3	View on Option 4
Norfolk County Council	yes	Somewhat against	Somewhat against	Strongly in favour	Somewhat in favour
Broadland District Council	yes	Strongly against	Somewhat in favour	Strongly in favour	Somewhat in favour
Acle Parish Council	yes	Neutral	Neutral	Somewhat in favour	Neutral
Beighton Parish Council	yes	Neutral	Neutral	Somewhat in favour	Neutral
Blofield Parish Council Planning Group	yes	Not answered	Not answered	Not answered	Preferred Option
Great Yarmouth Borough Council	yes	Not answered	Not answered	Not answered	Not answered
Lingwood and Burlingham Parish Council	yes	Somewhat against	Strongly against	Neutral	Strongly in favour
Upton with Fishley Parish Council	yes	Neutral	Neutral	Somewhat in favour	Neutral
Blofield Allotment Association	yes	Not answered			
Cycling UK (CTC)	Not answered	Neutral	Neutral	Neutral	Neutral
Lingwood Parochial Church Council	yes	Somewhat in favour	Somewhat in favour	Strongly against	Somewhat in favour
Norwich Green Party	yes	Somewhat against	Somewhat against	Strongly against	Strongly against
Rambler Association	yes	Strongly against	Neutral	Somewhat in favour	Somewhat in favour
The Church of	yes	Strongly	Strongly	Strongly in	Somewhat

England Parish of North Burlingham		against	against	favour	in favour
Norwich Cycling Campaign	yes	Not Answered			

## 25.4 Main Response Themes

### Congestion/Traffic/Capacity

- 25.4.1 Many respondents comment on the need to reduce congestion and improve journey times between Blofield and North Burlingham. Some respondents express concern about frequent bottlenecks along the route, particularly at the sections where two lanes merge to a single carriageway. They added that the congestion along the single carriageway at peak times increases the concentration of traffic at the roundabout to the west of the Blofield bypass section, which makes entry to the A47 from Blofield and Brundall difficult.
- 25.4.2 Some respondents said that there were traffic delays specifically at commuter times and during holiday periods, as well as delays for drivers attempting to access the A47 from local roads. Local traffic uses smaller roads to bypass the A47 which affects local villages and a few respondents commented that these roads are unsuitable for the volume of traffic that uses them. They also identified slow-moving HGVs and farming vehicles as causes for the build-up of traffic (particularly from vehicles that access the Cantley sugar beet factory during certain months of the year) as the single carriageway does not allow for overtaking, which also causes driver frustration.
- 25.4.3 Some respondents express concern about the impact that future traffic increase would have on the road. Several of these respondents suggest that planned housing developments in Blofield and Brundall would necessitate the improvement of the A47 as local traffic increase would have a particular impact on the Cucumber Lane/Yarmouth Road roundabout and the Brundall roundabout. One respondent also commented that plans for a factory close to the Blofield roundabout will considerably increase the numbers of vehicles trying to exit onto the roundabout.

### Safety

- 25.4.4 Safety was the most common reason given by respondents who supported the need for improvements. Many of them commented on the high rate of accidents along this stretch of the A47, particularly where the dual carriageway merges with the single carriageway. Some of these respondents suggested that drivers are impatient or inattentive on these sections, attempting to cut in as the lanes merge, endangering other drivers and sometimes shunting into the back of other cars.
- 25.4.5 Many respondents express safety concerns about the White House junction (A47/B1140) and Lingwood junction. Some respondents report that visibility is poor and that slip roads are too short, specifically at the White House junction. Several respondents commented that driver behaviour is also a factor that affects the safety at these junctions, for example, drivers ignoring the 50mph speed limit and ignoring the 'Give Way' signs at the White House junction.
- 25.4.6 A few respondents also said that the road poses a danger to cyclists and pedestrians.

### Engineering, design and construction

- 25.4.7 Many respondents felt that the junctions and slip roads on this stretch of the A47 require improvement, giving specific reference to the White House junction, South Walsham Road junction and Dell Corner Road. These respondents express concern about joining or crossing the A47 from all local side roads, as the high volume and speed of traffic at busy times does not allow much time between cars for drivers to pull out onto the road. They added that there were no filter lanes along this stretch, which added further difficulty to joining the flow of traffic

and that there is not enough room on the carriageway to pass waiting vehicles at junctions which contributes to hold-ups.

### **Pedestrians**

- 25.4.8 Several respondents comment that pedestrian access between Lingwood and North Burlingham is currently dangerous and is required for those accessing Lingwood church, or for children who attend schools in Lingwood. A small number of respondents express concern about the lack of safe pedestrian access between Blofield, Lingwood and Acle. Some respondents including The Ramblers Association Norfolk Area, make comments about the pavement alongside the A47, arguing that it is dangerous and not continuous throughout the stretch between Blofield and Acle. A small number of respondents comment that a footbridge between Lingwood and North Burlingham would improve access to footpaths and Burlingham Woodland.
- 25.4.9 Some respondents make comments relating to the impact on pedestrians of specific options. For example, some respondents express concern about the impact of Option 3, suggesting that the route will destroy existing local footpaths. Whereas other respondents believe that Option 3 would allow for pedestrians to safely use the existing A47. The Ramblers Association Norfolk Area believes that Option 3 would allow for a suitable route for NMUs between Blofield and North Burlingham provided there is a grade separated crossing between High Noon Lane and Yarmouth Road. The Ramblers also comment that Option 4 would sever the Lingwood/Burlingham footpath 3, requiring a gap in the central reservation. Some other respondents believe that Option 4 would allow for pedestrians to safely use the existing A47. A small number of respondents believe that Option 2 would have the least impact on walks in the area, and would allow for pedestrians to use the existing A47.

### **Cyclists**

- 25.4.10 Many respondents say it is currently too dangerous to cycle on the A47 due to the traffic, HGVs and road conditions. A few respondents express concern about the quality and layout of the cycling routes, with one respondent saying that they are too indirect. Cycling UK says that cycle travel should be more direct between Blofield and North Burlingham and the woodland nearby, adding that cycling commuters require quick routes for work.
- 25.4.11 A large proportion of respondents comment on provision for cyclists. Some respondents say that the proposals would encourage them to cycle between Blofield and North Burlingham rather than drive and a few say that the proposed routes would lead to more commuters cycling. A few comment that cycling provisions should be made a priority within these plans.
- “Any new construction should make provision for cyclists etc, even if it does not link up with anything currently existing. To do so will only encourage further work to improve access in the future.”
- 25.4.12 Several respondents comment on the impact of specific options on cyclists. A significant proportion of respondents believe that Option 1 does not allow for a cycle route in the area and several respondents believe that Option 3 and Option 4 would allow for cyclists to use the existing A47 safely.
- 25.4.13 Some respondents make suggestions for provisions for cyclists and of these, a large number suggest cycle paths for example connecting Lingwood, North Burlingham, Acle and South Walsham, which would facilitate access to local shops, as well as the Broads and Burlingham Woodland walks. A small number of other respondents believe that the A47 should be wide enough to allow for more space for cyclists or an integrated cycle lane.

## Equestrians

- 25.4.14 A small number of respondents express concerns about the current issues that equestrians face along this section of the A47. Respondents say that, although there is an active equestrian community in the area, traffic on the A47 is too heavy to permit safe access.
- 25.4.15 Some respondents express concern about the impact of Option 1 and Option 2 on equestrians, suggesting that equestrians frequently use the single-track roads that connect to the A47 so additional traffic on these roads would impact on safety. Several respondents believe that Option 3 and Option 4 would allow for equestrians to safely use the existing A47. However, other respondents express concern about Option 3, saying that bridleways would be affected during construction and cut off by the proposed route.
- 25.4.16 Some respondents suggest the implementation of a horse underpass to connect the bridleway at Lingwood to the other side of the A47. The British Horse Society is willing to assist in the decision-making process for equestrian facilities including the width of tracks and the type of surface to be used.

## Comments opposing the need for improvements

- 25.4.17 A few respondents gave reasons for why they believe improvements are not needed to this section of the A47. A small number comment that the congestion issues are not significant enough to justify improvements to the road and the subsequent loss of countryside, as well as prolonged period of roadworks on the village of Blofield.
- 25.4.18 Some other respondents expressed concern about the environmental impacts of road improvements and the increase of carbon emissions from traffic increase. One respondent believes that the existing narrow road encourages drivers to obey the speed limit which reduces the impact of noise pollution on Blofield. Other respondents comment that the Acle Straight and the local road between Lingwood and Blofield are more of a priority for improvements than the proposed scheme.
- 25.4.19 Several respondents say the A47 is too dangerous for NMUs to use and they should not be encouraged to do so and several suggest there is not enough demand among NMUs to require provision. A small number of respondents believe that it is important to allow the fast and smooth movement of traffic on the A47, which pedestrians or equestrians could hinder. A few respondents comment that there are many local and minor roads in the area that are more suitable for NMUs and one respondent says that these roads are already more popular with cyclists and equestrians.
- 25.4.20 A few respondents suggest that if Options 3 or 4 were implemented, NMUs would be able to use the existing A47 route, and no further NMU provision would be required. One respondent says that because there is no NMU provision on the rest of the A47, provision for the Blofield to North Burlingham section is not worth implementing.

## 25.5 How Responses were taken Forward

- 25.5.1 The responses, and suggestions made by the public were used and considered as part of the PCF Stage 2 assessment work and during the preferred route selection process (see Chapter 27).

## 26 Detailed Cost Estimate

### 26.1 Introduction

26.1.1 As a project develops through the PCF Stages the scheme costs are estimated based on the level of detail available at that time. The estimate is produced for use in the economic assessment of the project (see Chapter 29 for details) and as a check at each stage of the project of the affordability of the scheme.

26.1.2 At PCF Stage 2 the 4 route options as described in Chapter 23 along with other background information was used by Highways England Commercial as a basis to produce the Options Estimate for the scheme.

### 26.2 Options Estimate

26.2.1 The 4 route options as described in Chapter 23 along with other background information was used by Highways England Commercial as a basis to produce the Options Estimate for the scheme.

26.2.2 The Options Estimate for the scheme, prepared in accordance with the Highways England Commercial Cost Estimation Manual as explained in Chapter 17.

### 26.3 Summary of Estimate

26.3.1 **Table 26-1** below presents the range cost estimates for the Options described in Chapter 9.

**Table 26-1 – Blofield to North Burlingham Cost Estimates**

Option	Range Min (£M)	Range Most Likely (£M)	Range Max (£M)
1	62.69	94.04	157.78
2	63.64	94.03	161.69
3	58.45	86.06	153.17
4	56.67	83.05	146.80

26.3.2 Project risk has been assessed in several broad categories: those occurring within the PCF options and development phases, project overheads, method-related costs, roadworks, contractor fees and statutory undertakings, plus an allowance for non-recoverable value added tax.

26.3.3 Uncertainty adjustments are applied to agent and contractor fees and for the purpose of statutory undertakings as it may be necessary to perform additional studies and undertakings as the project progresses. Uncertainty adjustments are set to zero in the minimum cost scenario with increasing estimates for the most likely and maximum scenarios respectively.

26.3.4 The difference in estimated costs between PCF Stage 1 and PCF Stage 2 are largely due to the value management deep dive exercise completed early in PCF Stage 2, detailed in Chapter 21 of this report and in the PCF Product Value Management Workshop Report, document reference number A47IMPS2-AMY-BB-ZZ-DO-J0041



## 26.4 Derivation of Costs for Economic Assessment

26.4.1 The cost and expenditure profile for the scheme is shown in **Table 26-2**. The construction costs were firstly inflated to outturn costs using construction-specific inflation projected and then rebased to 2010 values using the Gross Domestic Product (GDP) deflator series in the WebTAG Data Book.

**Table 26-2: Estimated costs for Blofield scheme at base year values and prices**

Design option	Cost category	Total expenditure	Percentage of cost spent in				
			2017	2018	2019	2020	2021
Option 1	Preparation	£7,023,859	20%	23%	45%	11%	0%
	Supervision	£1,618,447	0%	0%	0%	55%	45%
	Works	£59,531,196	0%	0%	0%	53%	47%
	Land	£4,605,031	35%	0%	0%	65%	0%
	<b>Total</b>	<b>£72,778,533</b>	<b>4.2%</b>	<b>2.3%</b>	<b>4.3%</b>	<b>49.7%</b>	<b>39.5%</b>
Option 2	Preparation	£7,177,508	22%	20%	49%	8%	0%
	Supervision	£1,045,908	0%	0%	0%	76%	24%
	Works	£58,991,616	0%	0%	0%	69%	31%
	Land	£5,785,930	17%	0%	0%	83%	0%
	<b>Total</b>	<b>£73,000,963</b>	<b>3.6%</b>	<b>2.0%</b>	<b>4.9%</b>	<b>64.0%</b>	<b>25.5%</b>
Option 3	Preparation	£7,072,633	22%	20%	50%	8%	0%
	Supervision	£987,164	0%	0%	0%	82%	18%
	Works	£55,345,626	0%	0%	0%	74%	26%
	Land	£3,296,217	0%	0%	0%	100%	0%
	<b>Total</b>	<b>£66,701,640</b>	<b>2.3%</b>	<b>2.1%</b>	<b>5.3%</b>	<b>68.6%</b>	<b>21.6%</b>
Option 4	Preparation	£6,891,511	23%	20%	49%	8%	0%
	Supervision	£893,601	0%	0%	0%	82%	18%
	Works	£53,517,498	0%	0%	0%	74%	26%
	Land	£3,021,822	0%	0%	0%	100%	0%
	<b>Total</b>	<b>£64,324,433</b>	<b>2.5%</b>	<b>2.1%</b>	<b>5.2%</b>	<b>68.5%</b>	<b>21.6%</b>

26.4.2 Further information on the economics assessment for the Option is contained in Chapter 29.

## 27 Preferred Route Decision

### 27.1 Introduction

- 27.1.1 As part of Highways England's procurement process for a PCF Stage 3 supplier, a more detailed programme review of PCF Stage 3, determined that, to meet the start on site date that PCF Stage 3 work would need to commence in September 2017.
- 27.1.2 To facilitate a September 2017 start of PCF Stage 3 the programme review concluded that a Preferred Route Announcement would need to be made in mid-August 2017.
- 27.1.3 To give sufficient time for internal governance, preparation of PRA leaflets and DfT reviews a preferred route decision would be needed by mid-June 2017.
- 27.1.4 We took the decision to organise and hold a preferred route decision (PRD) workshop and meeting in mid-June 2017 to review the technical assessments undertaken to date and review the assessment of the public consultation and to determine based on the information available at that date a preferred route.
- 27.1.5 PCF Stage 2 assessment and reporting work had originally been programmed to complete in September 2017, therefore due to the timing of the PRD being part way through PCF Stage 2, all of the PCF Stage 2 assessments and reporting were not complete at the time of the PRD.
- 27.1.6 Where assessments were incomplete at the time of PRD, assessments were supplemented with PCF Stage 1 assessment information and/or qualitative assessments. At the PRD the limitations and risks of making an early decision based on the available information were highlighted to the PRD meeting to allow an informed decision to be made.
- 24.1.5 Limitations and risks of making an early decision based on the available information were highlighted to the PRD meeting to allow an informed decision to be made. A summary is presented in **Appendix O**.

### 27.2 Preferred Route Decision Meeting

- 27.2.1 The Preferred Route Decision (PRD) Workshop took place on 15th June 2017. This was attended by senior representatives from Highways England, Amey and the PCF Stage 3 Supplier Mott McDonald Sweco (MMS).
- 27.2.2 The minutes of the PRD meeting are included in **Appendix N**, the following assessments were presented to the PRD meeting
- Key Constraints
  - Alignment to Highways England Strategic Outcomes
  - Transport Economics and Environmental Assessments via Appraisal Summary Table (AST)
  - PIE Summary
  - Buildability Analysis
  - Key Risks & Opportunities
  - Cost and BCR

## 27.3 Key Constraints

27.3.1 The key constraints are summarised below:

- Existing properties and buildings
- Existing local access roads and property access
- Historic and listed buildings
- Areas of nature conservation
- Areas of potential ecological importance
- River and water bodies
- Statutory Undertakers
- Ground Conditions

### Environmental Constraints

27.3.2 Historic Environment Record (HER) which includes cropmarks to the north of the existing A47, adjacent to existing carriageway at the western end of the scheme. Options 1 and 2 both have impact on this HER record.

27.3.3 There are 3 villages close to the A47, Blofield, North Burlingham and Lingwood. Other farm and commercial buildings, churches and community facilities are near to the A47 and properties are scattered throughout the rural area.

