Road Investment Strategy

East Area 6

Scheme Assessment Report
A47 Guyhirn Junction

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List of Acronyms

AADT	Annual Average Daily Traffic
ASC	Asset Support Contract
AST	Appraisal Summary Table
AQMA	Air Quality Management Areas
BCR	Benefit Cost Ratio
BoQ	Bill of Quantities
CCC	Cambridgeshire County Council
CCTV	Closed-circuit Television
CDM	Construction Design and Management Regulations
COBALT	Cost & Benefit to Accidents Light Touch
CWS	County Wildlife Site
DCO	Development Consent Order
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EAST	Early Assessment and Sifting Tool
FDC	Fenland District Council
HAGDMS	Highways Agency Geotechnical Data Management System
HAPMS	Highways Agency Pavement Management System
HE	Highways England
HFS	High Friction Surfacing
ICD	Inscribed Circle Diameter
GCN	Great Crested Newt
KPI	Key Performance Indicator
LEP	Local Enterprise Partnership
LNR	Local Nature Reserve
NMU	Non-Motorised User
NPPF	National Planning Policy Framework
NPSNN	National Policy Statement for National Networks
NSIP	Nationally Significant Infrastructure Project
OAR	Options Assessment Report
OME	Order of Magnitude Estimate
ORM	Options Review Meeting
PCF	Project Control Framework
PCU	Passenger Car Unit
PIE	Public Information Event
PRD	Preferred Route Decision
PRA	Preferred Route Announcement
PSV	Polished Stone Value
RAG	Red, Amber, Green
RFC	Ratio to Flow Capacity
RIS	Roads Investment Strategy
SAC	Special Area of Conservation
SAR	Scheme Assessment Report
SAR0	Solutions Assessment Report (PCF Stage 0)
SOBC	Strategic Outline Business Case
SPA	Special Protection Area
SPB	Strategic Business Plan
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
TRADS	Traffic Flow Data System
TSRGD	Traffic Signs Regulations & General Directions
TUBA	Transport appraisal and modelling tools
VfM	Value for Money
VISSIM	Traffic microsimulation modelling software
VM	Value Management
VRS	Vehicle Restraint System
WebTAG	Web based Transport Analysis Guidance

Executive Summary

The A47 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 is responsible for planning the long term future and development of the Strategic Road Network and has identified through a previous route feasibility study key investment needs on the A47 corridor. The A47 Guyhirn Junction 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 completed in PCF Stages 1 and 2, building on work completed in PCF Stage 0.

Guyhirn junction is located at the intersection of the A47 Fen Road and A141 March Road. It lies approximately 9km south west of Wisbech, 6.5km north of March and 23km east of Peterborough.

During PCF Stage 1, 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. Three options from the eight were selected to proceed to PCF Stage 2 for further assessment.

Early in PCF Stage 2, a value management exercise was undertaken due to the high costs associated with the shortlisted options, meaning these were not economically viable. The best performing option was focussed upon for this exercise and the costs were reduced significantly. It was therefore decided that the options identified as not being economically viable would not be pursued any further. This meant that only one option (Option 1) would continue through PCF Stage 2 and was the only option presented to the public at the non-statutory public consultations.

This option was further assessed with regard to traffic modelling, environmental impact and engineering suitability, along with economic performance and buildability to ensure suitability for solving the identified transport problem.

This process resulted in Option 1 being selected as the Preferred Route for the Scheme and will progress to PCF Stage 3.

Based on the evidence reviewed, assessed and presented there is a clear rationale for the junction improvements at Guyhirn and the report concludes:

- There is a current transport issue caused by the lack of junction capacity. It is currently anticipated that the junction will be over capacity by 2021 on the A47 approaches.
- Junction improvements at Guyhirn provide a feasible potential solution to the identified transport problem.
- Journey time benefits and congestion relief from the Option give a clear case for the improvement works.
- The Option assessed at this stage appears feasible to design and construct. Although feasible, careful consideration is needed in regards to engineering solutions to minimise impacts on local conditions.
- The PCF Stage 2 Options Estimate of the scheme, Option 1, is £11.3m, resulting in a BCR of 3.78, which indicates a value for money category of high.

- Impacts on sensitive designated environmental sites in the area have the potential to be significant. Appropriate mitigation measures will need to be identified as the scheme progresses.
- The planning route for the Option is to be determined. At present, it is assumed that the scheme is classified as a Nationally Significant Infrastructure Project (NSIP) and thus requiring a development Consent Order (DCO) for construction. Should solutions be found to significant impacts then a DCO may not required which would offer significant programme savings.
- The result of the non-statutory public consultations was overall positive, with local people expressing their support for the scheme, although some areas require further consideration as the scheme progresses i.e. the junctions interaction with the A47 Fen Road / B1187 Gull Road junction.
- The impacts on nearby services, particularly the water surge chamber and drainage arrangements will need to be further developed and close liaison with stakeholders as the scheme progresses.
- Further development of the design in particular the provision for non-motorised users (NMU's) is required as the scheme progresses.
- The programme remains challenging, taking into consideration the required statutory processes.
- The construction methodology needs careful consideration to ensure disruption is minimised for the local area and users of the A47 and to inform environmental screening to aid the determination of the planning route.

1 Introduction

1.1 Background

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

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

1.1.4 In 2015 AECOM carried out feasibility studies for Highways Agency and the Department for Transport (DfT) to identify issues on the SRN 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 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) were 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[1]

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] This combines the schemes previously known as A47/A12 Vauxhall Junction improvements and A12 package of roundabout improvements

1.1.8 The section of the SRN in Great Yarmouth known as the A12 that included the A12 Junction Improvements schemes was renamed early in PCF Stage 2 to the A47.

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

1.1.10 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 (February 2015).

1.1.11 In April 2015 Highways England assumed responsibility for the SRN 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 led Strategy, Shaping and Prioritisation phase (PCF Stage 0) of scheme development.

1.1.12 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) Stage 0. This was completed in October 2015 and the Amey/AECOM team were retained to complete PCF Stage 1 for all six schemes.

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

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

AECOM were appointed to progress two schemes, namely:

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

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

1.1.15 This report will focus on:

A47 Guyhirn Junction Improvements

1.1.16 Hereafter A47 Guyhirn Junction Improvements will be known as the Scheme.

1.2 Project Control Framework

1.2.1 Highways Agency introduced 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.

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 A47/A12 Corridor Feasibility Study (2015) stated that junction capacity assessments completed suggest that without intervention the junction is predicted to be over capacity by 2021 on the A47 approaches. By 2031 this is further exacerbated by potential future developments 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 SAR is produced which 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 SAR 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, Highways England have taken the decision, where required to maintain programme, that PCF Stages should 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. It has also allowed the PCF Stage 3 work to commence whilst PCF Stage 2 reporting and close out work is being completed.

1.4.5 In line with the decision to keep the project on programme and overlap PCF Stages, Highways England 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 SAR. This document has therefore been structured as follows;

Chapter 1	Introduction (this Section)
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 - 34	reports on the PCF Stage 2 work
Chapter 35	reports the conclusions of PCF Stage 2 and recommendations for next steps

1.5 Overview of Timeline of PCF Stages and the Document

Chapters 2-19 (December 2015 to November 2016) – PCF Stage 1

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) in 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 were based on available information. Where assessment work had not been completed, the information available was robust enough to support a clear decision on the options to be taken forward. Those assessments have since been produced and validated. Based on the timeline to acquire the outstanding data and following an assessment of the depth and quality of work that had been undertaken throughout PCF Stage 1, Highways England undertook to proceed to PCF Stage 2 based on the merits of the available qualitative and quantitative data. Any outstanding assessment information has since been produced and further validates that decision.

1.5.3 This first section 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) – Transition from PCF Stage 1 to PCF Stage 2

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.

Chapters 21 to Chapter 27 (January 2017 to June 2017) – PCF Stage 2

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 Highways England bringing forward the programmed date for the Preferred Route Announcement (PRA). The determination of the Preferred Route and a summary of the available information at the time of the decision, is presented in Chapter 27.

Chapters 28 to Chapter 34 (June 2017 to October 2017) – PCF Stage 2

1.5.7 In order to validate the early preferred route decision, assessment work continued beyond the PRA; this is reported in Chapters 28 to 34. Any variance from previous assumptions or issues associated with the early determination of the Preferred Route are captured in these sections.

Chapter 35 (November 2017) – PCF Stage 2

1.5.8 Chapter 35 presents the conclusions from PCF Stage 2 and recommendations for future stages.

2 Planning Brief

2.1 Introduction

2.1.1 This section 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 RIS.

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). Section 6 of the Guyhirn Junction Evidence Review (July 2015) responds to this requirement.

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 improvements to Guyhirn junction will meet the criteria for a NSIP 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 32 of this report.

The Road Investment Strategy

Strategic Vision

2.2.9 The DfT's RIS defines a national programme of improvements to the SRN.

2.2.10 The RIS introduces long-term strategic planning and funding for the SRN, underpinned by a significant increase in investment. It is the ambition of Highways England to substantially modernise the SRN within 25 years and this vision for improvement is outlined in more detail through the Key Performance Indicators (KPI's) in Table 2-1.

2.2.11 The RIS states that 127 major schemes will be taken forward over the course of the first RIS period (2015-2020), in order to deliver benefits quickly.

2.2.12 In the longer term, up to 2040, Highways England will look to achieve an upgraded network which makes use of the latest technology in line with KPI's.

Investment Plan

2.2.13 The RIS sets out a number of specific locations for improvements to the SRN. The A47/A141 Guyhirn Junction is included, based on evidence gathered in the A47 / A12 Corridor Feasibility Study (2015):

A47/A141 Guyhirn Junction creation of a new, larger junction linking the A47 and A141.

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 RIS: 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 - Section 8).

Performance Specification

2.2.17 The RIS provides a Performance Specification and KPI's for Highways England.

2.2.18 Table 2-1 summarises the KPI's as they apply to each point of the Performance Specification.

2.2.19 The RIS requires Highways England to develop detailed Performance Indicators (PIs) to provide further detail on how the Company 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
Making the Network Safer	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.
Improving User Satisfaction	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.
Supporting the Smooth Flow of Traffic	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	
Encouraging Economic Growth	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 Helping the government support small and medium sized enterprises.
Deliver Better Environmental Outcomes	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

Topic	Measure	Key Performance Indicator Target	Performance Indicator
	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	Company and its supply chain that occur as they carry out work on the SRN.
Helping Cyclists, walkers and other vulnerable users	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.
Achieving Real Efficiency	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 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 (2015-2020)

2.2.20 Highways England's SBP responds directly to the RIS and describes how Highways England will "go about delivering the requirements of a demanding Performance Specification".

2.2.21 The SBP defines KPI's, against which the performance of Highways England will be measured, based on the Performance Specification included in the RIS.

2.2.22 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.

Highways England Delivery Plan (2015-2020)

2.2.23 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.

2.2.24 The A47 Guyhirn junction improvement 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

Greater Cambridge Greater Peterborough Local Enterprise Partnership Strategic Economic Plan 2014

2.3.1 The Greater Cambridge Greater Peterborough Local Enterprise Partnership (LEP) Strategic Economic Plan is produced by a partnership between Greater Cambridge and Greater Peterborough and provides a plan for growth in Cambridge and Peterborough.

2.3.2 The plan highlights that the A47 is the most important east-west route in the north of the LEP area, and carries up to 42,000 vehicles a day around Peterborough, and around 22,000 vehicles a day on the single carriageway stretch around Wisbech. The mix of functions and the varying quality of the route leads to delay and to unreliable journey times.

2.3.3 The plan identifies the A47/A141 Guyhirn roundabout as one of the A47 Wisbech junction capacity improvements which are needed on the trunk road network. The plan also says that significant levels of growth along the A47 route including housing and employment development at Wisbech and Kings Lynn are unlikely to come forward without improvements to the A47.

Cambridgeshire Local Transport Plan (LTP) Long Term Transport Strategy (LTTS) 2014

2.3.4 The LTTS provides a high-level framework for strategic transport policies which support sustainable development and continued economic prosperity to 2031 and beyond. It links the delivery of transport infrastructure and services that are required to enable and provide for planned growth to the delivery of that growth.

2.3.5 It details how the transport network will be developed to:

- Support sustainable growth across Cambridgeshire to 2031 in accordance with Local Plans of Cambridgeshire's City and District Council's;
- Consider longer term aspirations in support of sustainable growth to 2050; and
- Support the Greater Cambridge Greater Peterborough Growth Prospectus

2.3.6 The A47/A141 Guyhirn roundabout is included in the list of projects that are required to directly mitigate the transport impacts of major development allocations.

Fenland District Council Local Plan 2014

2.3.7 The Fenland District Council Local Plan was adopted in 2014 and contains the policies and broad locations for the growth and regeneration of Fenland over the next 20 years.

2.3.8 The plan identifies the A47 as being a constraint to growth in Wisbech.

2.3.9 Guyhirn is identified as a small village in the plan and any developments would be considered on merit but would only include those of a very limited nature and scale such as residential infilling or a small business opportunity.

Fenland Infrastructure Delivery Plan 2013

2.3.10 The Fenland Infrastructure Delivery Plan (FIDP) 2013 outlines the key infrastructure requirements needed or desired to support the growth in Fenland.

2.3.11 The FIDP acknowledges that the A47 is a key Trunk Road that serves many functions beyond access for local and long distance journeys.

2.3.12 In order to mitigate the impacts of the proposed growth in Wisbech, upgrades to the A47 are likely to be required.

2.3.13 The A47 junction improvements at A141/Guyhirn Roundabout are listed in the Infrastructure Delivery Schedule and notes that the scheme is necessary if growth in Wisbech is to be delivered.

Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016

2.3.14 The Cambridgeshire and Peterborough East Anglia Devolution Proposal 2016 included forming a Combined Authority that would include the following organisations – Peterborough City Council, Cambridgeshire County Council, Fenland District Council, Huntingdonshire District Council, East Cambridgeshire District Council, South Cambridgeshire District Council, Cambridge City Council and the Greater Cambridge Greater Peterborough Local Enterprise Partnership and was submitted to Government in March 2016.

2.3.15 Key areas of the proposal included a £20m annual fund for 30 years to support economic growth, development of local infrastructure and job creation; £170m for affordable housing and providing new homes across Cambridgeshire and Peterborough including affordable homes in Greater Cambridge; supporting the delivery of the Wisbech Garden Town and the Wisbech-Cambridge rail connection and transport infrastructure improvements such as A14/A142 junction and upgrades to the A10 and the A47.

2.3.16 Details of key stakeholder engagements completed during PCF Stage 1 can be found in Chapter 19 and updated for PCF Stage 2 in Chapter 32.

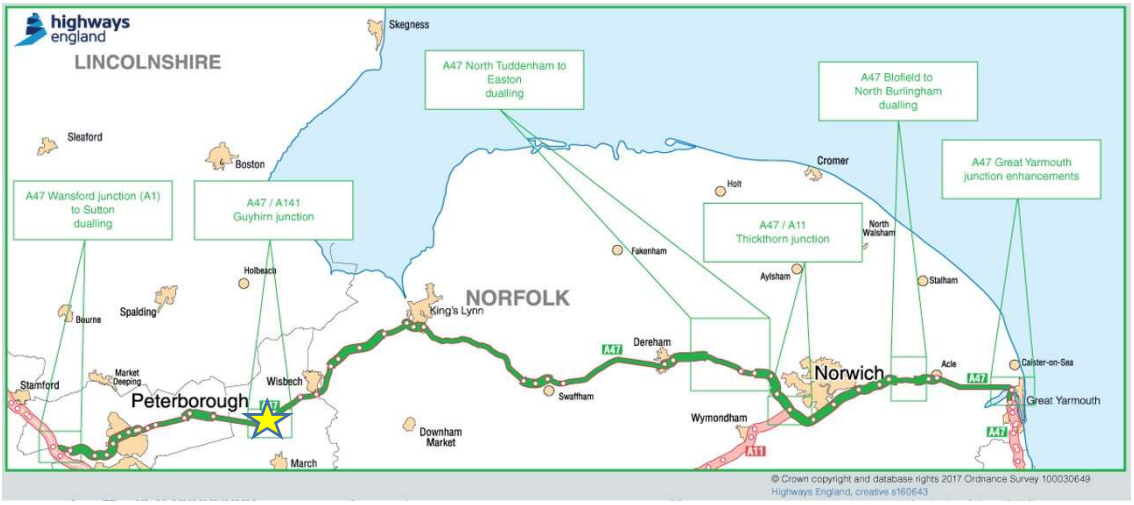
3 Existing Conditions

3.1 Description of the Locality

A47 Corridor

3.1.1 The A47 trunk roads form part of the SRN and provides for a variety of local, medium and long distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 210,000) and Peterborough (population over 180,000), 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 Guyhirn junction is indicated with a yellow star.

Figure 3-1: Location Plan



3.1.2 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.

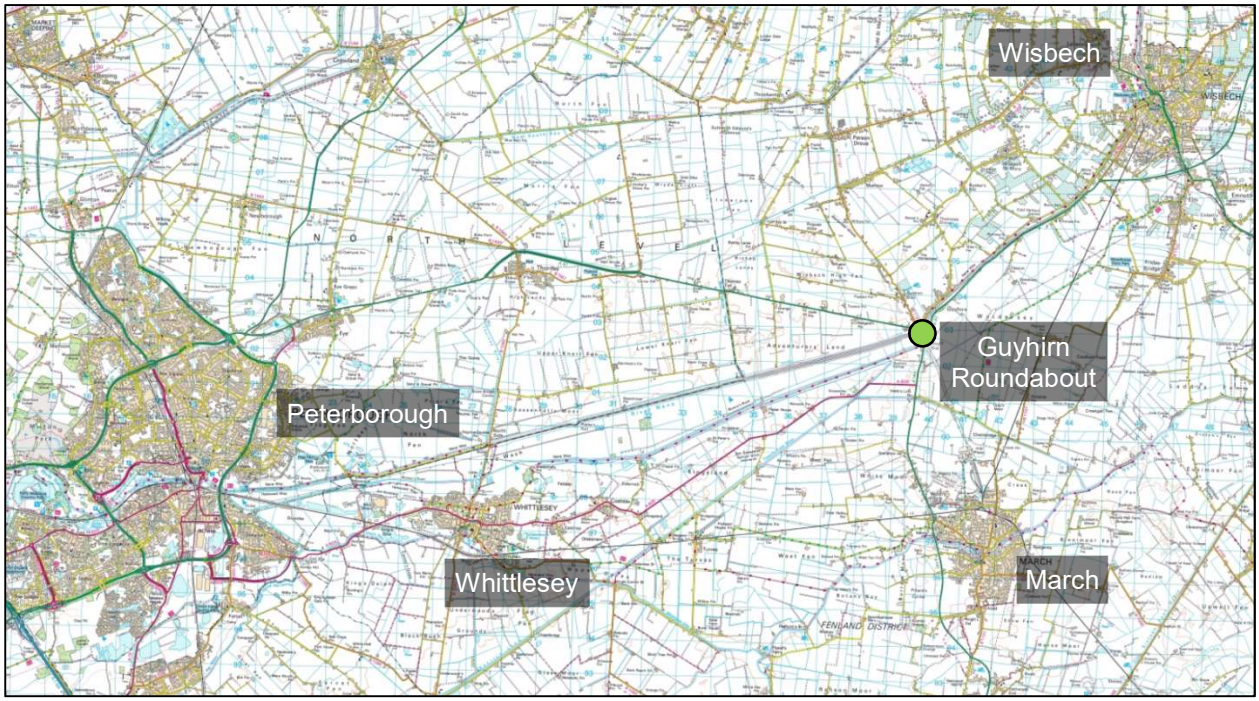
3.1.3 The A47 corridor is around 115 miles long; 54 miles (47%) is dual carriageway while 61 miles (53%) is single carriageway. Previous studies have proposed dualling a number of sections of the A47 in the short and long term, together with a number of junction improvements.