27.3.4 There are 20 listed buildings in the study area; and two Grade 1 listed churches in the vicinity

27.3.5 There are 2 county wildlife sites (CWS) nearby. Church and Drive plantation CWS being the closest

27.3.6 A number of ponds and watercourses are within the area.

27.3.7 There are limited nature/conservation/ecology constraints for the scheme.

### Engineering Constraints

27.3.8 Statutory Undertakers – There is a major gas main running parallel with the existing A47 and just to the south.

27.3.9 There are a number of other statutory undertaker's plant in the existing verges (including fibre optics) and several overhead lines cross the existing A47, including British Telecom and several HV electricity cables.

27.3.10 Ground Conditions – there is a risk of differential settlement of earthworks and materials susceptible to weathering. Ground Investigation is needed.

27.3.11 Access – A number of side roads (incl. North Burlingham access) joining the A47 and a number of properties, both commercial and residential have direct access.

### Existing Properties and Buildings

27.3.12 Other items discussed were:

- Village of North Burlingham adjacent to and north of the Existing A47.
- Village of Lingwood to the South of all scheme Options.
- Two properties on Yarmouth Road very close to western tie-in for all Options which will require extensive accommodation works.
- Existing care home on Dell Corner Road.

## 27.4 Alignment to Highways England Strategic Outcomes

27.4.1 The strategic outcomes assessed in PCF Stage 1, see Chapter 10.3 were re assessed for the 4 options the results were as highlighted in **Table 27-1** below

**Table 27-1 High Level Strategic Outcomes Assessment**

Option	Fit with wider transport and government objectives								Average	Rank
	Managing the network safer	Improving user satisfaction	Supporting the Smooth Flow of Traffic	Encouraging Economic Growth	Delivering better environmental outcomes	Helping cyclists, walkers and other vulnerable users	Achieving real efficiency	Keeping the Network in Good Condition		
1	4	4	5	4	3	4	3	4	3.9	1
2	4	4	5	4	3	4	3	4	3.9	1
3	4	4	5	4	3	4	3	4	3.9	1
4	4	4	5	4	3	4	3	4	3.9	1

27.4.2 The conclusion of the assessment against the Highways England KPIs was that as the KPIs are at a reasonably high level that each of the route options is likely to meet the KPIs and score against the KPIs in a very similar way.

## 27.5 Traffic Assessment and Economics Assessment at PRD

27.5.1 The NATS transportation model update (as outlined in Chapter 13) was not complete for PRD, although the model had been validated and do-min scenarios were being run. There were no forecasting results for the 4 options and the BCRs which were reported to the PRD meeting were derived from PCF Stages 1 transportation assessments.

27.5.2 There were no discernible differences between the 4 Options in terms of the economic categories (Business users and transport providers; reliability impact on business users; regeneration and wider impacts); all options showing a beneficial rating when assessed against these economy criteria.

27.5.3 The 4 options all provide a dual carriageway replacing the length of single carriageway between Blofield and North Burlingham. From a transportation assessment all routes will predominantly perform in a similar way, the only real differentiating factor in terms of preliminary initial transportation assessment is the minor route length difference between the options. It was therefore considered that the transportation effects of the 4 options were not a significant differentiating factor for the preferred route decision.

## 27.6 Environmental Assessment pre PRD

27.6.1 A draft version of the Environmental Assessment Report was prepared for PRD. It was based on information from PCF Stage 1 supplemented with available PCF Stage 2 surveys and assessments that had been completed up to PRD. The quantum and quality of available PCF Stage 2 information varied across the environmental categories; where information was incomplete informed decisions on projected outcomes were required in order to support the early PRD process. **(Full environmental results can be found in chapter 30. And the PRD validated in chapter 35)**

27.6.2 In the first instance the Environmental Assessments were used to complete the environmental sections of a Department of Transport WebTAG AST table. WebTAG assessment encompasses engineering, economic, accessibility and environmental; it utilises 8 environmental categories as listed below in **Table 27-2**. Each of the environmental categories were assessed based on an estimated impact on a 7 point scale as follows:

- Large adverse
- Moderate adverse
- Slightly adverse
- Neutral
- Slightly beneficial
- Moderate Beneficial
- Large Beneficial

27.6.3 The results of the environmental assessment were R-A-G rated for presentation at the PRD, the results are summarised in **Table 27-2** below:

**Table 27-2 Environment Assessment Summary from AST table (7 point scale)**

Environmental Category	Scheme Options			
	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment	Option 4 Assessment
Noise	Slight adverse	Slight adverse	Slight adverse	Slight adverse
Air	Neutral	Neutral	Neutral	Neutral
Greenhouse Gases	Neutral	Neutral	Neutral	Neutral
Landscape	Neutral	Slight adverse	Slight adverse	Neutral
Townscape	Neutral	Neutral	Neutral	Neutral
Historic Environment	Moderate adverse	Moderate adverse	Slight adverse	Slight adverse
Biodiversity	Slight adverse	Slight adverse	Moderate adverse	Moderate adverse
Water	Slight adverse	Slight adverse	Slight adverse	Slight adverse

27.6.4 The initial AST assessment presents Option 1 as the preferred environmental solution and Option 3 as the least preferred.

- 27.6.5 The AST used environmental topics from the Department of Transport guidance to provide the environmental input to the AST which includes engineering, economic and accessibility assessments. The DMRB topics are broader based for environmental assessment to capture topics not included in the TAG guidance.
- 27.6.6 The Environmental Assessment Report applies DMRB Chapter 11 guidance and the associated nine environmental topics listed in **Table 27.3**; these topics are broader and capture topics not included in the WebTAG guidance.
- 27.6.7 In addition to the AST, the Environmental Assessment Report utilising the environmental topics within the DMRB, also assessed and ranked each of the options per environmental topic and in conclusion comparatively ranked these to give a comparison between the options, which again was R-A-G rated - the results are summarised in **Table 27-3**.

**Table 27-3 Environment Assessment Summary (based on Rankings)**

Environmental Category	Scheme Options			
	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment	Option 4 Assessment
Air Quality	Green	Orange	Yellow	Red
Cultural Heritage	Red	Orange	Yellow	Green
Landscape and Visual	Green	Red	Orange	Yellow
Biodiversity	Green	Yellow	Red	Orange
Noise and Vibration	Grey	Grey	Grey	Grey
Road drainage and water	Grey	Grey	Grey	Grey
People and communities	Green	Yellow	Red	Orange
Geology and soils	Orange	Yellow	Green	Red
Materials	Grey	Grey	Grey	Grey

- 27.6.8 Utilising the environmental topics contained within the DRMB, the assessment completed within the Draft Environmental Assessment Report also identified, in greater detail, that Option 1 was the preferred environmental solution while Option 4 was the least preferred option using this methodology. This was however based on incomplete surveys and no traffic data.
- 27.6.9 Following a discussion during the PRD meeting it was agreed that the Environmental Assessment summary based on the rankings within the Environmental Assessment Report was a better way of comparing the options for the PRD.
- 27.6.10 The following sections give a brief overview of the environmental assessments completed and briefly highlights any additional baseline information and any data limitations. For more detailed information the Draft Environmental Assessment Report should be referenced.

## Air Quality

### Methodology and Limitations

27.6.11 Due to a lack of traffic data the methodology used for the draft report only partially followed the 'simple' assessment level described in HA207/07. This was combined with the application of professional judgement to evaluate the pros and cons to determine an option ranking.

### Baseline update

27.6.12 To characterise the baseline air quality in the local area a series of nitrogen dioxide diffusion tubes were placed in representative locations in the study area around Blofield. The data shows that the background and roadside site concentrations are all under the annual mean NO<sub>2</sub> objective of 40µg/m<sup>3</sup>.

27.6.13 The study area was refined from Stage 1, according to DMRB HA207/07 and encompasses only those receptors within 200m of the affected roads. **Table 27-4** below shows the air quality receptor counts used in the assessment for the existing and proposed alignments.

**Table 27-4 Receptor counts\***

Receptor Type	Quantity			
	0-50m	50-100m	100-150m	150-200m
Existing	27	27	39	34
Option 1	18	28	24	11
Option 2	15	37	40	32
Option 3	12	28	29	26
Option 4	18	32	33	48

\*Receptors counts for air and noise vary slightly due to assessment method – refer EAR for further information.

### Options Review and Preference

27.6.14 Option 1 was considered to be the preferred option with respect to local air quality primarily because the carriageway, which is proposed to be predominantly online, provides no reason to acquire properties and results in no unacceptable exposures to new or existing sensitive receptors.

27.6.15 Option 4 was the least preferred option because it would lead to an overall increase in the number of sensitive receptors exposed to air quality pollutants in the study area.

## Cultural Heritage

### Methodology

27.6.16 The methodology adopted was in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2 'Cultural Heritage', HA 208/07 (Ref 7.1) and hence examined archaeological remains, historic buildings and historic landscapes.

### Baseline update

27.6.17 During Stage 2 a site walkover was completed and the critical features more clearly defined.

27.6.18 There are a large number of archaeological features within the study area of which 30 are likely to be directly impacted by the proposed options. These features range from the site of an old smithy, former sandpits to cropmarks of possibly Roman or prehistoric origin of field

boundaries and enclosures. The parkland around Burlingham Green and Burlingham Hall are relicts of post medieval landscape parks.

27.6.19 Of the listed buildings only the churches of St Andrew in North Burlingham, Church of St Peter in North Burlingham and Church of St Peter in Lingwood are likely to experience effects on their settings. Other significant buildings in the study area include the White House on Acle Road and the Old Post Office on the A47.

#### **Options Review and Preference**

27.6.20 Options 1 and 2 in taking new road alignments to the north of the existing A47 will impact upon the site of the late prehistoric to Roman settlement, resulting in a large impact. Option 2 doesn't introduce an overbridge into the landscape so will have the least impact on the built heritage. The significance of impact on the listed buildings from the overbridges with options 1, 3 and 4 is not significant. Overall option 4 was the most preferred with option 1 the least preferred.

### **Landscape and Visual**

#### **Methodology and Limitations**

27.6.21 The description of the baseline and the assignment of sensitivities follow the headings and tables of IAN 135/10.

27.6.22 A winter landscape survey was undertaken in March 2017 to gain a better understanding of the landscape character and to assess viewpoints. No summer survey had been completed at the time of the draft assessment.

#### **Baseline update**

27.6.23 The options are located in the National Character Area: North East Norfolk and Flegg. On a local scale the landscape is dominated by arable farming and the study area lies within the Blofield Tributary Farmland Landscape Character Area and Freethorpe Plateau Farmland. The landscape is generally flat with some woodland cover to the north of the A47.

27.6.24 Visual receptors in the area include local residents and farms, users of Public Rights of Ways and permissive paths as well as road users.

#### **Options Review and Preference**

27.6.25 Option 1 is the most preferred as the online widening will have a minimal impact on the landscape and visual receptors. Although the other options all introduce new features into the landscape, Option 4 is the second preferred option, as it is located close to the existing infrastructure and will have less of a visual impact than options 2 and 3. Option 2 is the least preferred as it will affect the most number of visual receptors with a significance of moderate or large adverse.

### **Nature Conservation and Biodiversity**

#### **Methodology and Limitations**

27.6.26 A desk top study and extensive field surveys were completed during Stage 2 to inform the preferred route assessment. Planned surveys included Phase 1 and protected/notable species including aquatic invertebrates (Desmoulin's whorl snail), badgers, bats, great crested newts, otter/water vole and wintering birds.

27.6.27 The following surveys were incomplete at PRD: aquatic invertebrates and bat roost assessment. In addition, land access issues prevented completion of the badger surveys.



### Baseline update

27.6.28 The key survey findings noted up to this point included:

- There are two badger setts located within the survey area.
- There are a large number of trees with bat roost potential, of which 16 were identified as having high potential.
- Two ponds in the survey area support two small populations of great crested newt.
- No evidence of otter or water vole was recorded during the surveys.
- Wintering bird surveys identified two Schedule 1 species, 14 Red listed Birds of Conservation Concern (BoCC) and 9 Amber BoCC species.

### Options Review and Preference

27.6.29 Option 1 was the preferred option as it will have less impact on priority habitats and slight effects on bats and badgers. Option 3 was the least preferred option as it will result in habitat loss from priority habitats, including ponds. It will also result in severance of the broad-leaved woodland to the south of the A47. Option 2 is second preferred with Option 4 the third preferred.

## Noise and Vibration

### Methodology and Limitations

27.6.30 As traffic data was not available the methodology applied recognised guidance, professional judgement and the information currently available. Potential changes in noise levels were estimated at representative receptors as either beneficial, no perceptible change or adverse.

### Baseline update

27.6.31 There are four Noise Important Areas located along the A47 between Blofield and North Burlingham, with NIA5208 incorporating the property at the Old Post Office.

27.6.32 Noise Sensitive receptors are receptors potentially sensitive to noise or vibration. They typically include dwellings, hospitals, community facilities and designated areas. **Table 27-5** shows the noise sensitive receptors in distance bands up to 600m from each of the options.

**Table 27-5 Noise Sensitive Receptor counts**

Layout	Band						Total
	0-50m	50-100m	100-150m	150-200m	200-300m	300-600m	
Existing	18	24	26	34	98	644	844
Option 1	9	26	15	9	18	360	437
Option 2	14	27	29	28	92	664	854
Option 3	11	21	20	26	110	748	936
Option 4	17	20	30	38	120	656	881

### Options Review and Preference

27.6.33 Due to the similarity of each of the options and the lack of traffic data to allow noise modelling to be completed it was impossible to differentiate between the options and no ranking was specified.

## Road Drainage and Water

### Methodology and Limitations

27.6.34 The assessment was undertaken in line with HD 45/09 – Road Drainage and the Water Environment and included a desk study and a site walkover in February 2017. Due to lack of traffic data no HAWRAT assessment was completed.

### Baseline update

27.6.35 There are no major rivers or surface waterbodies within the study area, the closest watercourse is the Witton Run, located approximately 0.9km from the A47. Within the study area are located approximately thirty ponds and seven drainage channels.

27.6.36 The western end of the scheme overlies a groundwater source protection zone – total catchment (Zone 3).

27.6.37 The scheme is not located in an area at risk of flooding.

### Options Review and Preference

27.6.38 Given the lack of surface waterbodies in the study area and as all the options will have similar effects on the groundwater environment no option is preferred over another.

## People and Communities

### Methodology and Limitations

27.6.39 The term ‘people and communities’ refers to the interactions of local people with community facilities, roads, infrastructure and land use. It looks at land use impacts, non-motorised users and journey amenity.

27.6.40 The assessment of impacts on agricultural land was restricted by lack of information on individual farm units and potential landtake.

### Baseline update

27.6.41 There are numerous Public Rights of Way and permissive paths located north and south of the A47. The key constraints are the PRoW running from Lingwood to North Burlingham, and the permissive paths south of the A47, which will be directly affected by all the options. There are also community allotments located in Blofield, which have potential to be affected by the western section of the scheme. In terms of agricultural land, the area is almost exclusively grade 1 and 2 arable farmland.

### Options Review and Preference

27.6.42 With the assumption that cycle and pedestrian access will be provided, option 1 is the most preferred option. This option will require the least amount of land take due to its online nature. The provision of an overbridge for the affected PRoW will result in an improvement to community severance.

27.6.43 Option 3 was least preferred due to extent of land take required and extent of severance of the permissive paths south of the A47.

## Geology and Soils

### Methodology and Limitations

27.6.44 This assessment is undertaken in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 11 Geology and Soils, 1993 methods for a Stage 2 assessment. At the time of writing, the earthworks volumes and land take areas were not available; thus the impacts to geology and soils could not be fully understood.

### Baseline update

27.6.45 Overall the local geology is not considered a significant constraint although the soils are classed as very good and excellent arable farmland. There are isolated pockets of potential contamination sources in the form of infilled sand pits to the south of the A47, although these can be managed during construction and are not expected to be a constraint to development.

### Options Review and Preference

27.6.46 All four options will have similar impacts on the underlying soils and geology. Option 2 is considered marginally preferred as it will have less of an impact on existing sources of land contamination. Options 1 and 4 are expected to have the greatest impact on land contamination by creating/aggravating pollution linkages.

## Materials

### Methodology and Limitations

27.6.47 This chapter assesses the impacts associated with material use in the construction of the options as well as the handling and disposal of waste produced by construction works.

27.6.48 As the design is ongoing, it is not possible to quantify the use of materials in absolute terms at this stage, for example, tonnes of primary aggregate, concrete or steel required for the scheme. Similarly, the projected volumes of waste, excavated material or potential reuse of materials cannot be quantified at this stage.

### Baseline update

27.6.49 The route options will require the procurement of quantities of aggregates, pavement, concrete and steel. Given the high quantities of these materials on the UK market (i.e. low scarcity), the sensitivity of the material resources for this scheme are considered low. The sensitivity of the waste infrastructure within the study area is considered low given the availability of waste management sites within 30km of the scheme (i.e. high waste management capacity).

### Options Review and Preference

27.6.50 It is important to note that the impacts on materials and waste infrastructure are anticipated to be neutral or slight adverse and therefore they are not considered significant. Given that the volumes of waste produced or materials required is not known, no one option is preferred over another for materials.

## Overall Environment Ranking

27.6.51 The options ranked from most to least preferred based on environmental effects considered within the Interim Environmental Assessment Report are as follows:

- Option 1

- Option 3
- Option 2
- Option 4

## 27.7 Non-Statutory Public Consultation Summary

27.7.1 The results of the Public Consultation are described in Chapter 25

## 27.8 Buildability Analysis

27.8.1 A buildability contractor was asked to make some preliminary assessments of construction durations. The timescales proposed by the buildability contractor were generally in line with those assumed in the cost estimates. The largest time constraint in Option 2 was building the bridge over the existing A47 carriageway.

27.8.2 Other Key points noted by the buildability contractor which could affect the programme duration and cost estimate were;

- The gas main is a significant constraint but would likely be diverted similarly on all options.
- Options 3 and 4 with mainly offline construction gave greater programme flexibility, with the opportunity for the offline underbridge to utilise box culverts to reduce programme.

27.8.3 While programme timescale durations for all the options were largely in line with those assumed within the estimate it was noted that the buildability programmes showed a start for construction as October 2020. It was agreed that there should be further scope to challenge the construction programme in later PCF Stages.

27.8.4 The meeting thus agreed to proceed with the costs presented in section 6.6 of the minutes of the A47 Preferred Route Decision – Blofield to North Burlingham dated 14<sup>th</sup> June 2017 (see **Appendix N**), and accepted the risks associated with the likely cost increases.

## 27.9 Key Risks & Opportunities

27.9.1 As explained in Chapter 27.4, it was assumed during the PRD discussions that as the routes are largely similar in length and all replace an existing single carriageway section of road with a dual carriageway section that from a traffic flow perspective there will be no discernible difference between the 4 options in terms of volumes of traffic movements and the way the options perform in terms of flow of traffic.

27.9.2 It was agreed that traffic flow should not be a differentiating factor between the options for the PRD.

27.9.3 The limitations of the information presented to the PRD were noted in the meeting, the limitations of the information, assessments and the Stage 2 PCF Products prepared up to the date of the PRD meeting were highlighted in a table, Refer to **Appendix O** – ‘Exceptions and Limitations Document -A3 - Rev A.

27.9.4 A table showing a qualitative review and comparison of risks to highlight areas where the risk profile differs across options was considered, which showed no significant variance across the options. See **Appendix P** – A47 Blofield to North Burlingham risk comparison.

27.9.5 Other Benefits and Opportunities were considered at the meeting as follows;

- All options meet the RIS commitments: -
  - Supports economic growth
  - A Safe and Serviceable Network
  - A More Free-Flowing Network and improved journey times
  - Improved Environment
  - An Accessible and Integrated Network

27.9.6 Other Issues and Risks were considered at the meeting as follows;

- Programme – Starting construction in March 2020 and 15 month construction will be challenging but achievable
- Other Developments, planning permissions (Food Hub Site)
- High estimate at end of Stage 1 Estimates provided for Stage 2 are above budget figure for all options. (HE to consider this further).
- Value Engineered Scheme introduces delays/congestion with the provision of an “at grade” roundabout
- Line of Preferred Route – Objections from Local Residents
- Connectivity of local road access (large number of side roads and local accesses to accommodate)
- Ground conditions most likely soft compressible ground and/or chalk susceptible to weathering

## 27.10 Cost

27.10.1 The options estimates detailed in Chapter 26 were presented to the PRD meeting.

27.10.2 In terms of costs provided by Highways England commercial the options ranked 4-3-2-1 in order of preference, with Option 4 clearly having the lowest cost estimate.

## 27.11 Overall Assessment Summary for PRD

27.11.1 A discussion regarding the way in which the assessments and information presented could now be combined and used to best make an overall assessment was held.

27.11.2 It was noted that much of the information presented was based on incomplete Stage 2 products and had low analytical assurance. The assessments overall were discussed and the following were agreed in the room

### **Alignment to Strategic Objectives**

27.11.3 The high level strategic assessment of KPIs aligned to the strategic assessment of the Delivery Plan and showed little if any difference as all options were likely to meet the KPIs in a similar way

### **AST comparison**

- 27.11.4 There was no real differentiation between the options from the AST's. Economy rated as beneficial across all the options and there was also no discernible difference considering the environment categories.
- 27.11.5 Along with a desk top study, a number of environmental surveys were undertaken to inform the option selection process. The findings of these studies were included within an Environmental Assessment Report with a ranking assigned to each option to provide a preferred option.
- 27.11.6 A summary of the assessment findings is provided below; however it was noted that although ranked the difference in the potential effects across the certain environmental topics was not significant and as such for these topics the weighting of the ranking is reflected in the overall option preference.
- 27.11.7 The report concluded that option 1 was the most preferred environmental option, as the online dualling would result in less impact on land take and ecology.
- 27.11.8 In terms of air quality and noise, all the options would have similar effects, with some receptors having a beneficial impact, while others would have an adverse effect.
- 27.11.9 Options 2 and 4 had similar impacts with option 2 only marginally preferred as it was more favourable in terms of requiring less landtake and having less of an effect on the public rights of way in the area.
- 27.11.10 Option 3 was the least preferred. This is an entirely offline option and was assessed as having adverse effects on ecology through habitat loss, would affect public rights of way and community woodland as well as resulting in the greatest ground disturbance. The impact of an entirely new road in an existing area of arable fields was also considered to have a significant effect on the local landscape.
- 27.11.11 In terms of Environmental ranking the options ranked 1-2-4-3 in order of preference option 1 being the best

### **Consultation Feedback**

- 27.11.12 The overall result from the consultation feedback with regard to route preference was that the Options ranked 4-3-1-2 in order of preference with Option 4 being favoured by more responses and having fewer responses against.
- 27.11.13 It was confirmed that Options 3 and 4 were generally most preferred by local authorities, with Option 3 slightly more favoured.

## **27.12 PRD Discussion and Deliberation**

- 27.12.1 The following is a summary of the discussion at the PRD
- 27.12.2 It was discussed and agreed that consideration of the cost estimates (high), disruption to the public, longer construction periods and the low level of support from both the public and local authorities (more against than in favour) for Options 1 and 2 that these options should be discounted at this point.

### **Option 3 and 4 comparison**

- 27.12.3 It was noted that there was no discernible difference on economic or environmental considerations between Options 3 and 4

27.12.4 Both gave the opportunity for improvements for pedestrians, cyclists and equestrian riders, with both allowing the utilisation of the existing A47 for this purpose.

27.12.5 Both Option 3 and 4 had been estimated as requiring 18 months to construct.

27.12.6 Option 3 was slightly more expensive (£86.01m compared to £83.05m) than Option 4 and potentially could lead to greater severance to farms, community woodland and dwellings. However, Option 3 did have a slight majority in favour from the local authorities from the consultation results.

27.12.7 Option 4 was the only option that showed an overall majority of support from the public and was the most favoured by the public; it was also the cheapest.

## 27.13 Preferred Route Decision

27.13.1 The meeting agreed that Route Option 4 should be taken forward as the preferred route option.

## 27.14 Preferred Route Summary

### Option 1

- Pros
  - Least land take
  - The most environmentally preferred option
- Cons
  - Online so high disruption during construction
  - Highest Cost

### Option 2

- Pros
  - Allows for improvements for pedestrians, cyclists and equestrian riders on the existing A47
- Cons
  - Longest and most complicated construction period

### Option 3

- Pros
  - Most supported by local authorities
  - Completely off line so easy to construct
  - Joint shortest construction period

- Allows for improvements for pedestrians, cyclists and equestrian riders on the existing A47
- Cons
  - Possible severance of farmland communities and woodland
  - Highest land take
  - Third preferred option for environmental considerations

#### **Option 4**

- Pros
  - Most supported by general attendees of the Public Information Events.
  - Lowest cost
  - Completely off line so less disruptive during construction.
  - Joint shortest construction period
  - Allows for improvements for pedestrians, cyclists and equestrian riders on the existing A47
- Cons
  - Fourth environmentally preferred route (at this stage)
  - Loss of un-useable farmland between existing A47 and new alignment

### **27.15 Interim SGAR 2**

27.15.1 Following the PRD meeting an Interim Stage Gate Review was held to confirm the status of the scheme

27.15.2 The Interim SGAR acknowledged the risk of making a Preferred Route Announcement (PRA) prior to the completion of the assessment work but concluded that the level of risk was acceptable and risk was sufficiently mitigated by the initial assessments made

27.15.3 It was confirmed that the PCF Stage 2 reporting should be concluded alongside the PCF Stage 3 supplier commencing developing the scheme based on the PRA. PCF Stage 2 environmental, transport and economic assessments should be completed where time limited for PRD and written up within transportation, economics and environmental reports and these summarised within the Scheme Assessment Report to verify the PRA decision. These completed assessments are presented in the following chapters

- Chapter 28 Transportation Assessment
- Chapter 29 Economic Assessment
- Chapter 30 Environmental Assessment
- Chapter 31 Additional Assessment of Public Consultation
- Chapter 32 Appraisal Summary Tables



27.15.4 The above completed assessment will then be used to confirm and validate the assessments prepared for PRD

## 28 Traffic Analysis

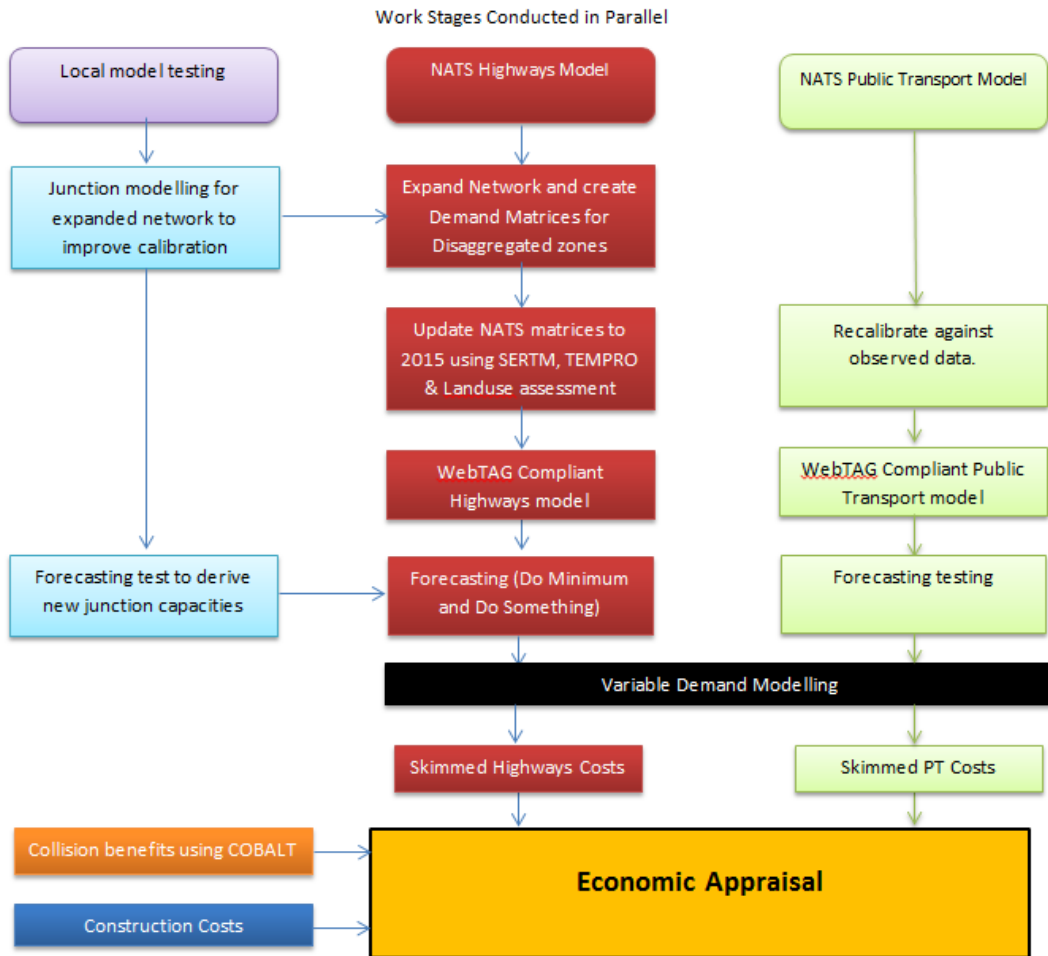
### 28.1 Introduction

- 28.1.1 As explained in Chapter 12, the traffic analysis of the scheme has been undertaken using an updated and revalidated version of the NATs model.
- 28.1.2 The detailed methodology to update the NATS model has been developed through PCF Stage 1 and 2. The detail of the methodology and revalidation of the model is contained in the “Local Model Validation Report”.
- 28.1.3 Following validation of the updated NATs model, the model has been used as a base for traffic forecasting. The methodology and results of the traffic forecasting are contained within the “Traffic Forecasting Report”
- 28.1.4 The Local Model Validation Report and the Traffic Forecasting Report have been reviewed by the Highways England Transport Planning Group to ensure the modelling and forecasting work is suitable to provide a robust analysis of the proposed scheme and suitable to make appropriate assessments of the scheme options during PCF Stage 2.
- 28.1.5 The following sections give a brief over view of the method in summary form and a brief overview of the process to update and revalidate the NATS model and the methodology and results of the traffic forecasting undertaken using the model. The results and outputs of the forecasting have been used to provide an economic assessment of the scheme (see Chapter 29) and to inform the traffic based environmental assessments of noise and air quality (see Chapter 30).

### 28.2 Outline methodology

- 28.2.1 The traffic assessment will focus on the scheme location and local roads that are likely to be affected by any change in connectivity with the A47. The assessment of each of the scheme options will be based on a revision of the existing NATS model. The outline approach is presented in Figure 28-1 below
- 28.2.2 The junction modelling will be used to establish junction capacities in the expanded area of NATS model. This junction modelling will also be used in the operational assessment stage to test future traffic flows on the junctions.

**Figure 28-1 : Scheme appraisal - PCF Stage 1/2 Programme Outline**



## 28.3 Norwich Area Transport Strategy (NATS)

28.3.1 The Norwich Area Transport Strategy (NATS) Model consists of three main elements:

- A highway assignment model developed in SATURN
- A public transport model developed in VISUM
- A demand model using the DIADEM software

28.3.2 The original NATS base model was developed in 2002 and re-validated using 2006 flows in April 2011. This highway assignment base model was again calibrated using 2012 traffic flows to test Northern Distributor Road (NDR) DCO process. The LMVR for the calibration using 2012 flows was issued in January 2014 and states that the model is WebTAG compliant.

28.3.3 The NATS model matrix development for the 2012 model was rebased using the 2006 NATS synthetic matrices. For private vehicles only the 2006 tripends have been retained and factored by purpose using NTEM 6.2 to give 2012 tripends. For goods vehicles the previous matrices have been used as a basis from which to prepare the 2012 trip matrices.

28.3.4 The current NATS model was updated to support the DCO application of the Norwich Northern Distributor Road (NDR). The NDR will be a 20km long dual carriageway road

connecting the A47 from Postwick to A1067 Fakenham Road, as shown in Figure 5. The NDR scheme work started in December 2015 and is expected to be completed in 2017.

- 28.3.5 The NATS highway and public transport assignment models have been developed for AM Peak (08:00 to 09:00), average Inter-peak hour (10:00 to 16:00) and PM Peak hour (17:00 to 18:00).

## 28.4 Use of NATS Model

- 28.4.1 It is intended that the scheme options will be tested in a revised expanded NATS highways model, not a cordon model. Full details of the existing model extents and areas of coverage and the increased model coverage from the updates proposed are included in the Appraisal Specification Report. The model will also include expansion on the eastern and western sides of Norwich to facilitate the assessment of the Tuddenham to Easton and Thickthorn schemes.