3.1.4 Comprehensive improvement of the A47 is a strategic aspiration of local Members of Parliament, local government, businesses and other stakeholders who, together, form the A47 Alliance. Their aim is to capitalise on the potential economic benefits of improved accessibility to the Midlands and the North as well as addressing congestion and safety issues.

Locality of scheme

3.1.5 Guyhirn roundabout is located on the A47 near Guyhirn and Ring's End villages in Fenland, Cambridgeshire. The junction is approximately 23km east of Peterborough city centre, 9km south-west of Wisbech and 6.5km north of March. The location of Guyhirn Roundabout in relation to these population centres is shown in Figure 3-2.

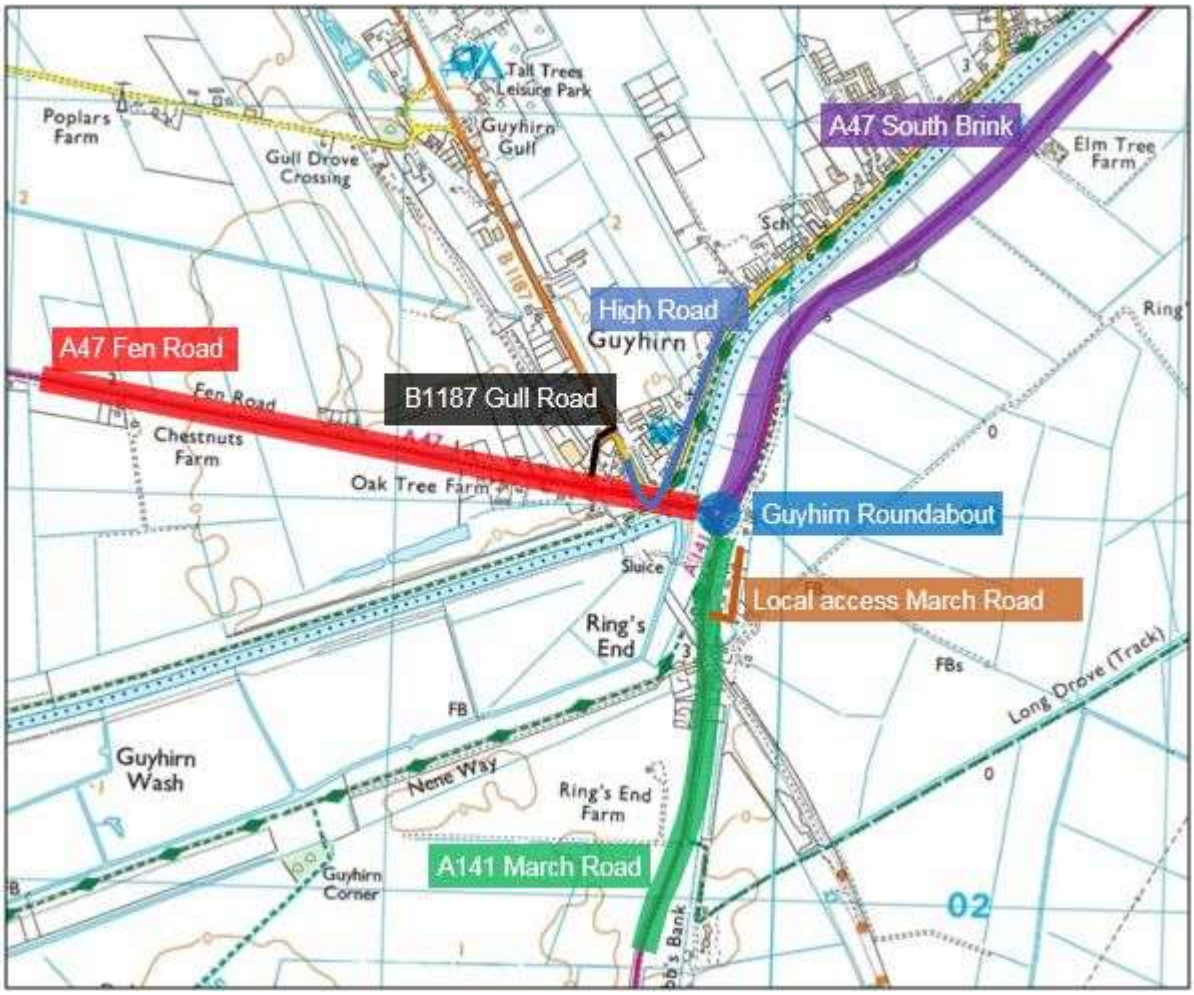
Figure 3-2: Guyhirn Roundabout and its environs



3.1.6 Guyhirn roundabout is the junction between the A47, known as Fen Road to the west and South Brink to the north-east, and the A141 March Road to the south. It is located immediately east of a crossing of the River Nene. To the immediate west of the roundabout it is largely open land, bordered by A141 or A47 and the River Nene. To the east of the roundabout is small wooded area, and beyond that is the local access March Road providing access to a number of domestic properties.

3.1.7 The location of the roundabout and the approach links in relation to Guyhirn Village and the river are shown in Figure 3-3.

Figure 3-3: Guyhirn Roundabout scheme location



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3.2 Existing Highway Network

3.2.1 The existing Guyhirn junction is a 55m Inscribed Circular Diameter (ICD) roundabout which connects the A47 Fen Road, A47 South Brink, and A141 March Road; all three are single carriageways.

3.2.2 The A47 generally runs east-west and connects Norwich and Great Yarmouth in the east and Peterborough and the A1 in the west.

3.2.3 The A47 links in the vicinity of Guyhirn are 7.3m-wide single carriageways, with the nearest dual carriageway sections on the Thorney bypass 8km to the west and at Walton Highway 13km to the east.

3.2.4 The A141 runs roughly north-south and joins Guyhirn in the north with Huntington and the A1 and A14 in the south, passing via March. The A141 is a single carriageway route along its entire length.

3.2.5 The existing highways of the A47 Fen Road leading onto A47 South Brink and A141 March Road have been assessed in terms of their horizontal and vertical geometry. Departures from standards have been identified where the existing alignment affecting the proposed works is substandard.

3.2.6 The roundabout is built on an embankment adjacent to the River Nene and is therefore elevated higher than the surrounding land and local access March Road.

3.2.7 The existing speed limit within the vicinity is 40mph, except for on the A47 South Brink where approximately 100m after the roundabout, the speed limit becomes the derestricted national speed limit.

3.2.8 B1187 Gull Road, located 400m west of Guyhirn junction on the A47 Fen Road, currently provides for left in left out movements onto the A47 Fen Road. The junction was remodelled in the last 5 years to limit turning movements onto and from B1187 Gull Road. Further consideration regarding the interaction of this junction with improvements to Guyhirn junction will be considered in future PCF stages.

3.2.9 There are no specific cycle routes at the junction. Cyclists are not permitted to use the existing footpaths described in 3.2.8 above. There is however one cycle route local to the scheme. National Cycle Route 63 follows the Graysmore Drove Road to the east in winter, while in summer use of another route along the Long Drove track is available.

3.2.10 The existing 3 span continuous steel girder bridge on the A47 Fen Road crosses the River Nene at a skewed angle. Further detail on the bridge structure is contained in Appendix 1 - HE551493-ACM-SBR-GJ-TN-SE-00003. As stated in Section 3.2.8 there are footways on either side of the single carriageway bridge.

3.2.11 Road lighting is present on the approaches to the junction as well as on the roundabout.

3.2.12 There are 4 bus stops relatively close to the junction. The nearest stop is on the A141 March Road approx. 200 metres south of the junction (one southbound and one northbound). There are another 2 bus stops (one eastbound and one westbound) on the A47 Fen Road at the Shell petrol station approximately 400m to the west of the junction.

3.2.13 NMU provision is described in Chapter 5.

3.3 Traffic

3.3.1 This section discusses the traffic at Guyhirn junction. This information has been used to assess the performance of the existing layout as well as the potential options. Details of the traffic analysis is contained in Chapter 12.