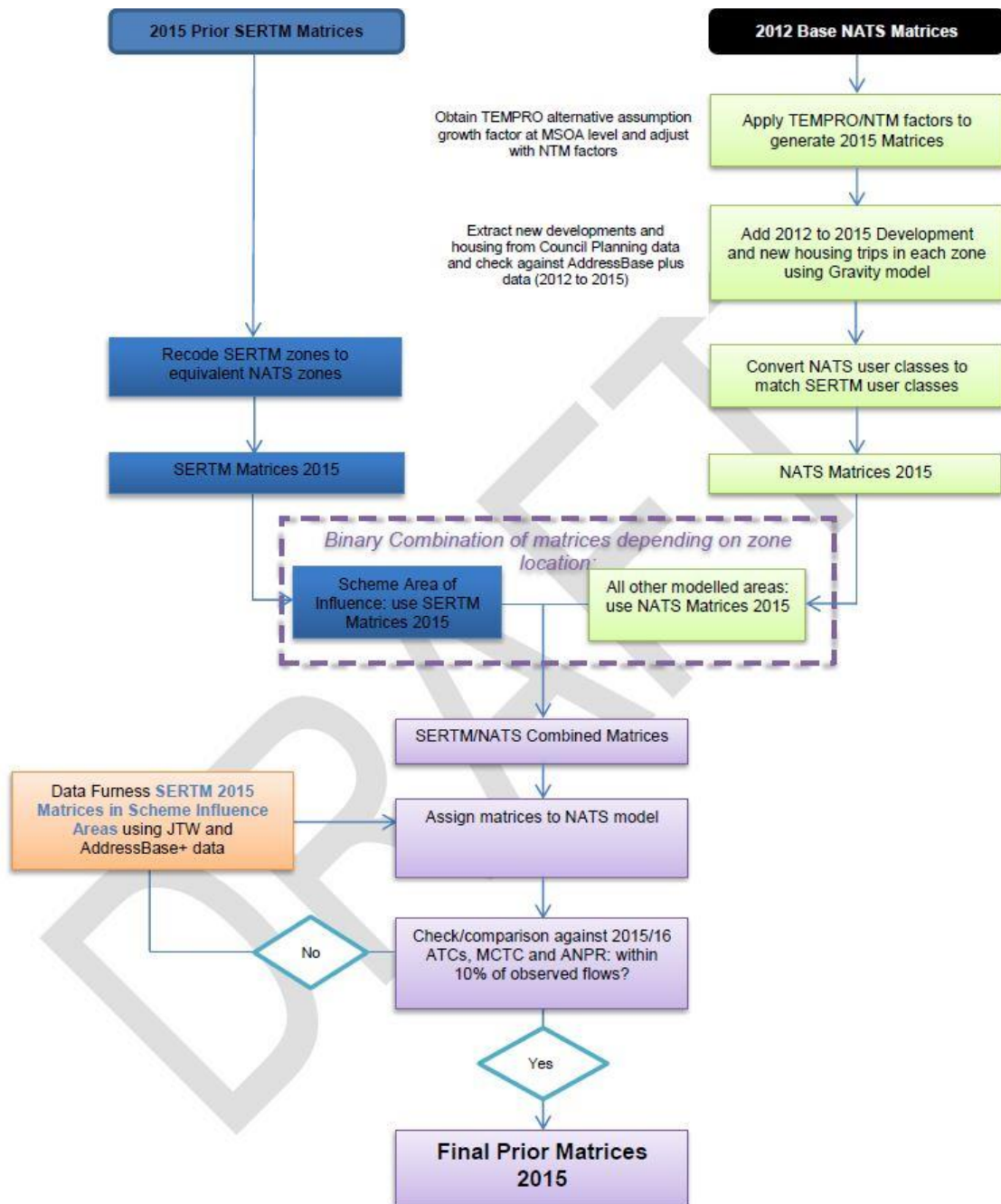
### Update to NATS Model Detail

- 28.4.2 The local road network in the vicinity of the scheme area has not been modelled in detail in the current NATS base year model.
- 28.4.3 Part of the scheme lies in the fully model area but outside the area of detailed modelling (the non-detailed area), while the remaining part lies in the buffer area. The proposed A47 scheme requires expansion of the NATS model especially in the region of the scheme.
- 28.4.4 The portion of the scheme in the fully model area but outside the area of detailed modelling of the NATS model is modelled. Junctions in this area have been coded with less detail than those within the area of detailed modelling. As such amendments to junctions, saturation flows and signal timings are required to increase the detail of the junctions in this area.
- 28.4.5 The local road network within the scheme influenced area is not included in the current NATS model. New nodes and links will be added to the NATS model so the impact on the local road network can be assessed. A refinement of zones in the area is also required.

### Modify zones and matrices

- 28.4.6 The current NATS model's zones in the scheme influenced simulated area will be disaggregated to a level to match the new links. Figure 12-2 shows the proposed new zoning within the scheme influenced area. The zone boundaries correspond with existing ward boundaries.
- 28.4.7 Land-use data for the disaggregated zones, including main land-use types, density/scale of activities and dominant trip purposes, will be derived from aerial photos, maps, plan data and 2011 census journey to work data. This will then be used to construct the demand matrix for the disaggregated zones.
- 28.4.8 As part of the model updates, the modelled zones within the model, and the matrices used within the model, will be updated using information from the Strategic Eastern Regional Model which has been developed by Highways England.
- 28.4.9 The process for matrix update is shown in Figure 28-2 below

Figure 28-2 Process for Matrix upgrade



### Calibrate and validate

28.4.10 The model recalibration and revalidation process of the 2012 base year NATS models will be carried out in accordance with WebTAG M3.1. The process will be undertaken using the calibration and validation of the models from an iterative process to achieve a robust platform for option testing.

28.4.11 The model calibration process will be carried out to ensure that the model assignments are appropriate and representative. Calibration is an iterative process in which the model is continually revised to ensure that:

- Traffic patterns throughout junctions are modelled accurately, including vehicle turning proportions;

- Traffic journey time on all the major routes, which include delays and queues.
- Junctions are modelled accurately in terms of vehicle behaviour, especially at stop lines and lane changing; and
- Traffic volumes through the junction are modelled accurately.

28.4.12 In order to achieve matrix calibration in the scheme area new screenlines will be introduced at the matrix build stage.

## 28.5 Forecast Approach

28.5.1 The current NATS model is based on 2012 flows. Any new (2015 or 2016) data obtained to expand current NATS model in the vicinity of scheme will also be factored back to 2012 by using NTM growth factors.

### Demand Forecasting

28.5.2 All forecasts will be completed in line with the WebTAG guidance on uncertainty given in Unit M4 'Forecasting and Uncertainty'. Local development information will be collected and classified according to the certainty that the development is likely to come forward. Only 'near certain' and 'more than likely' developments will be included in the core scenario.

### Supply Forecasting

28.5.3 As with the demand forecasts, all transport improvements which are either 'certain' or 'more than likely' to come forward will be included in the core scenario network for the without scheme and with scheme scenario.

### Income and fuel costs

28.5.4 Forecast Values of Time and Vehicle Operating Costs will be taken from WebTAG data book

### Variable demand modelling

28.5.5 Variable Demand modelling will be carried out as per WebTAG guidance to make sure that correct trip frequency and trip distribution is produced by the model. The convergence will also be checked against WebTAG to make sure that equilibrium has been achieved. The existing mode choice model will be kept and used in the analysis as it is expected that mode choice will not be effected this scheme.

### Realism Testing

28.5.6 Demand Model Realism testing will be undertaken on the base-year demand model in accordance with WebTAG M2.

### Western Link Road

28.5.7 Also under consideration is the Western Link Road (WLR) route which runs from the A47 to the A1067. (see Chapter 7.2) This route was originally part of the NDR route but was removed due to environmental constraints. Further work was carried out in September 2014 using the NATS model to evaluate potential route options. It is expected a WLR route would generate additional traffic on the A47 as it will connect through traffic from the A47 East as well as attracting other traffic to the route.

28.5.8 The current uncommitted status of the Western Link Road means that it will not be included in the modelling for this scheme in the current PCF Stage, but sensitivity testing is likely to be

required during junction and side road strategy and in future PCF Stage assessments to understand the potential influence of the route on the proposals.

## 28.6 Model Calibration, Validation and Convergence Results

28.6.1 As noted in the introduction (Chapter 28.1) the NATS model update and validation results are discussed in detail in the Local Model Validation Report

### Model Calibration

28.6.2 Each base year time period model was successfully calibrated against reference data, in respect of: network and zone configurations; O/D travel demands and segmentation; journey routes chosen; and network operational performance under trip matrix assignment.

### Model Validation

28.6.3 The reliability of the calibrated base year models was also satisfactorily verified against separate reference data and TAG criteria. The models were shown to achieve acceptable levels of 'validation' with regard to: O/D trip changes during ME; individual link and junction flows; 'pragmatic' aggregated screen-line movements; and route journey times.

### Model Convergence

28.6.4 It was confirmed that each base year time period model had been run to an appropriately 'converged' steady-state of assignment 'equilibrium', such that the outcomes extracted from the models were dependable and would not change under further assignment iterations. Satisfactory convergence was checked in respect of achieving: 'proximity' to the minimised travel-cost objective; and 'stability' between the ultimate assignment iterations, in terms of traffic flows and network delays.

### Variable Demand Travel Responses

28.6.5 DIADEM has been satisfactorily configured and tested for 'realism' and integrated with the hybrid SATURN model, as a tool for predicting 'variable demand', or people's changing travel decisions, in response to changing travel costs. This enables a realistic picture of how travellers may change trip frequency, change travel mode, change trip destination, or change highway route, as generalised travel costs (time and distance) rise and fall.

28.6.6 This VDM aspect of the A47 hybrid model is important, as it could have a considerable influence on the outcomes and reliability of the forecast A47 scheme appraisals.

### Overall Conclusion

28.6.7 The LMVR reporting lists the model strengths and weaknesses and concludes that "it is judged that the A47 hybrid 2015 base year model gives a sufficiently accurate overall representation of true highway conditions to provide a reliable foundation from which to develop scheme forecasts. It should therefore be accepted as such."

## 28.7 Forecasting Results Traffic Flows

28.7.1 As noted in the introduction (Chapter 28.1) the traffic flows taken from the forecasting results are discussed and presented in the Traffic Forecasting Report, A47 IMPS2-AMY-BB-DO-J0029.

28.7.2 Model outputs extracted from the Traffic Forecasting Report for the comparative 2-way AADT flows on the A47 with and without the scheme in the core scenario are summarised in **Table 28-1**.

**Table 28-1 Forecast 2-Way AADT Flows on the A47 at 2021 and 2036, Core Scenario**

Link	Year	DM	DS1	DS2	DS3	DS4
<b>Modelled Flow (AADT)</b>						
A47 at Blofield	2021	2021	2021	2021	2021	2021
	45953	45953	45953	45953	45953	45953
A47 at North Burlingham	2021	2021	2021	2021	2021	2021
	34729	34729	34729	34729	34729	34729
<b>Flow Change from Do Minimum (%)</b>						
A47 at Blofield	2021	-	5.5%	5.8%	5.8%	5.8%
	2036	-	4.1%	4.2%	4.2%	4.2%
A47 at North Burlingham	2021	-	15.3%	14.6%	15.0%	15.4%
	2036	-	19.2%	18.3%	18.8%	19.4%

28.7.3 The comparison in **Table 28-28-1** demonstrates that the proposed capacity improvements between North Tuddenham and Easton bring about significant increases in traffic flow in all options. Some of the key outcomes are as follows:

- Do Something 3 attracts the largest number of users to the A47 at both Blofield and North Burlingham by 2036, however, there is little difference between the various options; and
- Across the different scheme options and sections, traffic flow on the A47 increases by around 9.6% (averaged over all options/sections) at 2021 and 9.9% at 2036 with the introduction of the scheme.

### Changes in Traffic Flows on the Wider Network

28.7.4 The A47 Blofield to North Burlingham improvement is not expected to make a significant impact upon individual traffic flows across the wider study area. Examination of the AADT flow plots for the core scenario shows that the scheme would impact on several local routes (both positively and negatively), but the changes would be relatively small overall. Refer to the Traffic Forecasting Report for further detail.

## 28.8 Forecasting Results Journey Times

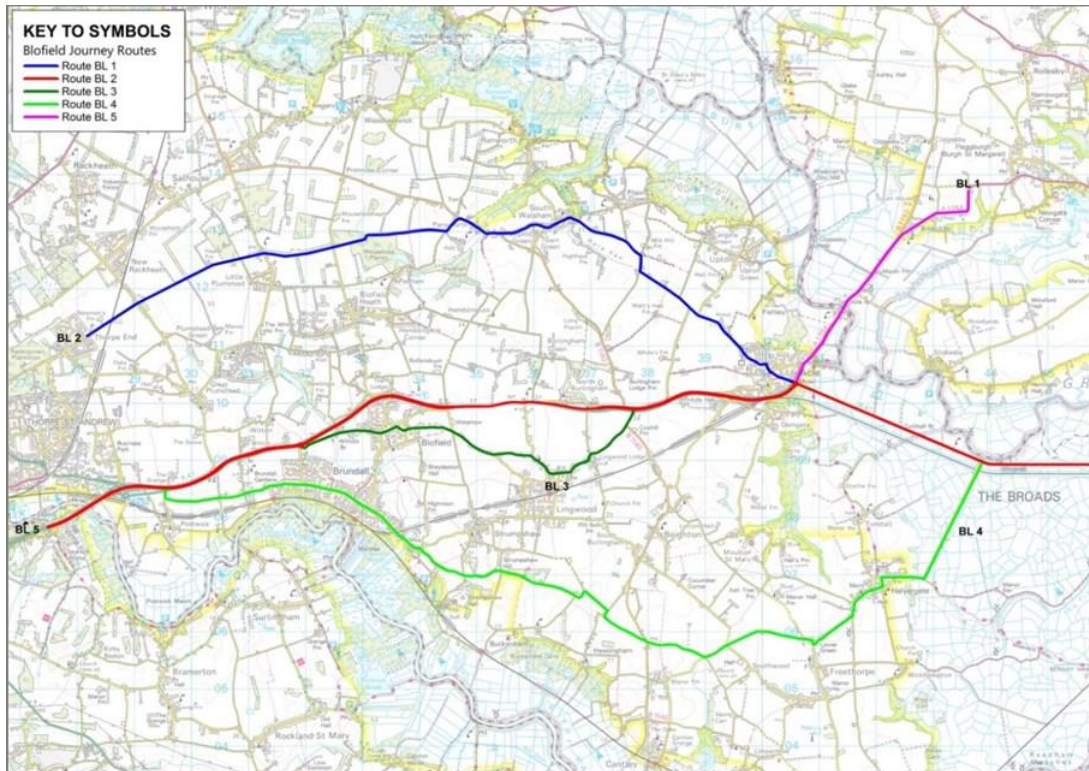
28.8.1 As noted in the introduction (Chapter 28.1) the forecasted changes in journey times taken from the forecasting results are discussed and presented in the Traffic Forecasting Report

28.8.2 The report compares the journey times between fixed points across the Area of Interest on the existing A47, parallel routes and others that pass through the area for the forecast year do minimum and do something scenarios. The six routes are shown in Figure 28-3 below

28.8.3 All the network changes for do something scenarios occur along Route BL5 and beyond this route the networks are the same for all options.



**Figure 28-3 Journey Time Comparison Routes Locations**



28.8.4 The journey times for each route are presented in the forecasting report **Table 28-2** and **28-3** below present a summary for the 2036 modelled journey times to show a comparison between the Do-minimum and the 4 scheme options for the core scenario. Results for other modelled years and interpeak periods can be found in the Traffic Forecasting report.

**Table 28-2 AM Peak Journey Time Comparison (2036 Core Scenario)**

Route	Direction	DM	DS1	DS2	DS3	DS4
<b>Modelled Journey Times (min:sec)</b>						
BL1	EB	02:47	02:47	02:47	02:47	02:47
	WB	03:06	03:24	03:26	03:26	03:25
BL2	EB	14:27	19:16	19:13	19:13	19:15
	WB	16:02	15:50	15:50	15:50	15:50
BL3	EB	11:45	12:52	12:51	12:53	12:54
	WB	08:33	09:12	09:11	09:21	09:18
BL4	EB	28:18	31:07	31:03	31:04	31:04
	WB	22:13	22:30	22:31	22:31	22:31
BL5	EB	17:59	17:00	16:59	16:59	16:59
	WB	19:25	18:09	18:13	18:13	18:08
<b>Change from Do Minimum (min:sec)</b>						
BL1	EB	-	00:00	00:00	00:00	00:00
	WB	-	00:18	00:20	00:20	00:19
BL2	EB	-	03:47	03:44	03:44	03:46
	WB	-	-00:31	-00:31	-00:31	-00:31

Route	Direction	DM	DS1	DS2	DS3	DS4
BL3	EB	-	01:07	01:07	01:08	01:09
	WB	-	00:39	00:38	00:48	00:45
BL4	EB	-	02:49	02:45	02:46	02:47
	WB	-	00:17	00:18	00:18	00:18
BL5	EB	-	-01:00	-01:00	-01:00	-01:00
	WB	-	-01:16	-01:12	-01:12	-01:17

**Table 28-3 PM Peak Journey Time Comparison (2036 Core Scenario)**

Route	Direction	DM	DS1	DS2	DS3	DS4
<b>Modelled Journey Times (min:sec)</b>						
BL1	EB	02:54	02:54	02:54	02:54	02:54
	WB	02:47	02:49	02:50	02:50	02:50
BL2	EB	15:11	17:42	17:43	17:43	17:43
	WB	15:41	15:52	15:52	15:52	15:52
BL3	EB	10:18	08:50	08:53	08:52	08:53
	WB	08:16	08:15	08:14	08:20	08:20
BL4	EB	25:52	26:00	25:57	25:56	25:57
	WB	22:07	22:06	22:06	22:06	22:06
BL5	EB	19:54	19:19	19:19	19:17	19:19
	WB	17:54	16:24	16:24	16:24	16:23
<b>Change from Do Minimum (min:sec)</b>						
BL1	EB	-	-00:00	-00:00	-00:00	-00:00
	WB	-	00:03	00:03	00:03	00:03
BL2	EB	-	01:16	01:16	01:16	01:17
	WB	-	-00:10	-00:10	-00:10	-00:10
BL3	EB	-	-01:28	-01:25	-01:26	-01:25
	WB	-	-00:00	-00:02	00:04	00:04
BL4	EB	-	00:08	00:04	00:04	00:05
	WB	-	-00:01	-00:01	-00:01	-00:00
BL5	EB	-	-00:35	-00:35	-00:37	-00:35
	WB	-	-01:30	-01:31	-01:30	-01:31

28.8.5 The comparison of scheme options against the do minimum journey times shows there is little difference between the various options. The following describes the key impact on the A47:

- Travel times eastbound along the A47 (route BL5) are around 10% quicker (around 1.5 mins) in 2021 and around 7% (around 1 min) in 2036 in the do something than in the do minimum; and
- Travel times westbound along the A47 (route BL5) are around 10% quicker (around 1.5 min) in 2021 and around 9% (around 1.5 min) in 2036 in the do something than in the do minimum.

## **28.9 Forecasting Results for Environmental Assessment**

28.9.1 Peak hour flows, AADT flows, 24hr and 18hr AAWT flows and speeds have been calculated using the model outputs and have been made available to the highway design and environmental noise and air quality modelling teams as part of the design development and environmental assessments processes.

## **28.10 Assignment Results for Operational Performance Assessment**

28.10.1 Operational assessment has not been done at this stage of the PCF process. It has been assumed that the junctions will be designed with sufficient capacity and the design is not yet at a standard where assessing the operational capacity of the junctions would add anything to scheme assessment.

28.10.2 A uniform junction strategy has been applied across the four options so that the only difference between options is the alignment. This allows the selection of the best route without any potentially misleading effects arising from the influence of various junction layouts.

## 29 PCF Stage 2 Economic Assessment

### 29.1 Introduction

29.1.1 This section summaries the methodology and results of the Economic Assessment of the four options undertaken in PCF Stage 2. The transportation modelling and forecasting assessment detailed in Chapter 28 provides the input to the Economic assessment detailed in this Chapter

### 29.2 Economic Assessment Methodology

29.2.1 The methodology of the economic assessment is broadly similar to that undertaken in PCF Stage 1 and detailed in Chapter 18. The user benefits of the scheme have been assessed using TUBA 1.9.7, with costs provided by Highways England Commercial team.

29.2.2 Accident benefits were calculated using COBALT version 2013.02.

29.2.3 The economic appraisal process follows WebTAG guidance and assumptions, where practical, for the assessment.

29.2.4 Traffic volumes and journey times have been taken from the modelling undertaken. The distances of each do-something option have been taken from the long section plans produced by the engineering team. Default journey purposes and vehicle split/user classes from WebTAG have been used.

### 29.3 Travel Time and Vehicle Operating Costs

29.3.1 The user benefits of the scheme are the savings in travel time and vehicle operating cost, accrued over 60 years following the assumed opening of the scheme in 2021. Journey time savings and changes in vehicle operating costs have been calculated for the representative scheme, compared to the Do-Nothing, using TUBA 1.9.7.

29.3.2 The User Benefits to travel time and vehicle operating costs, in present values discounted to 2010, in 2010 prices, are shown in the Economics Summary tables below.

### 29.2 Accidents

29.3.3 The benefit from a reduction in collisions has been calculated using Cobalt v2013\_02. Collisions have been assessed using a combined link and junction based assessment. In the Do Minimum, link type 8 has been assumed which represents a single carriageway A road designed to modern standards. In the Do Something, link type 10 has been assumed which represents a dual carriageway with two lanes in each direction designed to modern standards.

29.3.4 The results are included in the AMCB table.

### 29.4 Assumptions

29.4.1 A number of assumptions have been performed in the construction of economic analysis, and these must be considered in the context of the assessment as a whole:

- The assessment at this point does not consider construction delays, the impact of accidents or noise and air quality at this stage;

- Journey purpose splits and vehicle occupancies do not utilise local data and are instead based entirely on national averages from the WebTAG Data Book;
- The model outputs represent the average of a full peak hour; no profiling or shoulder peaks have been modelled and annualisation has been used to provide a best estimate of how benefits rise and fall over the full day;
- Only basic greenhouse gas emissions data from TUBA has been used to generate quantitative environmental impact

## 29.5 Journey Time Reliability

29.5.1 Journey time reliability is typically impacted by two main sources: incidents and congestion. Incidents are those which reduce or stop carriageway capacity, typically accidents or vehicle breakdowns. Congestion effects journey time reliability when the flow exceeds capacity and a break down in the flow occurs. Anecdotal evidence suggests that journey time reliability on the A47 is also affected by the presence of agricultural vehicles and limited safe overtaking opportunities.

29.5.2 Dualling the A47 would address the two main typical sources impacting journey time reliability; the A47 would be more resilient to incidents and the increased capacity would reduce the incidence of congestion causing a break down in flow. The effect of the presence of agricultural vehicles would be reduced by providing a second lane which other vehicles could use to overtake.

## 29.6 Option Estimate

29.6.1 The Options estimates used in the PCF Stage 2 economic assessment are described in Chapter 26

## 29.7 Economic Summary Tables

### Transport Economic Efficiency

29.7.1 The Transport Economic Efficiency (TEE) table for each option is shown in **Table 29-1**. User charges, private sector provider impacts and developer contributions are omitted from this table as they do not apply to this scheme, and maintenance delays have not been assessed, as is explained elsewhere in the report.

**Table 29-1 Transport Economic Efficiency**

Option	User type	Benefit type	Benefits by journey type			
			Road Personal	Road Freight	Bus Personal	Total
Option 1	Commuting	Journey time	18285	-	-	18285
		VOCs	-5961	-	-	-5961
	Other	Journey time	48796	-	-	48796
		VOCs	-16798	-	-	-16798
	Business	Journey time	20599	31675	-	52274
		VOCs	328	-4221	-	-3893
Present Value of Transport Economic Efficiency Benefits						<b>93165</b>
Option 2	Commuting	Journey time	18835	-	-	18835
		VOCs	-5936	-	-	-5936
	Other	Journey time	48931	-	-	48931

Option	User type	Benefit type	Benefits by journey type			
			Road Personal	Road Freight	Bus Personal	Total
		VOCs	-16568	-	-	-16568
		Business	Journey time	20696	32422	-
		VOCs	511	-3605	-	-3094
	Present Value of Transport Economic Efficiency Benefits					<b>95907</b>
	Option 3	Commuting	Journey time	19449	-	-
VOCs			-6048	-	-	-6048
Other		Journey time	48666	-	-	48666
		VOCs	-16591	-	-	-16591
Business		Journey time	20605	32200	-	52806
		VOCs	429	-3705	-	-3276
Present Value of Transport Economic Efficiency Benefits					<b>95418</b>	
Option 4	Commuting	Journey time	17737	-	-	17737
		VOCs	-5958	-	-	-5958
	Other	Journey time	48833	-	-	48833
		VOCs	-16766	-	-	-16766
	Business	Journey time	20620	31604	-	52225
		VOCs	512	-3740	-	-3228
	Present Value of Transport Economic Efficiency Benefits					<b>93229</b>

29.7.2 The scheme is predicted to deliver TEE benefits ranging between £93m and £95m. Business users are predicted to benefit from vehicle operating costs whilst commuters and other users will see a disbenefit. All users will have significant benefits associated with improvements in journey times with all options. Personal travel accounts for over 70% of benefits in all options with freight less than 30%.

### Public Accounts

29.7.3 An abridged Public Accounts (PA) table for each option is shown in **Table 29-2**. In the absence of any revenue, operating cost data, developer contributions and grants/subsidies, only the cost to central government and the changes in indirect tax revenues are non-zero for this scheme.

29.7.4 The PA is reported as a cost table, so the signs are inverted from the other tables in this chapter; costs appear as positive numbers while benefits appear negative.

**Table 29-2: PA table**

All figures in £1000s at 2010 prices and values

Option	Central Government Broad Transport Budget	Wider Public Finances
Option 1	61359	-17580
Option 2	62072	-17510
Option 3	56328	-17536

Option 4	54578	-17598
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29.7.5 The present year costs (discounted to 2010, in 2010 prices) associated with each option range from £55million (Option 4) to £62million (Option 2).

### Cost Benefit Analysis

29.7.6 The cost-benefit analysis for each option is summarised in the Analysis of Monetised Costs and Benefits (AMCB) table shown in **Table 29-3**. The AMCB is constructed from the TEE and PA tables, and allows for the effects of construction delays, accidents and greenhouse gas emissions.

**Table 29-3: Core scenario AMCB table**

All figures in £1000s at 2010 prices and values

Category	Benefit			
	Option 1	Option 2	Option 3	Option 4
Construction delays	Not Assessed			
Accidents	5313	5078	5074	5098
Greenhouse Gas Emissions	-1731	-861	-6807	-4360
Noise Impacts	-246	-380	-414	-278
Air Quality Impacts	2676	2918	2435	2531
Commuter travel time benefits	12339	12892	13170	11805
Other user travel time benefits	32478	32959	32680	32391
Business user travel time benefits	48348	50056	49568	49033
Indirect taxation revenues	17580	17510	17536	17598
Present Value of Benefits (PVB)	116757	120172	113242	113818
Present Value of Costs (PVC)	61359	62072	56328	54578
Net Present Value (NPV) = PVB - PVC	55398	58100	56914	59240
Benefit to Cost Ratio (BCR) = PVB ÷ PVC	1.90	1.94	2.01	2.09

29.7.7 Present Value Benefits (PVB) for the different options range between £114million (Option 4) and £113million (Option 3) with Present Value of Costs ranging between £55million and £62million. **Table 29-3** indicates that in all options, the scheme delivers significant benefits over and above its cost and is likely to repay the central government investment over the scheme appraisal period.

## 29.8 Non-Monetised Benefits

29.8.1 Other benefits such as regeneration effects have not been monetised at this stage, relying on the regional growth scenario to determine the level of regeneration expected for the scheme. It is recognised that there is the potential for benefits to be derived from the scheme, including:

- Expected journey time benefits for business users will help support planned residential and employment regeneration in the Norwich Area;
- Improvements in journey times will improve access to services in Norwich from the areas local to the scheme;

- Benefits in journey time savings will improve resilience and reliability which directly affect journey quality, predominantly associated with traveller stress; and

## 29.9 Economic Summary

29.9.1 Value for Money assessments are produced to support scheme and programme decisions, whereby the performance of the scheme, utilising the BCR can be appraised on a common scale. A Value for Money (VfM) category is defined for each option's BCR as described in the DfT's "Value for Money Assessment: Advice Note for Local Transport Decision Makers". The VfM categories are shown in **Table 29-4**.

29.9.2 The scale is defined as follows:

**Table 29-4 Value for Money Categories**

Rating	BCR
Poor	< 1.0
Low	> 1.0 and < 1.5
Medium	> 1.5 and < 2.0
High	> 2.0 and < 4.0
Very High	> 4.0

29.9.3 Option 4 is observed to have the highest Benefit to Cost Ratio (BCR) at 2.09 and is observed to be the cheapest option.

29.9.4 A Value for Money (VfM) category is defined for each option's BCR as described in the DfT's "Value for Money Assessment: Advice Note for Local Transport Decision Makers". The VfM categories are shown in Table 29-4. It can be observed that all options provide a positive BCR in the Medium or High VfM category.



## 30 Environmental Assessment

### 30.1 Introduction

30.1.1 The purpose of this section is to provide a summary of the environmental assessment undertaken during the Stage 2 PCF process. The PCF Stage 2 Environmental Assessment Report (EAR) is a standalone document which provides a detailed assessment of the environmental effects of the proposed option for the A47 Blofield to North Burlingham dualling scheme. The EAR also provides assurance that all legislative requirements to safeguard the existing environment are complied with, and to support this, an Environmental Impact Assessment (EIA) screening report and Habitats Regulations Assessment (HRA) have also been produced.

### 30.2 Options considered

30.2.1 In seeking to resolve the transport problem eight potential options were developed and assessed during PCF Stage 1 to identify their performance against environmental, engineering, transportation and economic criteria so that they could be compared to allow the most appropriate options to be taken forward. This concluded with four of the options being taken forward to public consultation in PCF Stage 2. The options all resolved the transport problem, further details can be found in Chapters 10-12. The four options taken forward to public consultation in PCF Stage 2 were renumbered as explained in Chapter 22. The options are described below.

#### Option 1 Online widening

30.2.2 Option 1 is online dualling of the existing A47 route, with some sections moving away from the existing highway corridor. The junction at the western end of the scheme will allow traffic to access the A47 westbound from Yarmouth Road only. A new local access road will be created which will extend Yarmouth Road and connect to Main Road in North Burlingham. This link road will be located to the north of the dualled A47 and cross the route on an overbridge.

30.2.3 The junction at the eastern end of the scheme will be a new at grade roundabout on the A47 with connections to South Walsham Road to the north and to Acle Road to the south. Both South Walsham Road and Acle Road will be slightly realigned to connect into the new roundabout, with the existing junctions with the A47 stopped up. A new link road will be provided connecting Main Road in North Burlingham with South Walsham Road.

#### Option 2 Offline widening to north and south

30.2.4 Option 2 is offline dualling to the north of Blofield and to the south of North Burlingham. The existing A47 where unaffected by the new dual carriageway will remain as part of the local road network. The junction at the western end of the scheme will allow traffic to access the A47 westbound only from Yarmouth Road. A new local access road will be constructed connecting the slightly realigned Yarmouth Road with the old A47, with the new A47 passing under the existing route.

30.2.5 The junction at the eastern end of the scheme will comprise a new at grade roundabout on the A47 with connections to South Walsham Road and Acle Road. Acle Road will be realigned at the northern section to connect into the new roundabout. A new short link road will be constructed to connect Main Road to South Walsham Road.

### **Option 3 Offline to the south**

- 30.2.6 This option is offline dualling to the south of the existing A47. The western junction will be revised with only westbound traffic accessing the A47 from Yarmouth Road. A new access link road will be constructed which will connect Yarmouth Road with the old alignment of the A47 passing over the A47 on an overbridge. The junction of Yarmouth Road and Hemblington Road will be upgraded to a T junction or roundabout.
- 30.2.7 The eastern junction will comprise a new at grade roundabout on the A47 with connections to South Walsham Road and Acle Road. Acle Road will be realigned slightly at its northern end to connect to the roundabout and a new link road constructed connecting Main Road to South Walsham Road.

### **Option 4 Offline slightly to the south**

- 30.2.8 Option 4 is also offline dualling to the south, although this alignment follows more closely the existing A47 than that for Option 3. The western junction for accessing the A47 from Yarmouth Road will permit westbound traffic onto the A47 only. A new roundabout will be provided at the junction of Yarmouth Road and Hemblington Road with a short section of new link road connecting to the A47 which will pass over the new alignment on an overbridge.
- 30.2.9 The eastern junction will be a new at grade roundabout on the new A47 with connections to South Walsham Road and Acle Road. Acle Road will be realigned to tie into the new roundabout and a link road will connect Main Road to South Walsham Road.