3.3.2 At PCF Stage 1, a review was undertaken of available strategic models which informed the study. Strategic models covering the A47 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
East of England Regional Model (EERM)	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.
Peterborough Transport Model (PTM)	A47 (A1 to Thorney)	2003/ 2006	Strategic SATURN model Age of base year data exceeds desirable time limit.
Wisbech Area Transport Study (WATS) model	A47 (A141 Guyhirn to B198 Lynn Road junction NE of Wisbech)	2008	Strategic SATURN model Base data is reaching time limit.
King's Lynn Transport Model (KLTM)	A47 (A17 to A149)	2007	Strategic SATURN model Base data is reaching time limit.
Norwich Area Transportation Strategy (NATS)	A47 from Dereham to Acle	2006/ 2012	Strategic SATURN model 2006 Base data is reaching time limit. Status of 2012 recalibration unclear.
Great Yarmouth Area Transport Strategy (GYATS)	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.
Lowestoft	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 Of the models shown in Table 3-1, only the Wisbech Area Transport Study (WATS), the East of England Regional Model (EERM) and the Peterborough Transport Model (PTM) contain Guyhirn junction.

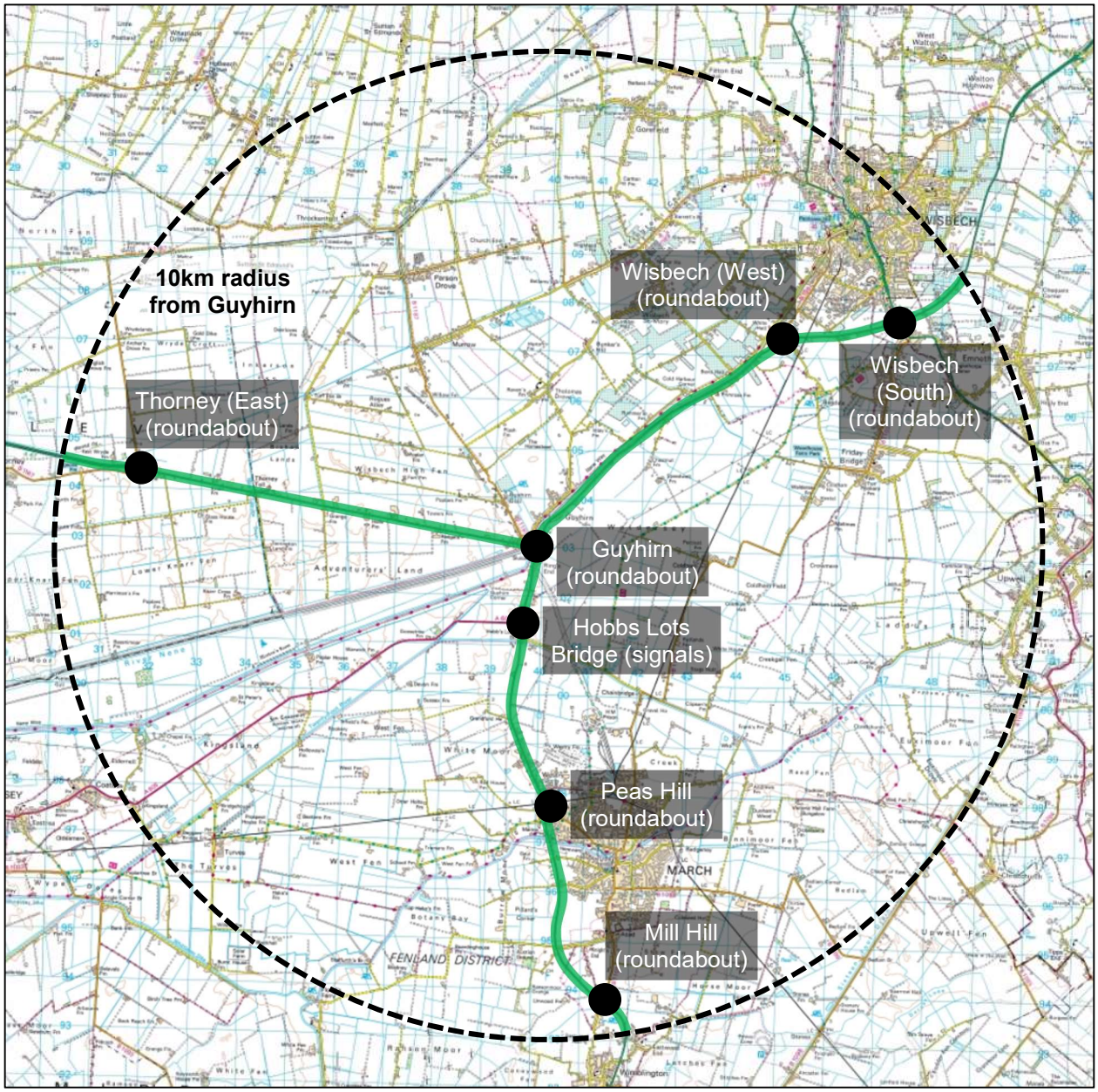
3.3.4 However, the WATS model was not used during PCF Stage 1 as the junction is located at the very edge of the model and so was deemed inappropriate for this study.

3.3.5 The EERM was not available for use at PCF Stage 1 as it was under review. As the project advanced to PCF Stage 2, a regional model was used to improve the modelling of wider routing behaviour, further detail is contained in Chapter 28.

3.3.6 A review of the PTM shows that although Guyhirn roundabout is included in the model network, it is at the very edge of the network. It was concluded that the use of this model would not be appropriate for the appraisal of the Scheme.

3.3.7 In addition to Guyhirn roundabout, the assessment identified a number of major junctions on the A47 and A141, within a 10km radius of the junction which are shown in Figure 3-4.

Figure 3-4: Major junctions on the A47 and A141 within 10km of Guyhirn Roundabout



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3.3.8 There is a roundabout downstream of Guyhirn on each of the three junction arms. In the event that an improved junction allows more and/or faster throughput there, the behaviour of each of those downstream roundabouts could be subject to changes or additional delay. The immediately downstream roundabouts are:

- **Thorney (East) Roundabout** between the A47 and B1167 at the eastern end of the Thorney bypass, 8km west of Guyhirn;
- **Wisbech (West) Roundabout** between the A47 and B198 at the western end of the Wisbech bypass, 7km north-east of Guyhirn;
- **Peas Hill Roundabout** between then A141 and B1099 to the north of March, 6km south of Guyhirn.

3.3.9 In addition to these roundabouts, there is a major signalised junction between the A141 and A605 at Hobbs Lots Bridge around 1.5km south of Guyhirn. There are also a number of priority accesses to the A47 and A141 along their lengths, particularly near the major population centres at March and Wisbech but also for smaller areas including Guyhirn village itself.

3.3.10 The impact on downstream junctions as a result of improvements at Guyhirn are included in the overall benefits/disbenefits calculated by the SATURN model and discussed in Chapter 12.

Traffic Data Collection

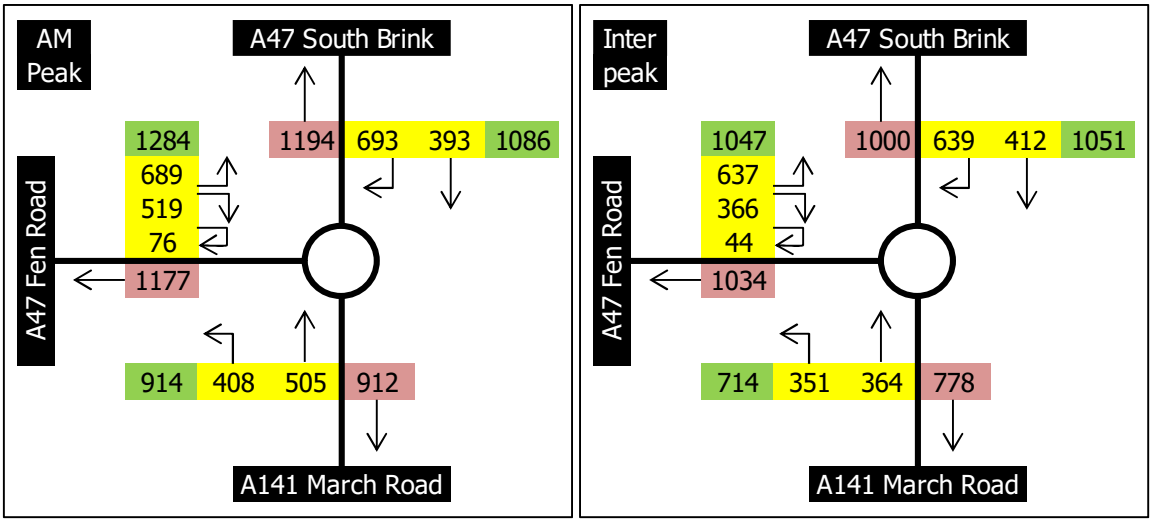
3.3.11 Traffic assessment were based on data from a variety of sources, with general WebTAG assumptions being applied where localised data was not available.