## **30.3 Assessment methodology**

- 30.3.1 The environmental assessment followed, where possible the Design Manual for Roads and Bridges (DMRB) Volume 11, Environmental Assessment. Any limitations to the environmental assessment are set out in each environmental topic section within Chapters 6 to 14 of the PCF Stage 2 EAR. For each environmental topic, a study area was identified, with the baseline conditions relevant to the scheme determined by both desk study and field study.

## **30.4 Environmental assessment of proposed options**

### **Introduction**

- 30.4.1 The following section summarises the baseline information on all environmental topics and provides a summary of the potential impacts on receptors and features of each topic from the proposed options. The environmental assessment is considered in more detail in the PCF Stage 2 EAR.

### **Air Quality**

#### **Baseline conditions**

- 30.4.2 There are no Air Quality Management Areas within the study area used for assessing air quality impacts. In order to characterise the existing air quality in the area a series of nitrogen dioxide diffusion tubes were placed at various representative locations around Blofield and North Burlingham. The tubes monitored the air quality between January 2017 and September 2017.
- 30.4.3 The diffusion tube results show that nitrogen dioxide levels in the study area are below the air quality objective of 40µg/m<sup>3</sup>.

30.4.4 Sensitive receptors were identified through a review of maps during a desk study which were then confirmed by a subsequent site visit. Sensitive receptors within 200m of each of the options were identified and are summarised in the **Table 30-1** below.

**Table 30-1 Banded receptor counts**

Layout	Band				
	0-50m	50-100m	100-150m	150-200m	0-200m
Existing	27	18	22	7	74
Option 1	25	26	21	9	81
Option 2	26	26	20	13	85
Option 3	20	17	10	12	59
Option 4	23	14	28	18	83

30.4.5 The Highways England DMRB Screening tool spreadsheet was used to estimate levels of NO<sub>x</sub>, NO<sub>2</sub> and PM<sub>10</sub> at fourteen residential receptors, chosen to be representative of the study area.

**Impacts**

30.4.6 The potential magnitude of effects during construction related to each option is considered to be minor adverse. With the implementation of mitigation measures the effect is likely to be negligible for all receptors.

30.4.7 For operation effects, predictions of air quality changes at the fourteen receptors for each option have shown a range of effects from no change to major. However, no exceedances of the AQS objectives for nitrogen dioxide are predicted with overall effects for each option assessed as not significant.

**Option 1**

30.4.8 This option will result in a reduction in the total number of receptors affected by traffic from the A47. Modelling results show that the predicted exposure at the receptors are under half the 40µg/m<sup>3</sup> objective, with the exception of The White House. The net assessment of effects on air quality for weighted concentrations of NO<sub>2</sub> and PM<sub>10</sub> shows option 1 will have an overall beneficial effect on air quality.

**Option 2**

30.4.9 Option 2 will also result in a reduction of the total number of receptors affected by traffic from the A47. The model results show predictions of annual average nitrogen dioxide are under the 40µg/m<sup>3</sup> objective with the exception of the White House. Overall option 2 will have a beneficial effect on air quality.

**Option 3**

30.4.10 Option 3 will result in a reduction of the total number of receptors affected by traffic from the A47. The modelled results show predicted exposure at all receptors, with the exception of the White House, as under half the 40µg/m<sup>3</sup> objective for nitrogen dioxide. Overall, there will be a beneficial effect on air quality.

**Option 4**

30.4.11 Option 4 will result in a reduction in the total number of receptors affected by traffic. With the exception of the White House, all modelled receptors will experience nitrogen dioxide levels under half the 40µg/m<sup>3</sup> objective. Overall, option 4 will have a beneficial effect on air quality.

**Option Ranking**

30.4.12 Option 2 is the preferred option for air quality as the net route assessment benefits are the highest for the three off line options, all of which reduce the number of receptors exposed to

pollutants compared to existing. Option 1, the online option is the least preferred option as the carriageway remains closest to the highest number of receptor exposures. In summary the options are ranked from most to least preferred as:

- Option 2
- Option 3
- Option 4
- Option 1

## **Cultural Heritage**

### **Baseline conditions**

30.4.13 There are numerous archaeological sites, monuments and findspots located across the study area. North of the A47 are extensive areas of former field systems which have been identified as cropmarks on aerial photographs. These may date from the late Prehistoric to the Roman period. South of the A47 cropmark evidence suggests former field systems and associated features are present with a Bronze Age barrow cemetery to the south east of Blofield.

30.4.14 Evidence of medieval agricultural activity has been identified to the north of the A47 where a series of cropmarks indicate the presence of a field system which existed prior to the creation of the parkland associated with Burlingham.

30.4.15 There are eight listed buildings within the study area, of which 2 are Grade I listed (Church of St Peter, Lingwood and Church of St Andrew on Main Road, North Burlingham). The remaining six are Grade II listed and include Church of St Peter at North Burlingham and Home Farm House on Dell Corner Lane.

30.4.16 The historic landscape character of the area reveals a rural environment, which reflects the intensification of agriculture in the late 20<sup>th</sup> century. Two post medieval parks survive, one to the west of Burlingham Green associated with Burlingham House and the other to the north of North Burlingham associated with Burlingham Hall.

### **Impacts**

#### ***Option 1***

30.4.17 Construction of the link road to the north of the A47 has potential to affect the possible late prehistoric to Roman settlement and associated field system. Once operational this option will have a moderate effect on the house known as the Old Post Office, as the link road will result in it being surrounded by roads. The option will result in the loss or interruption to historic field boundaries.

#### ***Option 2***

30.4.18 As with option 1, this option will affect the possible late prehistoric or Roman settlement and associated field system as the route alignment may result in damage to the features during construction. The alignment moves slightly further away from the listed churches in North Burlingham, having a slight beneficial effect. The route will also affect the Old Post Office, as it will be enclosed by roads.

### **Option 3**

30.4.19 This route moves away from the listed churches in North Burlingham, having a slightly beneficial effect to their setting. As this route is mostly offline, it will impact on the historic field boundaries by interrupting or resulting in the removal of boundaries.

### **Option 4**

30.4.20 This option moves the new alignment of the A47 away from the listed churches in North Burlingham, having a beneficial effect. The offline sections will result in the loss or interruption to the historic landscape character, although the effects are minor.

### **Option Ranking**

30.4.21 Overall the effects on the historic environment is broadly similar between the four options. However the significance of the effect on the late prehistoric to Roman archaeological site north of the A47 means that options 4 and 3 are preferred over options 1 and 2.

## **Landscape and Visual**

### **Baseline Conditions - Landscape**

30.4.22 The study area is located within the North East Norfolk and Flegg National Character Area. The landscape is generally flat and low lying, notable for its fertile soils, resulting in a predominance of arable farming.

30.4.23 On a local level, the study area falls within the Blofield Tributary Farmland and Freethorpe Plateau Farmland Landscape Character Areas. The Blofield Tributary Farmland LCA is dominated by arable farming with woodland found along river tributaries, enclosing historic lodges, farmhouses and around settlements.

30.4.24 The study area is set within an area of gently undulating farmland lying between Norwich to the west and Acle to the east. North of the A47 the landscape fabric is composed of small to medium rectilinear fields, with blocks of woodland at North Burlingham. South of the A47 the fields tend to be larger and woodland is restricted to narrow belts around arable fields.

30.4.25 The A47 is a major transport route in the study area and forms the principal source of disturbance in the rural environment. The churches at North Burlingham, Lingwood and Blofield are notable landmarks in the landscape. There is a network of Public Rights of Way and remissive paths located throughout the study area, often associated with the woodland areas, providing a recreational resource for local residents.

### **Impacts**

30.4.26 During construction all four options will result in the removal of vegetation, affecting the landscape structure. However, with replanting post construction, effects will be somewhat mitigated.

### **Option 1**

30.4.27 The widening of the existing carriageway will result in the loss of trees and hedgerows, affecting the landscape fabric, resulting in a moderate adverse effect. There will be no significant effects on the wider landscape character areas. At Year 15, with some maturing of vegetation the significance of effect on the landscape fabric will be slight.

### **Option 2**

30.4.28 The amount of vegetation removal for this option will be greater than for option 1, due to the offline sections north and south of the A47 and for construction of the underbridge. The effect

will be large adverse. There will be no significant effects on the wider landscape character areas. At Year 15 although vegetation will have matured the significance of effect remains large.

### ***Option 3***

30.4.29 This option will result in a new alignment through the farmland to the south of the A47. The loss of mature hedge trees and field boundaries, as well as the loss of newly created woodland will have a very large adverse effect on the local landscape fabric. There will be no significant effects on the wider landscape character areas. As this option will have the greatest amount of vegetation removal, even at Year 15 the effect on landscape fabric is large.

### ***Option 4***

30.4.30 This option will result in the removal of mature trees at the north end of Lingwood Lane and field boundaries. Small areas of newly created woodland will be lost, although this will be much less than for option 3. The significance of effect will be moderate adverse. There will be no significant effects on the wider landscape character areas. At Year 15 the significance of effect will remain moderate due to the two roads in close proximity.

## **Baseline conditions – Visual**

30.4.31 The land to the north and south of the A47 is slightly elevated creating gently sloping plateaux from which there are views across the landscape. While views are not extensive in character, they encompass tracts of countryside that exhibit well wooded characteristics with hedge trees and the influence of settlement and the existing A47.

30.4.32 There a number of residential receptors within the study area that have views of the existing A47 to varying degrees, depending on their position relative to the road and location of screening vegetation. Receptors were grouped according to their views and full detail is provided in chapter 8 of the EAR.

30.4.33 Other visual receptors in the study area include users of the Public Rights of Way and permissive paths, travellers along the A47 and minor road network and businesses in the area.

## **Impacts**

30.4.34 For all options construction impacts are temporary and associated with loss for vegetation for construction and impacts from machinery, earthworks etc. Those visual receptors closest to the construction corridor for the options will experience the most significant effects, with some properties having large adverse effects, while others will be slight adverse.

### ***Option 1***

30.4.35 For most of the residential receptors, effects from this option will be slight adverse. However, for properties at Lingwood Road close to the A47, the online dualling will have a moderate adverse effect, even at Year 15 when planting along the alignment has somewhat matured.

30.4.36 The Public Rights of Ways most likely to be affected by this options are P3 and P4 (see figure 8.7a/b in EAR). The new dualled carriageway will be visible from the northern section of P3, resulting in a large adverse effect at Year 15.

### ***Option 2***

30.4.37 Option 2 will have similar effects than option 1 on most of the residential properties. However, for residents at the Old Post Office, North Burlingham, and Poplar Farm, the significance of effect at year 15 will large due to the impact of the underbridge in views. The

White House at the eastern extent of the scheme will also have large effects due to the new roundabout and road realignments.

30.4.38 Option 2 will have very similar effects on the PRowS than option 1.

#### ***Option 3***

30.4.39 This option will bring the A47 alignment closer to properties that don't have an existing view of the carriageway. It will have moderate adverse effects on properties at Heater Lane and Hemblington Road and very large effects on properties at Lingwood Road, even at Year 15.

30.4.40 Option 3 will have a very large adverse effect on P3 as it will result in the loss of woodland and the PRow will be raised above road level on an overbridge. The road alignment will be a prominent feature in the view from the path.

#### ***Option 4***

30.4.41 The junctions at the eastern and western end of the scheme will result in moderate adverse effects on properties on Hemblington Road, Lingwood Road and Yarmouth Road. Effects on The Lindens, Poplar Farm and Oaklands will be large adverse, even at Year 15 due to the overbridge despite vegetation being more mature.

30.4.42 Effects on the PRowS from this option will be similar to options 1 and 2.

#### **Option Ranking**

30.4.43 Option 1 is the preferred option with regard to landscape and visual as it has a reduced effect on the landscape fabric and character. The online widening also minimises impacts on visual receptors. Option 4 is second preferred with option 2 third preference and option 3 the least preferred.

- Option 1
- Option 4
- Option 2
- Option 3

### **Nature Conservation and Biodiversity**

#### **Baseline conditions**

30.4.44 There are a number of statutory designated sites located within 2km of the scheme options, these are:

- The Broads Special Area of Conservation
- Broadland Special Protection Area/Ramsar
- Decoy Carr Site of Special Scientific Interest

30.4.45 Non-statutory sites of local importance include:

- Church and Drive Plantation County Wildlife Site
- Belt Plantation CWS



- Lingwood Community Woodland

30.4.46 Priority habitats found in the study area include: arable field margins, eutrophic standing water, hedgerows, lowland mixed deciduous woodland, traditional orchard and ponds. A Phase 1 habitat survey was undertaken in 2016 (updated in 2017) which identified the following habitats: arable, broadleaved community woodland, semi-natural broadleaved woodland, improved grassland, poor semi-improved grassland, hedgerows, scattered trees, ponds, tall ruderal, amenity grassland and scrub.

30.4.47 Surveys were undertaken in 2017 for a number of protected and priority species such as bats, otter, badger, great crested newt and invertebrates. Signs of badger were recorded throughout the study area with a possible sett identified. Bat roost surveys identified a number of trees and buildings with bat roost potential, ranging from negligible potential to high potential.

30.4.48 Great crested newt surveys showed that two ponds in the wider area support a small population of GCN, further detail is provided in chapter 9 of the EAR. Aquatic invertebrate surveys indicated that the ponds in the study area generally have poor water quality and species present were common generalist species. No signs of water vole or otter were recorded in the survey area.

30.4.49 A wide range of birds was recorded during the wintering bird surveys, which ranged from raptors through to common farmland birds.

### **Impacts**

30.4.50 Construction impacts will be similar from all options, with vegetation removal and disturbance to species the key impacts. There is also potential for pollution of habitats although these will be controlled through adherence to best practice measures and pollution prevention.

#### ***Option 1***

30.4.51 There will be direct impact on priority habitats – arable field margins, ponds and hedgerows through habitat loss, additionally the route will result in severance to hedgerows. Other habitat loss will occur from scrub, tall ruderal, arable and loss of trees. There is likely to be a slight to moderate adverse effect on bats due to loss of potential bat roost trees, effects on other species are neutral or slight.

#### ***Option 2***

30.4.52 Impacts from option 2 will be similar to option 1 with habitat loss from arable field margins, hedgerows, scrub, arable and mature trees. Effects on bats will be slight to moderate adverse from loss of potential bat roost trees, effects on other species are neutral or slight.

#### ***Option 3***

30.4.53 This option will have a direct impact on the community woodland at Lingwood, resulting in habitat loss and severance. It will have a moderate adverse effect on arable field margins, ponds and hedgerows. Impacts on species include severance and increased risk of mortality from road collisions as the route will be on a new alignment through existing immature woodland and arable fields. Loss of potential bat roost trees and severance of foraging/commuting habitat will have a moderate adverse effect on bats.

#### ***Option 4***

30.4.54 Option 4 will have similar impacts to options 1 and 2 with loss of habitat and a slight degree of severance. Effects on species are likely to be similar with slight to moderate effects on bats from loss of potential bat roost trees. Effects on other species are slight or neutral.

### Option Ranking

30.4.55 Options 1, 2 and 4 will have similar effects on biodiversity, with option 4 being the preferred option as it will affect a smaller number of potential bat roost trees. Option 1 is second preferred and option 2 is third preferred. Due to the greater landtake and degree of severance associated with the new alignment, option 3 is the least preferred.

- Option 4
- Option 1
- Option 2
- Option 3

### Noise and Vibration

#### Baseline conditions

30.4.56 Noise mapping undertaken by Defra for the study area shows the noise levels at the closest sensitive receptors along this section of the A47 are in the region of 70 to 75dB, with the dominant noise traffic on the A47. Noise monitoring was undertaken at various locations in the study area and indicated that noise levels are in the region of 51 to 79dB.

30.4.57 There are four Noise Important Areas within the study area. NIA ID 5206 is the largest area containing 12 dwellings while the other NIAs are small, typically containing one or two dwellings. NIA ID5208 is likely to be affected by the proposals as it is located close to the junction of Lingwood Road and the A47.

#### Impacts

30.4.58 There are a number of noise sensitive receptors located within the study area that would be affected by changes in noise levels, as summarised in the **Table 30-2** below.

**Table 30-2: Noise sensitive receptors for each option**

Layout	Band (metres)						Total
	0-50	50-100	100-150	150-200	200-300	300-600	
Existing	20	14	15	7	17	361	434
Option 1	18	22	14	9	22	362	447
Option 2	18	20	15	13	50	380	496
Option 3	11	13	10	12	45	397	488
Option 4	14	11	25	14	28	397	489

#### *Option 1*

30.4.59 This option will result in 9 receptors experiencing a predicted noise increase of between 1 and 2.9dB above the SOAEL. Nine receptors are predicted to experience noise increase of between 3 and 4.9dB, with 37 receptors having noise increase of between 5 and 9.9dB.

#### *Option 2*

30.4.60 This option will result in 5 receptors experiencing a noise increase of between 1 and 2.9dB above the SOAEL, with one receptor (The Old Post Office) showing an increase of more than 10dB. Thirteen receptors will experience a noise increase of between 3 and 4.9dB with 40 receptors showing an increase of between 5 and 9.9dB.

### **Option 3**

30.4.61 This option will result in 3 receptors having a noise increase of between 1 and 2.9dB above the SOAEL, with 1 receptor (27 Lingwood Road) showing an increase of more than 10dB. There are 10 receptors with increases of between 3 and 4.9dB with 42 receptors showing an increase of between 5 and 9.9dB.

### **Option 4**

30.4.62 This option will result in 3 receptors with predicted noise increases of between 1 and 2.9dB above the SOAEL. There were 20 receptors showing noise increases of between 3 and 4.9dB while 39 receptors show an increase of between 5 and 9.9dB.

### **Option Ranking**

30.4.63 In terms of noise and vibration all options were predicted to result in adverse effects. However, option 1 was predicted to give rise to the least number of adverse noise effects in the long term and is considered to be the preferred option.

- Option 1 (most preferred)
- Option 3
- Option 4
- Option 2 (least preferred)

## **Road Drainage and the Water Environment**

### **Baseline Conditions**

30.4.64 There are no main watercourses or rivers located in close proximity to the route options. The closest watercourse is the Witton Run, located approximately 0.9km south west of the A47. Surface water features in the study area are confined to small ponds and drainage ditches. The drainage channels are small and contain little water which tends to flow discontinuously.

30.4.65 The study area is underlain by Crag Group sand and gravel bedrock which supports a principal aquifer. The overlying superficial deposits have potential to support a superficial aquifer, due to their permeability. The western end of the scheme overlies Zone 3 of a Groundwater Source Protection Zone.

30.4.66 Due to the lack of major watercourses in the study area, there is a very low risk of flooding.

### **Impacts**

30.4.67 During construction all options have potential to affect the water environment through pollution and sediment runoff, however these will be controlled through best practice measures and adherence to pollution prevention.

### **Option 1**

30.4.68 Operational effects on surface waters and flood risk from this option are negligible. There is potential for spillages or road traffic collisions to adversely affect the groundwater source protection zone.

### ***Option 2***

30.4.69 This will have similar effects to option 1, although there is some potential for direct impacts on groundwater from the excavations for the underbridge affecting local hydrology.

### ***Option 3***

30.4.70 Although this option is offline, effects on the water features will be similar to that for option 1.

### ***Option 4***

30.4.71 Effects from this option will be similar to those for options 1 and 3.

### **Options Ranking**

30.4.72 The potential impacts associated with each of the options are similar and therefore a ranking has not been applied. There will be minimal effect on the water environment from all options.

## **People and Communities**

### **Baseline Conditions**

30.4.73 Community facilities located within the study area include churches in Lingwood, Blofield and North Burlingham, Norwich football grounds, Blofield allotments and schools in Blofield.

30.4.74 Residential properties are scattered throughout the study area with main concentrations at Blofield, North Burlingham and Lingwood. Land use in the study area is dominated by agriculture, predominantly arable farming.

30.4.75 There are small areas of land in Blofield designated for development, with proposals including housing and mixed use development (employment).

30.4.76 There are numerous recreational paths and Public Rights of Way located in the study area. The Burlingham Woodland walks are located in the woodland to the north of North Burlingham and connect to the recently planted woodland south of the A47 around Poplar Farm via PRoW FP3. However, users of the path have to cross the A47, which provides a barrier to safe movement.

30.4.77 A review of traffic data for the scheme indicates that existing driver stress on the A47 is high.

### **Impacts**

#### ***Option 1***

30.4.78 The online widening of this option means that landtake is minimised. The total amount of landtake is approximately 356 120m<sup>2</sup>.

30.4.79 There will be a beneficial effect on pedestrians as FP3 will be carried over the dualled section of the A47 on an overbridge, improving severance and potentially increasing use.

30.4.80 Driver stress is likely to be slightly reduced although the dualling will slightly improve traffic flow compared to the existing single carriageway.

30.4.81 View from the road for drivers is not expected to significantly change.

### **Option 2**

30.4.82 Landtake from this option will be approximately 519 880m<sup>2</sup>, most of which will be from arable land.

30.4.83 The impact on pedestrians will be beneficial as the existing A47 will be retained and the new road will pass under it. This will improve severance by removing traffic from the old A47, allowing pedestrians using FP3 easier access to paths north of the A47.

30.4.84 Driver stress will reduce slightly and the view from the road is not expected to significantly change.

### **Option 3**

30.4.85 Landtake from this option will be approximately 368 000m<sup>2</sup>, mostly from arable land.

30.4.86 The impact on community severance will be beneficial as although the route crosses over FP3, an overbridge will be provided to allow safe access. The alignment will however result in the severance of the permissive paths around FP3, having an adverse effect on journey amenity. Journey length will remain unchanged.

30.4.87 Driver stress will slightly reduce. The view from the road will change slightly due to the change in alignment but this is unlikely to be significant.

### **Option 4**

30.4.88 Landtake from this option will be approximately 342 410m<sup>2</sup>.

30.4.89 The provision of an overbridge to carry FP3 over the dualled section of the A47 will be beneficial by reducing severance. Journey length will slightly increase although this is not expected to be significant.

30.4.90 Driver stress will slightly reduce and view from the road is expected to remain largely unchanged.

### **Option ranking**

30.4.91 Option 4 is the most preferred as it will have the smallest landtake and will have similar effects on journey amenity and community severance as options 1 and 2. Option 1 is the least preferred as it is expected to have the most disruption to travellers during construction. Overall the ranking is:

- Option 4 (most preferred)
- Option 2
- Option 3
- Option 1 (least preferred)

## **Geology and Soils**

### **Baseline conditions**

30.4.92 The underlying bedrock in the study area is the Crag Group sand and gravel. Superficial deposits are composed of Lowestoft Formation Diamicton and Happisburgh Glacigenic Formation Sand.

30.4.93 The agricultural classification of the soils is either Grade 1 or Grade 2, both high quality and suitable for arable crops.

30.4.94 Although the land use in the study area is predominantly agricultural there are areas of made ground associated with the settlements and road infrastructure. There is potential for land contamination associated with a garage on High Noon Lane, the gas main and commercial properties in North Burlingham. Historical mapping shows that the area south of the A47 has some infilled sand pits.

#### **Impacts**

30.4.95 All options have potential to result in pollution of underlying soils during construction, however these can be managed through best practice measures and adherence to pollution prevention.

#### ***Option 1***

30.4.96 There is a low risk to construction workers from contamination sources (sand pits) and these can be mitigated through techniques such as appropriate working practices, use of PPE and delineation of areas of contamination.

30.4.97 Once operational it is assessed that there will be no significant effects on geology, soils or land contamination from this option.

#### ***Option 2***

30.4.98 This option largely avoids potential contamination sources and there will be very low risk to construction workers.

30.4.99 Once operational it is assessed that there will be no significant effects on geology or soils.

#### ***Option 3***

30.4.100 This option will have the greatest amount of excavations as it is entirely offline, with greater potential to affect underlying deposits. Like option 2, it largely avoids the sand pits and there is a very low risk of encountering potential land contamination.

30.4.101 Once operational it is assessed that there will be no significant effects on geology or soils. It will however, result in the loss of good quality agricultural land.

#### ***Option 4***

30.4.102 Impacts from option 4 are similar to those of option 1.

#### **Option comparison**

30.4.103 Options 1, 2 and 4 are similar in effects as they largely follow the existing alignment of the A47 and have lesser landtake. Option 1 is the most preferred as it would have little impact on existing potential sources of contamination. Option 3 is the least preferred as it is likely to have the greatest amount of cut and fill quantities, being an offline option. The overall ranking is:

- Option 1 (preferred)
- Option 4
- Option 2

- Option 3 (least preferred)

## Materials and Waste Management

### Baseline conditions

- 30.4.104 The existing carriageway along the section proposed for improvement is single carriageway with associated drainage.
- 30.4.105 There are a number of utilities present in the road verge with communications cables and water mains. A medium pressure gas main is located in the westbound verge of the Yarmouth Road.
- 30.4.106 There are a number of waste facilities located in the wider area with landfill sites in and around Norwich.

### Impacts

- 30.4.107 All options will result in the use of virgin or recycled materials and generate waste. Where possible existing materials will be reused and the amount of virgin materials used will be minimised.

### Option comparison

- 30.4.108 At this stage of the assessment there is not information on potential cut and fill quantities or on the amounts of waste expected to be generated by the options to provide a comparison between them.

## Conclusions

- 30.4.109 According to the assessment undertaken, significant impacts will be experienced in relation to landscape, visual, noise and vibration and nature. The options were ranked using colour coding, with the preferred option ranked green and the least preferred red, with the second option yellow and third orange.

**Table 30-3: Environmental Ranking of Options**

Environmental topic	Option 1	Option 2	Option 3	Option 4
Air Quality	Red	Green	Yellow	Orange
Cultural heritage	Orange	Red	Yellow	Green
Landscape and Visual	Green	Orange	Red	Yellow
Nature conservation and biodiversity	Yellow	Orange	Red	Green
Noise and vibration	Green	Red	Yellow	Orange

Road drainage and the water environment				
People and communities	Red	Yellow	Orange	Green
Geology and soils	Green	Orange	Red	Yellow
Materials				

30.4.110 The above table shows that option 4 is the environmentally preferred option, with option 1 second preferred. Option 2 is the third preferred option, while Option 3 is the least preferred.

30.4.111 In summary the ranking is:

- Option 4 (environmentally preferred option)
- Option 1
- Option 2
- Option 3 (least preferred option)

30.4.112 Further detailed assessment will be undertaken during the Stage 3 PCF to identify specific mitigation and monitoring requirements where these may be required.

## 30.5 Next Steps and Potential Mitigation

30.5.1 During PCF stage 3 further detailed environmental surveys and assessment will be undertaken. A full environmental assessment and a formal Environmental Statement will be prepared as part of the submission of the scheme for DCO.

30.5.2 The PCF Stage 2 Environmental Assessment Report (EAR) contains some initial potential mitigation statements for each of the 4 options and each of the topic areas. A summary of these is included in the sections below. It should be noted that these mitigation measures will need to be developed, reviewed and updated once the preferred route has been developed but give an idea of the type of mitigation measures which are likely to be considered during PCF Stage 3.

### Mitigation – Air Quality

30.5.3 In accordance with the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, a dust risk assessment will be carried out and the appropriate mitigation measures will be implemented during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

30.5.4 Where significant adverse effects on air quality are predicted, mitigation measures would take the form of a review of the proposed design of the option to consider relocating some sections of road further from sensitive receptors, or reviewing speed limits to improve emissions from



vehicles, or the consideration of options to manage the volumes of traffic using the new road alignments.

### **Mitigation – Cultural Heritage**

- 30.5.5 It is likely that archaeological mitigation will be required in relation to the potential for encountering currently unknown archaeological remains. The mitigation strategy will be determined in part by the potential impacts not only from the construction works within the land-take, but also from enabling works the nature and location of which are currently unknown. Depending upon the nature of the impacts this could require an evaluation prior to construction to understand the presence, character and significance of any archaeological remains to further inform mitigation in line with National Planning Policy Framework (NPPF) paragraph 128 and National Policy Statement for National Networks (NPSNN) paragraph 5.127. Mitigation measures will be put in place through a Written Scheme of Investigation (WSI) to reduce the impact on the historic environment.
- 30.5.6 Mitigation strategies relating to impacts to the built environment and historic landscapes will be developed alongside the design process and will be taken into account as part of the landscape design. This may include provision for ensuring that distant views of the two churches are included to secure and enhance their prominence in the landscape and, where relevant, to maintain a degree of the inter-visibility which exists between them.

### **Mitigation – Nature Conservation**

- 30.5.7 Lingwood community woodland will be directly impacted by land take, mitigation measures include habitat replacement, habitat improvement and improving connectivity of habitat. Appropriate mitigation and compensation for impacted habitats will be assessed in more detail at PCF Stage 3. However, mitigation is likely to include habitat replacement where priority habitats are directly affected. Impacts on water habitats from pollution will be mitigated through the development of a detailed Construction Environmental Management Plan.
- 30.5.8 Mitigation for protected species such as badgers and bats may be required such as works being done under licence, provision of artificial setts, badger fencing, badger underpasses, habitat enhancement, provision of bat roost boxes and improving foraging and commuting areas. Specific mitigation for great crested newts will be included in PCF Stage 3, although this is unlikely to be required based on current data. Potential mitigation may include works done under licence, translocation, habitat enhancement and habitat creation.
- 30.5.9 Mitigation for wintering birds will include retention of important habitats where possible, such as open arable habitats and replacement of lost habitats (hedges and woodland).

### **Mitigation – Landscape and Visual**

- 30.5.10 During construction the working corridor will be minimised to reduce the need to remove existing vegetation and minimise disturbance to existing ground and soils. A pre-construction tree survey will be undertaken to identify key specimens or groups of trees to retain and protect and to advise on detailed mitigation. Trees and hedges will be protected during construction in accordance with BS5834:2012 Trees in Relation to Design, Demolition and Construction.
- 30.5.11 A soil resource plan will be prepared in accordance with good practice guidance such as the Construction Code of Practice for Sustainable Use of Soils on Construction Sites.
- 30.5.12 Construction compounds will be sited and designed to minimise effects on vegetation and soil.
- 30.5.13 Operational effects will be mitigated by the design of the road, including its horizontal and vertical alignment and layout and design of junctions and link roads to get the best fit with

existing contours. Existing vegetation will be retained where possible. Secondary mitigation measures include use of on and offsite planting, mounding and earth shaping, alignment and appearance of roadside ditches and fences. Mitigation planting will use local species and a mixture of deciduous and evergreen species. Mitigation planting will seek to avoid emphasising the alignment as a linear feature and will take into account the need to preserve key views across the landscape to important features such as church towers and woodland.

### **Mitigation – Noise and Vibration**

30.5.14 Road design should aim to minimise effects from noise and vibration on receptors through:

- horizontal alignment (i.e. moving route away from sensitive receptors)
- vertical alignment (i.e. using natural screening such as cuttings or tunnels)
- noise barriers in the form of earth mounds or noise fencing. Noise barriers are usually only effective in reducing noise but not vibration. Earth mounds may be provided where a lowering of the road into cutting generates extra fill
- low noise surfacing, which is effective at speeds of at least 75km/h
- speed and volume restrictions (however these are rarely introduced and should be avoided in a new scheme).

30.5.15 As far as practicable, mitigation should be addressed through optimising horizontal and vertical alignments, which would be in line with national noise policy of avoiding significant adverse effects before mitigating and minimising them.

### **Mitigation – Road Drainage and the Water Environment**

30.5.16 A Pollution Prevention and Spill Response Procedure will be developed by the contractor for the duration of the works. Works will comply with pollution prevention guidance such as Policy and Practice for the Protection of Groundwater, and Guidance for Pollution Prevention.

30.5.17 Surface water runoff will be minimised by the phased removal of surface vegetation, provision of a grass buffer strip around the construction site, revegetating exposed soils and protection of drains and gullies.

30.5.18 Further assessment will be undertaken at stage 3 to fully quantify operational impacts and design appropriate drainage to minimise impacts on the water environment. This may include the incorporation of SuDS into the design.

### **Mitigation – People and Communities**

30.5.19 During the construction phase, HE will remain in contact with landowners to agree access and inform them of any disruption. Access to the PRoWs and permissive paths within the study area will be maintained throughout the construction phase where possible. Any diversions or temporary closures will be well signposted and arrangements made to inform local residents.

30.5.20 Agricultural land access will be agreed during the detailed design at PCF Stage 3 and any accommodation works designed. Improved provision for cyclists and pedestrians will be investigated at stage 3.