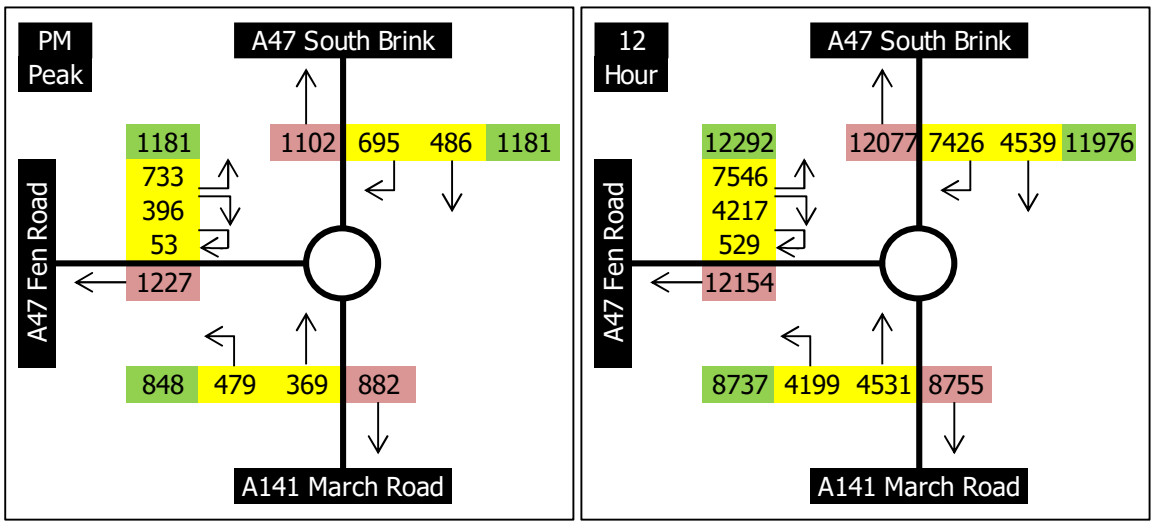
3.3.12 The approach adopted for the A47/A12 Corridor Feasibility Study (2015) made use of existing available traffic data and made general assumptions about traffic growth. Existing traffic levels were generally sourced from Highways England's Traffic Flow Data System (TRADS) or DfT counts. In some cases, additional manual counts were undertaken to supplement existing model data.

3.3.13 Traffic volumes at Guyhirn Roundabout were measured using manual classified turning counts obtained at the junction between 07:00 and 19:00 on Thursday 25th June 2015. Counts were collected for multiple vehicle classes which have been converted to Passenger Car Units (PCUs) using the conversion factors described in WebTAG Unit A5.4 Marginal External Costs.

3.3.14 The observed turning movements at the junctions are as shown in Figure 3-5 for the busiest AM peak (07:30 – 08:30), interpeak (14:00 – 15:00) and PM peak (16:45 – 17:45) hours as well as overall for the 12-hour observation period.

Figure 3-5: Turning counts (PCU's) at Guyhirn Roundabout, June 2015





3.3.15 The two A47 arms of the junction were found to be equally busy at most times, with around 1,050 entries per hour in the interpeak and around 1,180 entries per hour in the PM peak. In the AM peak period, the western approach to the junction was slightly busier at 1,284 entries per hour, the busiest of any of the approaches to the roundabout. The A141 was slightly less busy with up to 914 PCUs per hour entering the junction from this arm.

3.3.16 A total of 529 PCUs were observed to enter the roundabout from the A47 Fen Road arm and U-turn to continue westbound. This occurs due to a ban of right turning movements at the upstream priority junction with the B1187 Gull Road (currently outside the Scheme extents), forcing traffic to use the roundabout to proceed westbound on the A47.

3.3.17 Similar traffic counts were also conducted at the four junctions described in paragraphs 3.3.3 and 3.3.4, for use in the construction of a SATURN traffic model for the roundabout and surrounding area. This is further detailed in Chapter 12 of this report.

3.3.18 A queue survey was undertaken at the same time as the turning count survey, with queues on each arm recorded every 5 minutes. A summary of the queue data can be seen in Table 3-2 below.

3.3.19 The observed queuing shows that each arm has a similar level of queuing, which is to be expected given the balance of flows at the roundabout.

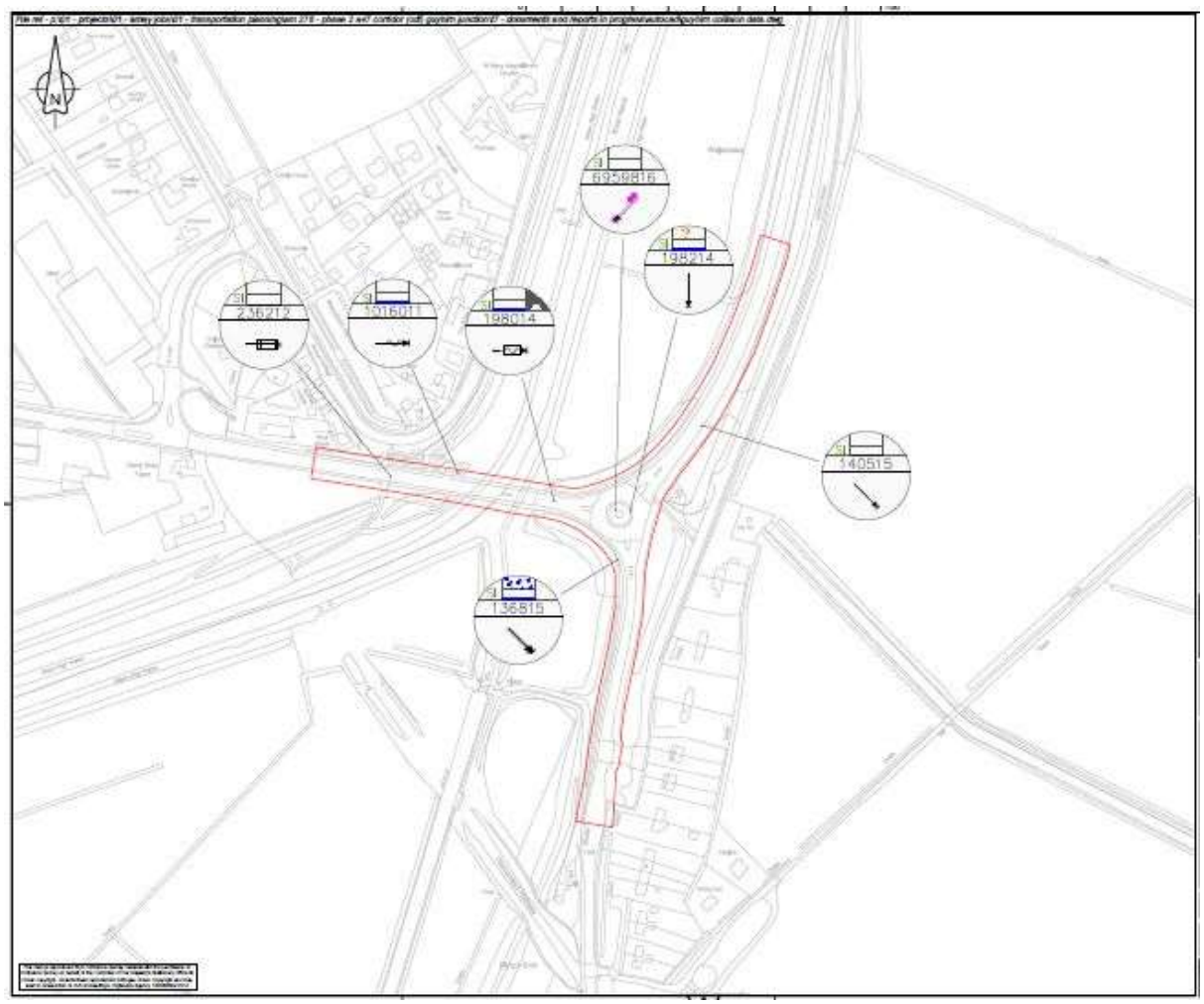
Table 3-2: Summary of Observed Queuing

	A47 S brink		A141 March Road		A47 Fen Road	
	AM	PM	AM	PM	AM	PM
Maximum	15	12	15	15	11	17
Minimum	4	2	7	1	3	0
Mean	8	7	10	7	7	7

3.4 Collision Data

3.4.1 Accident records for Guyhirn Roundabout and each of the junction approaches to a distance of 200 metres were obtained for the 5-year period between 1st October 2011 and 30th September 2016. The locations of these accidents are shown in Figure 3-6.

Figure 3-6: Location of accidents in the vicinity of Guyhirn Roundabout, 2011-2016



3.4.2 Seven injury accidents were recorded in the five-year period. Four of the accidents occurred on the western approach from A47 Fen Road and one accident occurred on each of the other two entry arms. The exact location of a seventh accident (marked 6 on the diagram) was not recorded.

3.4.3 All seven accidents were the result of rear-end shunts where a vehicle failed to stop. Four vehicle drivers and six vehicle passengers received minor injuries as a result of these accidents.

3.5 Topography, Land Use, Property and Industry

3.5.1 The topography in the vicinity of the junction is relatively flat, with the A47 being slightly elevated to the surrounding land. The land surrounding the roundabout falls away from the roundabout to the River Nene and from the roundabout to local access March Road.

3.5.2 The area surrounding the junction is predominantly drained fen land in agricultural arable use with the Nene Washes complex being used for pasture grazing.

3.5.3 The Nene Washes is a Site of Special Scientific Interest (SSSI), a Special Area of Conservation (SAC), a Special Protection Area (SPA) and a Ramsar site.

3.5.4 Land ownership within the vicinity of the junction falls into the following categories; Secretary of State, Environment Agency, residential properties, civil properties and limited commercial.

3.5.5 The Ring's End pumping station is immediately to the east of the Guyhirn junction on the other side of the local access March Road. There is also a surge chamber adjacent to the A47 South Brink on the east side that is linked to the pumping station and the culvert running under the A47 South Brink at this location.

3.5.6 The nearest local business is the Oliver Twist Country Inn and Restaurant located approximately 170 metres to the north west of the junction on the other side of the River Nene on High Road. There is no immediate access to this from the A47 roads; this is accessed from the B1187 Gull Road to the west of the junction.

3.5.7 There is a Shell petrol station approximately 400 metres west of the junction on the A47 Fen Road where a Spar grocery shop and local café/rest stop is also located.

3.5.8 Accessed from the B1187 Gull Road, which is a side road on the A47 Fen Road approximately 300 metres west of the junction, is a children's soft play, ten-pin bowling alley and 'laser tag' centre and also a self-storage business.

3.5.9 The nearest local residential properties are located on the local access March Road to the east and south east of the junction accessed by an entrance/exit onto the A141 March Road approximately 175 metres south of the junction.

3.5.10 Other commercial businesses are located to the north of the junction in the village of Guyhirn.

3.5.11 There is a disused railway line that is located to the south and west of the junction and runs approximately north west or south east in a diagonal direction. There are some remnants of the line that can be seen from the A141 March Road approx. 330 metres to the south of the junction where an old railway bridge has been severed by the road.

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.

3.7 Highway Drainage & Flooding

3.7.1 No formal drainage surveys were carried out during PCF Stage 1. 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 carriageways are drained through a system of gullies and carrier drains. Further detail can be found in points 3.7.11 – 3.7.13 below.

3.7.3 It is assumed that the land west of the roundabout will drain into the River Nene as a result of the grading, and that rainfall on the land east of the roundabout will infiltrate into the densely-wooded area.

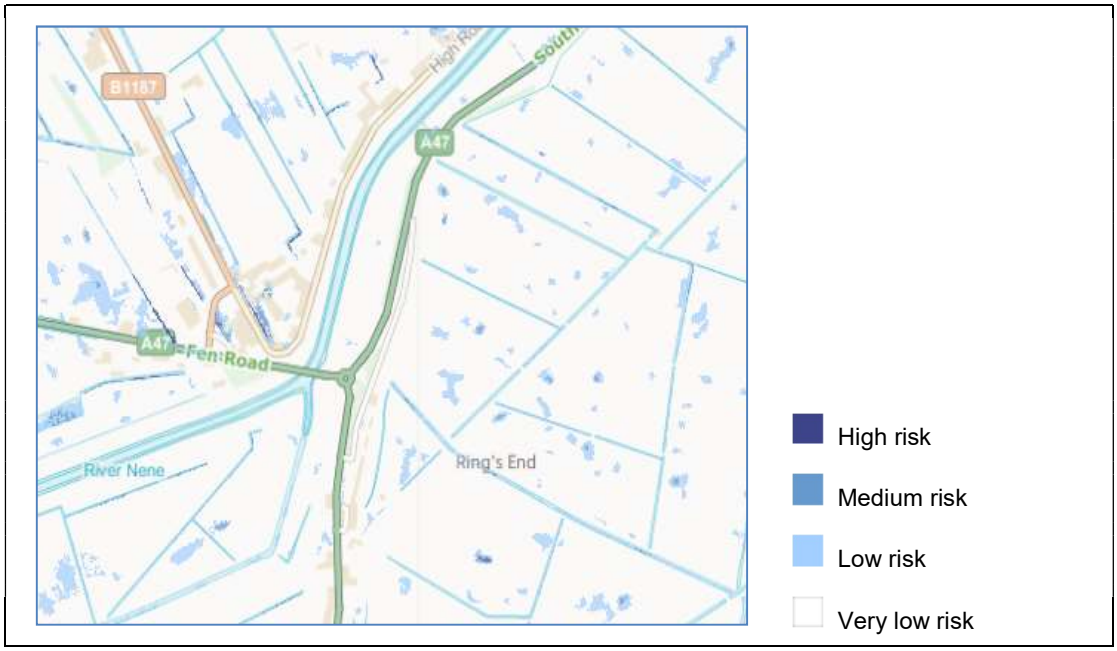
3.7.4 Groundwater strikes were recorded in a number of exploratory holes from the BGS borehole records and indicate that the soil is clayey silt on top of silty clay hence infiltration methods for surface water runoff disposal are not likely to be practical. Groundwater was present at 1.0m depth in places and will be affected by the surrounding fenland drainage system.

3.7.5 Within the vicinity of the junction there is no history of flooding problems. HADDMS lists one recorded minor flood event from 2011 where a burst water main flowed into the carriageway which resulted in damage to the road construction. On the Flood Severity Index this was rated 3 out of 10 (10 being “most severe”).

3.7.6 Flood protection for the area is provided by the A47 itself which was opened to traffic in 1990. The road, which is on embankment, acts as a flood bank and is part of the tidal flood defence of the UK east coast, 4m above the flood plain and the study area is included within a flood warning and flood alert area. Further detail on flooding can be found in Chapter 4.10. Flood plain maps can be found in Appendix 2 and have been obtained from HADDMS.

3.7.7 The risk of surface water flooding is shown in Figure 3-7. The risk of surface water flooding to the junction is low to very low.

Figure 3-7: Surface Water Flooding Risk (Environment Agency website)



3.7.8 To the east of the roundabout, some parts of the agricultural land are below sea level. The Waldersey Internal Drainage Board (IDB), controls the water levels in this area and uses the Ring’s End pumping station (see Figure 3-8), to remove surface water to the River Nene via a culvert, which passes under the northern edge of the roundabout, under the A47 South Brink. The culvert is not shown as a priority on HADDMS (culvert not designated as undersized). There is a surge chamber on the alignment of the IDB culvert, on the Highways England land as shown in Figure 3-9.

Figure 3-8: Ring's End pumping station looking east over IDB area (ref: google.co.uk)

Figure 3-9: Surge chamber on culvert alignment looking east from A47 South Brink Road (ref: google.co.uk)

3.7.9 The Morton's Leam sluice is approximately 150m south of the junction and controls the water levels in the Nene Washes which is part of a Protected Area, see Figure 3-10. The Nene Washes is used for water storage in a flood event.

Figure 3-10: Protected Areas Designation. Ramsar, SSSI, SPA, SAC and Local Nature Reserve Area (HADDMS)

3.7.10 There are no utility foul or surface water sewers in the vicinity of the junction.

3.7.11 The road drainage from the east side of the roundabout flows north and passes under the A47 in a 150mm diameter culvert approximately 75m north of the roundabout and joins the 250mm diameter carrier pipe from the north side of the junction. This carrier pipe discharges at the outfall into an open channel in the floodplain approx. 175m north of the roundabout and discharges into the tidal Nene under gravity.

3.7.12 The road drainage flows in a carrier pipe on the west side of the A141 in a southerly direction for approximately 230m then passes under the A141 in a 150mm diameter culvert and then discharges into an open drainage channel from where it is discharged into the River Nene via an IDB pumping station.

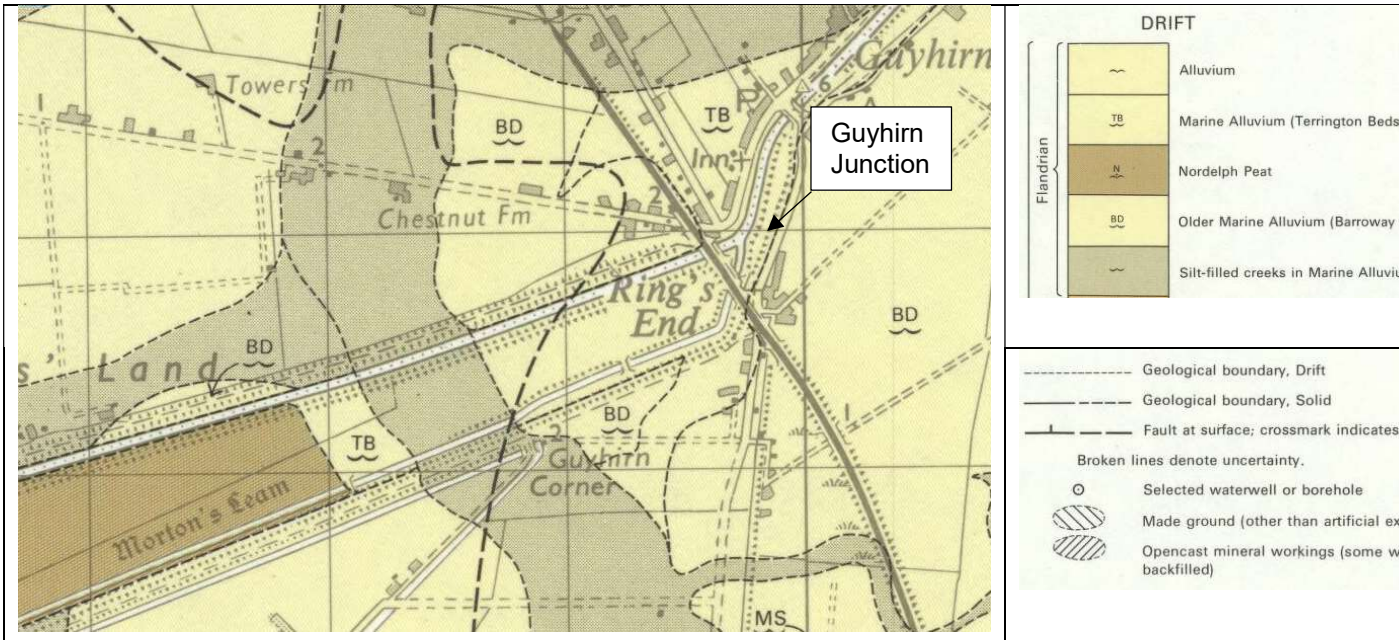
3.7.13 HADDMS does not classify any of the soakaways or outfalls in the area as high priority. In terms of the soakaways this means they are not at risk of polluting the groundwater aquifers that they flow into. In terms of outfalls this means they are not at risk of polluting the water course that they flow into The outfalls on the east side of the River Nene are described as low risk. There is no data on the drainage system condition on HADDMS.