### **Mitigation – Geology and Soils and Materials**

30.5.21 A Materials Management Plan and Soil Resource Plan will allow for the appropriate reuse of excavated soils and minimise any disposal. Designated haul routes will be set up to minimise

compaction impacts on underlying soils. The guidelines in Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites will be followed.

30.5.22 The development of a Site Waste Management Plan during the detailed design stage at PCF Stage 3 will allow for maximisation of existing resources, reducing the amount of material required from off-site sources and reduce waste taken off site.

30.5.23 The risks from land contamination will be reduced through further investigations at Stage 3 to allow the development of Conceptual Site Model and detailed mitigation measures. Such measures may include identifying areas of land contamination being demarcated so that excavated materials can be handled separately from greenfield soils. Appropriate health and safety and waste management procedures should be included in Risk Assessments and Method Statements to allow risks to workers to be mitigated.

## 31 Additional assessment of Public Consultation

### 31.1 Introduction

31.1.1 As discussed in Chapter 24, the total number of respondents to the consultation was 323, which includes responses from stakeholders and members of the public. Therefore the findings set out in the Report on Consultation and in Chapter 15 should be treated with caution and not be interpreted as representative of the views of the wider population of Blofield to North Burlingham and the surrounding area.

31.1.2 Chapter 24.3.1 to 24.3.5 explains the way in which the responses received from the consultation were coded for analysis

31.1.3 As part of the PCF Stage 2 route selection analysis of the consultation comments the comments were filtered to identify where comments were specific to “route” comments. This was undertaken by filtering comments which had been coded as follows:

- “General” theme comments also coded as
  - “Alternative suggestion”
  - “Design / route”
- “Option 1” theme comments also coded as
  - “Alternative suggestion”
  - “Design / route”
  - “Design / route – existing route”
- “Option 2” theme comments also coded as
  - “Alternative suggestion”
  - “Design / route”
- “Option 3” theme comments also coded as
  - “Alternative suggestion”
  - “Design / route”
- “Option 4” theme comments also coded as
  - “Design / route”

#### **Filtered “route” comments**

31.1.4 The “Design / route” comments identified by the filtering as explained in 31.1.3 above are presented in the table contained in **Appendix Q**

## 31.2 Review of comments

31.2.1 The comments have been reviewed and a response has been added. The response seeks to either explain how the comment has been considered or addressed within the PCF Stage 2 work undertaken or indicates that the comment will be considered or addressed within following PCF Stages of the scheme.

31.2.2 As is noted in the tables in **Appendix Q**. The majority of the filtered comments refer to issues which will be addressed and used by the design teams to help shape the preliminary design as explained in the recommendations in the Report on Public Consultation

“Going forward following Preferred Route Announcement, the responses and the information contained and appended to the responses, will be used by the design teams to help shape and develop the preliminary design of the preferred route into more detailed proposals This will include consideration of comments and suggestions when developing proposals for junction, side road and non-motorised user strategies. They will also be used to inform analysis, assessment and potential mitigation proposals and considerations for accessibility, environmental, buildability, landscape, severance and interconnectivity, planning and engineering.”

## **32 Other Relevant Factors considered in PCF Stage 2**

### **32.1 Summary of Engagement with Public Bodies in PCF Stage 2**

32.1.1 A number of formal and informal meetings and liaison with local councils with regard to planning the consultation events were held during the early part of 2017.

32.1.2 Chapter 24 details the non statutory public consultation which was held in March and April 2017. Immediately prior to and following the announcement of the preferred route a number of meetings have been held with local authorities as follows

32.1.3 HE need to advise a list of the meetings they have held with local authorities, County Council, District Councils and Parish Councils so these can be added here...

### **32.2 Assessment of Planning Requirements**

32.2.1 All of the options for the scheme would meet the criteria for a Nationally Significant Infrastructure Project and would therefore be subject to the DCO process due to the amount of land take required by the scheme.

### **32.3 Assessment of Options against Planning Policies**

32.3.1 This Chapter provides an update of the position of the scheme against the topics covered in Chapter 2 Planning Brief.

#### **National Policy Statement for National Networks (NPSNN)**

32.3.2 The NPSNN was reviewed and the relevant topics and impact on the options were summarized at a high level in the PCF Stage 2 product DCO Application - Planning Statement & National Policy Statement Accordance document.

32.3.3 As detailed in para 32.2.1 above the scheme would meet the criteria for a NSIP and would be subject to the DCO process. In this case, the planning application will be judged primarily against the NPSNN, according to the decision-making framework set out in the Planning Act 2008

#### **Roads Investment Strategy (RIS)**

32.3.4 The RIS described in Chapter 2 of this report is still applicable to the Scheme.

32.3.5 The objectives of the RIS including the KPI's from the SBP and the Delivery Plan were used to during the sifting of options described in Chapter 10.

#### **Highways England Strategic Business Plan (SBP) (2015-2020)**

32.3.6 The SBP described in Chapter 2 is still current and relevant to this Scheme and has not been updated.

32.3.7 The objectives of the RIS including the KPI's from the SBP and the Delivery Plan were used to during the sifting of options described in Chapter 10.

### **Highways England Delivery Plan (2015-2020)**

- 32.3.8 The Delivery Plan described in Chapter 2 is still current but is subject to an annual review/update. The latest update, published in August 2017, details current progress on schemes and performance against Highways England KPI's.
- 32.3.9 The objectives of the RIS including the KPI's from the SBP and the original Delivery Plan were used during the sifting of options described in Chapter 10.
- 32.3.10 The KPI's remain but the PI's within each KPI have been updated which will need further consideration during future PCF Stages.
- 32.3.11 A supplementary Annex was published in October 2017 which provides further update on scheme delivery and performance against KPI's.
- 32.3.12 The Scheme is still listed in the latest update but now has the start of works as 2020/21 in the 'Updated Scheme Schedule 2015-20'. This represents a delay to the Scheme not previously identified and is as a result of concerns regarding phasing of the works along the A47 as a whole. The start on site date will be confirmed in future stages.
- 32.3.13 Specifically, the update to the Delivery Plan describes the reason for delay as 'the route based review seeks to optimise the delivery programme of seven projects along the A47 linking Peterborough and Norwich. All schemes within this study have been rescheduled to avoid potential impact of simultaneous roadworks and minimise delivery risk. The schedules for the two schemes around Peterborough enable a joint traffic management strategy to be developed for improved delivery efficiency.'

### **Local Policy**

- 32.3.14 Chapter 2.3 gives a commentary on the local policy relevant to all of the four options for the scheme.
- 32.3.15 At the time of writing none of the options currently being developed have a negative impact on any of the plans described in Chapter 2 and all comply with the policies described therein.

### **Planning Applications**

- 32.3.16 Chapter 7 makes reference to a number of developments and planning applications. During PCF Stage 2, the developments listed have had no significant influence in the determination of the Preferred Route.

## **32.4 Conclusion**

- 32.4.1 At the time of writing none of the options currently being developed have a negative impact on any of the committed plans described in Chapter 2, Chapter 7 and in this Chapter and all comply with the policies described.

### 33 Appraisal Summary Table

- 33.1.1 The completed Appraisal Summary Table (AST), completed for each of the four options can be found in **Appendix R**. The AST includes the summary of the results of the economic assessment work and the environmental assessment work and includes results from the Distributional Impact Assessment.
- 33.1.2 The purpose of the AST is to provide the project team with a concise, across-the-board overview of the impacts of a scheme option, taking account of all the economic, social, environmental and financial impacts of a proposed solution as set out in the Treasury Green Book. This enables an assessment to be made as to the overall value for money an option provides. Further information on the Distributional Impact Assessment can be found in the Distributional Impact Appraisal Report, which supports the AST. At the time of writing no full AST have been produced for any Option.



## 34 Programme

34.1.1 A high-level programme for scheme delivery has been prepared in accordance with Highways England's PCF requirements. The current programme has been developed making allowance for the DCO process to be followed.

**Table 34-1: Summary of Key Milestones**

PCF Stage	Delivery Item	Estimated project delivery date	Estimated project duration
<b>PCF Stage 0</b>	Strategy, Shaping and Prioritisation	Complete	Complete
<b>PCF Stage 1</b>	Option Identification	Complete	Complete
<b>PCF Stage 2</b>	Option Selection	Complete	Complete
<b>PCF Stage 3</b>	Preliminary Design	Jan 18	13 Months
<b>PCF Stage 4</b>	Statutory Procedures and Powers	Feb 19	12 Months
<b>PCF Stage 5</b>	Construction Preparation	Feb 20	15 Months
<b>PCF Stage 6</b>	Construction, Commissioning and Handover	May 21	16 Months
<b>PCF Stage 7</b>	Close Out	Sep 22	12 Months

## 35 Validation of Preferred Route

### 35.1 Introduction

35.1.1 As highlighted in Chapter 27 the preferred route decision was made at the preferred route decision workshop based on the information and assessment work which had been undertaken at that point and which was available for consideration at the time.

35.1.2 The assessment work has now been completed and is reported in summary chapters 28,29,30,31 and 32 and a series of other technical reports which describe the assessments in more detail. The key technical reports being the

- Local Model Validation Report
- Traffic Forecasting Report
- Economic Assessment Report
- Appraisal Summary Table
- Environmental Assessment Report

35.1.3 The following Chapters highlight how the final PCF Stage 2 assessments undertaken since PRD compare to those done prior to the PRD and the significance of these differences with regard to the decision on the preferred route.

### 35.2 Transportation

35.2.1 Prior to the PRD as highlighted in Chapter 27.4.2 the transportation assessment was not identified as a specific differentiating factor between the Options as the 4 options all provide a dual carriageway replacing the length of single carriageway between North Tuddenham and Easton. From a transportation assessment view, all routes will predominantly perform in a similar way, the only real differentiating factor in terms of preliminary initial transportation assessment is the minor route length difference between the options. It was therefore considered that the transportation effects of the 4 options were not a significant differentiating factor for the preferred route decision.

35.2.2 The transportation work completed following PRD has provided data for completing the economic assessment as detailed in Chapter 29 and into the final air quality and noise assessments as detailed in Chapter 30.

### 35.3 Economics and Cost

35.3.1 The estimated costs for the 4 Options as detailed in Chapter 26 were presented for consideration at the PRD, the estimates were complete prior to the PRD and the costs were considered in reaching the PRD decision. The rankings of the Options remain unchanged.

35.3.2 The estimates have subsequently been used along with the results of the transportation assessment as the basis of the economic assessment as detailed in Chapter 29.

35.3.3 The economic assessment for the scheme shows that there is a range of BCRs from 1.90 to 2.09 for the four Options. The assessment shows that all options provide a positive BCR in the Medium or High VfM category.

## 35.4 Environmental

35.4.1 As detailed in Chapter 27 the environmental assessment completed at the time was presented to the PRD, each of the environmental topics were ranked and the results of these rankings presented in Table 27-3. Following PRD, the detailed environmental assessment was completed and is summarised in Chapter 30. The ranks were revisited for each environmental topic and the results of the final assessment are presented in Table 30.1 and in the Environmental Assessment Report.

35.4.2 Comparison of Table 27-3 and Table 30.1 shows that the final assessment for the following environmental topics gave the following topics broadly the same assessment rankings as those presented at PRD.

- Cultural Heritage
- Landscape and Visual
- Nature conservation and biodiversity
- Road Drainage and Water
- Materials

35.4.3 The other environmental topics show some differences in rankings between the assessment presented at PRD and the final environmental assessment. A primary driver for these variances relates to the change in junction strategy on the Scheme. The removal of the Roundabout at the western end of the scheme for example has changed the number of receptors and thus the outcome of the assessment. Further explanation is provided below.

### Air Quality

35.4.4 The ranking at PRD assessed the options in order of preference as Option 1 most preferred, Options 2 and 3 broadly similar in second, and least preferred being Option 4

35.4.5 The completed final assessment ranked Option 2 as most preferred with Option 3 second, Option 4 in third and Option 1 being least preferred.

35.4.6 The primary reason for the change is directly attributable to the change in design leading to a variance in the number of receptors on each option.

### Noise

35.4.7 No assessment of noise was undertaken as PRD so no direct comparison is possible.

### People and Communities

35.4.8 The ranking at PRD assessed the options in order of preference as Option 1 most preferred, Option 2 and 4 being second, with Option 3 least preferred.

35.4.9 The completed final assessment ranked Option 4 as most preferred with Option 2 second, Option 3 third and Option 1 fourth and least preferred.

35.4.10 More information on the land ownership gathered after the PRD showed that the link road with Option 1 had more of an effect than was considered at PRD, increasing the number of landowners affected resulting in a greater landtake. Option 4 becomes more favourable due to less landowners being affected and a smaller footprint.

### Geology and Soils.

- 35.4.11 The ranking at PRD assessed the options in order of preference as Option 2 most preferred, Option 3 second, with Option 1 and Option 4 least preferred
- 35.4.12 The completed final assessment ranked Option 1 as most preferred with Option 4 second, Option 2 third and Option 3 fourth and least preferred.
- 35.4.13 The assessment process between the PRD and the final assessments has seen less emphasis being placed on the contaminated land impacts, as these can be managed through the detailed design process and construction mitigation measures.

### Overall Environmental Assessment

- 35.4.14 The final overall environmental ranking **prior** to PRD (see Chapter 27.5.55) when combining the environmental ranking was
- Option 1
  - Option 3
  - Option 2
  - Option 4
- 35.4.15 The **completed** assessment at the end of PCF Stage 2 reported in the Environmental Assessment Report and summarised in Chapter 30 gave a different ranking order due to the changes listed above. The revised overall environmental ranking was as follows:
- Option 4
  - Option 1
  - Option 2
  - Option 3

## 35.5 Conclusion

- 35.5.1 The transportation and economic work which has been completed following PRD in PCF Stage 2 after the PRD, has confirmed that the assessment work considered at PRD although not complete at the time was sufficiently robust to give the correct consideration during the selection of the preferred route.
- 35.5.2 The change in overall assessment following the additional environmental assessment work shows that Option 4 now aligns more closely with the other assessments so confirming the decision that was taken at PRD this demonstrating that the preferred route decision that was made was robust and consistent with the completed assessments at the end of PCF Stage 2.

## 36 Conclusions and Recommendation

### 36.1 Introduction

36.1.1 This Chapters concludes the work carried out in PCF Stage 2 and describes the PRA route.

### 36.2 Conclusion

36.2.1 A preferred route has now been announced taking into consideration the environmental sensitivities in the area and key concerns raised at public consultation.

36.2.2 The preferred route is Option 4.

### 36.3 Recommended Preferred Route

36.3.1 The preferred route was announced on 14th August 2017. The PRA leaflet states:

*Having reviewed the feedback following the consultation, and completed a number of other assessments, we are proceeding with an amended version of Option 2 presented at consultation.*

*Option 4 was the favoured option by the public by a significant margin and solves the traffic and safety problems.*

*It can be built with the least disruption to drivers during construction, has the least impact on the environment and the existing road can remain for local traffic, pedestrians, cyclists and equestrians.*

*This will now be developed further before a statutory consultation*

36.3.2 The preferred route announcement was accompanied by a drawing of the preferred route, a copy of the preferred route announcement leaflet is included in **Appendix S**.

### 36.4 PCF Stage 3

36.4.1 The PCF Stage 3 Consultants were engaged and commenced work on the preliminary design Stage of the scheme before the close out of PCF Stage 2. Some of the key areas that have been identified during PCF Stage 2 which will need to be addressed in PCF Stage 3 include:

## 37 List of Appendices

- Appendix A – Key Features of Existing A47 Route Drawings
- Appendix B – Collision Data Plot
- Appendix C – Geology and Flood Plans
- Appendix D – Statutory Undertaker Plans
- Appendix E – Environmental Study Area Plan
- Appendix F – Strategic Diversion Routes
- Appendix G – Options 1-8 Route Layout Plans and Constraints Plan
- Appendix H – EAST Assessment
- Appendix I – Environmental and Engineering Ranking Tables
- Appendix J – Options 1, 2, 7 and 8 with Indicative Side Roads and Junctions
- Appendix K – AST for Option 8 (PCF Stage 1)
- Appendix L – Options 1, 2, 3 and 4 with Indicative Side Roads and Junctions
- Appendix M – Non-Technical Summary
- Appendix N – Minutes from PRD Meeting
- Appendix O – Status of PCF Stage 2 Products prepared at the date of the PRD
- Appendix P – Risk comparison
- Appendix Q – Comments table identified by the filtering (Chapter 31.1)
- Appendix R – Appraisal Summary Table for Options 1 – 4 (PCF Stage 2)
- Appendix S – Preferred Route Announcement Leaflet