3.8 Geology

3.8.1 This section provides information on the geology of the site that the junction is located on. Further information can be found in the PCF Stage 2 Preliminary Sources Study Report, document reference A47IMPS2-AME-GJ-ZZ-DO-J0049.

3.8.2 From the BGS records (sheet 158 Peterborough 1:50.000, BGS borehole records) and data included in the Highways England Geotechnical Data Management System (HAGDMS Ref. No. 8271, 8269, 20916 and 19205) the site is shown to be underlain by the following geological sequence. A geology map is included in Figure 3-11 below.

Figure 3-11: Geological map (BGS sheet 158 Peterborough 1:50.000).



Artificial Ground

3.8.3 No artificial ground has been recorded on the BGS maps or on HAGDMS; however, the historic and recent infrastructure development of the site is indicative of the presence of made ground beneath the existing carriageway, adjacent roads and disused railway infrastructure. Details of the makeup of the embankments are contained in the Geotechnical Feedback Report (Cambridgeshire County Council, 1993), which indicated the embankments are predominantly clay fill.

Superficial Geology

3.8.4 As shown on the Geological Map in Figure 3-11, the superficial deposits consist of Holocene alluvium saltmarsh deposits of shallow marine environment. The younger alluvium formation deposited 2,000 years ago and formed the Terrington beds. Terrington beds disconformably overlie the Nordelph Peat formation or lie directly on the Barroway Drove beds which are the older alluvium formation. As the saltmarshes were not permanent and the sea was retreating/ advancing, creeks and channels were formed which have become filled with silt; forming silt “roddons” within the old alluvium deposits (Barroway Drove Beds). The base of the drift stratigraphic sequence consists of the Terrace gravel stratum which is a discontinuous layer, varying significantly in thickness (HAGDMS Ref. No. 19205). However, in the older reports (HAGDMS Ref. No. 8271, 8269) the base of the drift sequence is comprised of the Boulder Clay formation which lies unconformably on the bedrock.

3.8.5 The geological boundary between the Terrington and Barroway Drove Beds is approximately along the disused railway, based on the Geological map, with the former encountered at the eastern and the latter at the western sides of the old railway. Consequently, the Terrington beds are expected to be encountered on the surface in the area of the junction.

3.8.6 Within the Barroway Drove Beds peat horizons and lenses (or organic matter in general) are present and especially towards the base. These horizons/ lenses may vary significantly from a few centimetres up to one metre in thickness.

3.8.7 The Nordelph Peat formation (in the BGS boreholes was described as “Upper Peat”) was encountered in both boreholes TF30SE37 (BH19) and TS30SE38 (BH 20) and recorded as soft and very soft to soft black peat. Although this layer is discontinuous, during the 1990 site investigation it was encountered in all three boreholes (BH 1, BH2/2A and BH 3) below the existing roundabout.

Bedrock Geology

3.8.8 The bedrock geology in the study area of Guyhirn junction consists of highly weathered calcareous occasionally silty mudstones of the Ampthill Clay and West Walton Beds (described as “Corallian” on BGS map) overlying silicate mudstones of the Oxford Clay formation. These formations originate from lithified sands, gravels, silts and clays deposited in shallow marine environments. Based on BGS borehole records, the (relative) basal geological formation in the area of interest consists of laminated fissured silty clay as product of weathered mudstone (Oxford Clay).

Fault Geology

3.8.9 There are no potential faults in the immediate vicinity of the junction. The only far field (inferred) fault is located close to Thorney, approximately 12km west from the site.

Historical Ground Investigation Data

3.8.10 The BGS GeoIndex Facility was interrogated to identify existing historic borehole records within the vicinity of the site. A total of five borehole records were identified within the vicinity of the site. These holes are broadly consistent with the geology described by the BGS map in Figure 3-11 above.

3.8.11 A review of the existing HAGDMS reports associated with the A47 within the boundaries of the proposed development was undertaken. Nine relevant reports were reviewed with the below giving further relevant details for the area;

3.8.12 Two of the above reports contained ground investigation and testing information relevant to the junction improvement site – report numbers 8269 (Foundation & Exploration Services Ltd, 1990) and 20916 (Foundation & Exploration Services Ltd). Information from these reports was used to summarise the ground conditions in the below section. Information from the geotechnical feedback report has also been used to determine the composition of the embankment fill.

3.8.13 The 1990 geotechnical report (Foundation & Exploration Services Ltd, 1990) indicated the existing embankment was constructed using surcharging and wick drains to accelerate settlement before the carriageway was installed. Initially, 1m of additional surcharge fill was added on top of the embankment fill, however due to the settlement progressing slower than expected, an additional 0.5m was placed after 8 months. Monitoring of settlements was continued following removal of the surcharge, with the maximum settlement recorded at the roundabout of approximately 1100mm after 460 days. Based on this, total settlement was predicted to be in the order of 1250mm.

3.8.14 The 1990 geotechnical report (Foundation & Exploration Services Ltd, 1990) suggested the amorphous nature of the tidal deposits led to the wick drains being much less effective than expected, resulting in significantly lengthened surcharge period. The actual recorded settlements over the surcharge period were also larger than expected from the oedometer testing carried out – for example at the 35 week point, 950mm of settlement was recorded compared to the predicted 750mm. The report attributes this to the peat layer below the roundabout, which was not encountered during previous ground investigations prior to construction.

Sensitive Geological Sites

3.8.15 Based on online data available from Environment Agency, there are two waste sites in the area of the junction (table 3-3 below):

Table 3-3: Landfill Sites

Distance from site (m)	Location	Operational period or licence status	Type of waste
600 west	A47 Thorney Road	19/04/1989-30/06/1991	L05 Inert landfill: Waste which remains largely unaltered once buried such as glass, concrete, bricks, tiles, soil and stones.
1,400 north west	Gull Road, , Guyhirn, Cambridgeshire, PE13 4EP	Closure	A05: Non-Biodegradable/ non-hazardous wastes

3.8.16 The Environment Agency does not classify either the bedrock or superficial deposits at the site as an aquifer and consequently there are no source protection zones in the vicinity.

GeoSure Datasets

3.8.17 GeoSure national datasets provide geological information about potential ground movement or subsidence that can help planning decisions, (http://www.bgs.ac.uk/products/geosure/home.html). 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 was conducted; a detailed review of the data is provided in the PCF Stage 2 Preliminary Sources Study Report (PSSR), document reference number A47IMPS2-AME-GJ-ZZ-DO-J0049.

3.8.18 As settlement was recorded during the initial construction phase of the junction roundabout and the associated embankments in the late 1980's/early 1990's, the presence of compressible ground in the superficial deposits is likely a function of their clayey/silty composition and especially in any occurrences of the Nordelph Peat (Class D).

3.8.19 Some hazard ratings are variable; these are likely to be related to the location of the deposit and the local conditions. The hazard rating for running sand is expectedly high (Class D-E); much of the area around the Wash has a similarly high risk and can be attributed to the sandy composition of the Terrington Beds and Barroway Drove Beds.

3.8.20 Earthwork defect information obtained from HAGDMS in the vicinity of the roundabout includes cracked pavements and subsidence of the road surface. Cracking in pavements ranged from 6m to 32m in length. Subsidence was reported as Class 1D.

Hydrogeology

3.8.21 Environment Agency (EA) and data available on HAGDMS provides the following information on the hydrogeological regime of the project area.

3.8.22 The Environment Agency website indicates that the site is not within or located nearby to any groundwater Source Protection Zones (SPZs). The closest SPZ is to the west of Peterborough approximately 30km to the west.

3.8.23 Aquifer vulnerabilities are classified as high, medium and low which are an indication of the likelihood of pollutants discharged at ground level reaching groundwater for both superficial and bedrock aquifers. The Environment Agency Website indicates that the site is not in a designated zone of soil vulnerability.

Landslide Risk

3.8.24 Landslide risk data available on HAGDMS does not show any areas at risk from landslides at Guyhirn junction.

Hydrology

3.8.25 Environment Agency records presented on HAGDMS identifies the River Nene as flowing south-west to north-east on the western edge of the scheme. Morton's Leam drainage channel joins the River Nene immediately south of the A47 Fen Road bridge. Morton's Leam was expanded in 1728 in order to improve navigation of the River Nene and drainage of the surrounding area (Watson, 1827). After Guyhirn and up to Peterborough, the river channel has a straight alignment which suggests that it is not its natural course. Numerous drainage ditches are recorded within close proximity to the existing carriageway and proposed route. One channel draining the fields to the east of the roundabout becomes a culvert underneath the A47 South Brink embankment before entering the River Nene.

3.8.26 Surface water drainage detail is provided on HAGDMS [2] and assets include: inlets, gully's pipework, catchpits, inspection chambers, connection nodes and rodding eyes arranged around and across the existing junction roundabout.

Geomorphological Review

3.8.27 The A47 route from Thorney to Guyhirn Junction crosses the alluvium dominated valley around the River Nene. The road embankment increases in height from around 1 to 2m above existing ground level to around 4m at Guyhirn junction.

3.8.28 The River Nene is located approximately 80m to the west of the existing roundabout and flows to the south of the site, but turns north to cross under the A47 Fen Road, which is carried on the aforementioned bridge.

3.8.29 Settlements were monitored at Guyhirn during construction of the junction as described in the "Embankment Construction Report on Site Investigation" (HAGDMS ref. No. 8269).

3.9 Unexploded Ordnance

3.9.1 The Regional Unexploded Bomb Risk map for Cambridgeshire (Zetica) shows the railway at March, approximately 7km south of the proposed junction, is considered as a War World II bombing target. The bomb tonnage for the March town is unverified and the probability of encountering unexploded bombs is low. However, it is noted that the railway line continued to the north, in the proximity of Guyhirn junction, where remains of the columns of the railway bridge are present. Therefore, a further unexploded ordnance (UXO) risk assessment is recommended at future PCF Stages.

3.10 Mining

3.10.1 Following a review of both The Coal Authority Gazetteer website and HAGDMS, it has been identified that there should be no presence of Mining Operations in the study area.

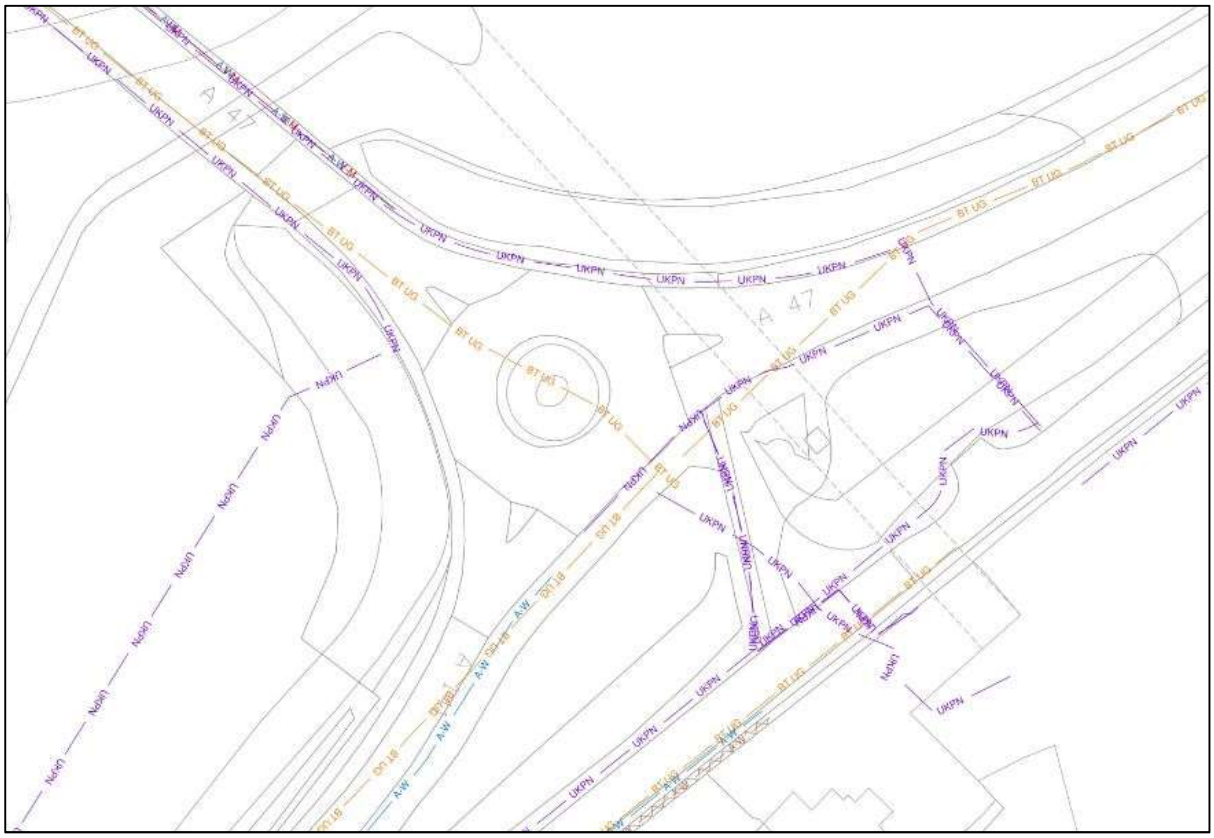
3.11 Public Utilities

3.11.1 Utilities records enquiries were issued to all Statutory Undertakers likely to have apparatus within the vicinity of the works. A diagram showing the utilities present can be seen in Figure 3-12. Four of the requested statutory undertakers responded illustrating located equipment within the vicinity of the junction. It is assumed that those that did not reply do not have

apparatus in the vicinity. Below is a summary that outlines the exiting apparatus at Guyhirn Roundabout;

- Anglian Water mains are located under the existing footpath and the verge along the northern side of A47 Fen Road and continue on the northern side of A47 South Brink Road. This water main crosses to the southern side of the A47 South Brink approximately 40m from the existing roundabout. Anglian Water mains have also been located along the western side of the A47 March and A47 South Brink Roads under the verge adjacent to the carriageway.
- Virgin Media cables are located under the existing footpath along the northern side of A47 Fen Road and continue under the eastern edge of the roundabout. The ducts cross perpendicular to the carriageway on the northern side of the roundabout under the A47 South Brink road before continuing along the western side of A47 South Brink road.
- BT cables are located under A47 Fen Road. These ducts connect to the BT ducts that run along the western side of A141 March Road and A47 South Brink road.
- UK Power cables are located along both sides of the A47 Fen Road under the existing footpath. The ducts on the northern side of the A47 Fen Road extend to the A47 South Brink road and crosses perpendicular to the carriageway to the western side of A47 Brink road. Ducts have also been located continuing along the A141 March Road on the western side.

Figure 3-12: Guyhirn utilities



3.12 Technology

3.12.1 There is limited existing technology at the Guyhirn junction.

3.12.2 There is a CCTV camera on the eastern side of the roundabout which looks west, as well as lighting columns throughout. There are no overhead utilities.

3.12.3 There are traffic count loops on each of the A47 arms of the Guyhirn junction at the below locations:

- TMU Site 6349-1 on link A47 westbound between B198 near Wisbech (west) and A141 - GPS Ref - 543583 - 306439
- TMU Site 6349-2 on link A47 eastbound between A141 and B198 near Wisbech (west) - GPS Ref - 543580 - 306443
- TMU Site 6350-1 on A47 eastbound between B1167 near Thorney (east) and A141 - GPS Ref - 537648 – 303358
- TMU Site 6350-2 on A47 westbound between A141 and B1167 near Thorney (east) - GPS Ref - 537648 – 303358

3.13 Maintenance Access

3.13.1 There is limited existing infrastructure for maintenance at the junction.

3.13.2 There are no maintenance laybys on any of the approaches.

3.13.3 There are steps that lead down to local access March Road from the A47 South Brink to the east of the junction for pedestrians and access to the adjacent surge chamber and pumping station can be obtained from here.

3.13.4 There is an access point to the west of the junction just over the River Nene bridge on the north side of the A47 Fen Road, approximately 150 metres from the junction, where the vehicle restraint system is interrupted that leads down to the embankment by the River Nene. Access to the bridge structure can be obtained from here.

3.13.5 Access to the sluice gate on Morton's Leam to the south west of the junction is obtained from an access point at the bus stop on the A141 March Road, approximately 200 metres south of the junction. This leads up a gravel track over the embankment towards Morton's Leam.

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 3 - HE551493-AME-EGN-GJ-DR-EN-0002 Study Area. Chapter 2 of the PCF Stage 1 EAR provides details of the methodology used to define the study area and 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 No air quality monitoring is undertaken within the study area by Fenland District Council (FDC). There are also no declared AQMAs within the study area or any likely to be impacted by the scheme outside it.

4.2.3 Background air quality concentration data for 2016 from Defra, based on the 2013 background mapping, show that there are no exceedances of the Air Quality Strategy objectives in the study area. Background air quality concentrations at the 1km grid squares in the study area show:

- that there is a higher concentration of oxides of nitrogen in the areas where roads are concentrated, with particulate concentrations higher both where roads are present and in the worked arable agricultural areas; and
- no exceedances of the Air Quality EU limit values are estimated for either pollutant in 2016 in the study area.

Receptors

Human Exposure

4.2.4 An approximate count of human receptors within the study area is shown in Table 4-1 and PCF Stage 1 EAR Figure 2.4.1.

Table 4-1: Approximate Counts of Human Receptors within the Study Area

Receptor Type	Quantity
Residential	112
Community	4
Commercial	6

Designated Sites

4.2.5 The Nene Washes Ramsar/SPA/SSSI and Nene Washes SAC designated sites, shown in PCF Stage 1 EAR Figure 2.4.1**,** are located partially within the study area. The SAC citation lists the following habitats within its boundaries (with further information provided in section 4.5 Nature Conservation and Biodiversity):

- N06 Inland water bodies (Standing water, Running water);
- N07 Bogs, Marshes, Water fringed vegetation, Fens; and
- N14 Improved Grassland.

4.2.6 The citation also lists *Juncus* sp. grasses as being present. Features of the listed habitats and the *Juncus* sp. grasses are sensitivity to elevated deposition of nitrogen.

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 the scheme. Risks during construction are primarily from construction dust. This can occur through particles suspended in the air, and through deposition of particles on receptor surfaces. Construction dust can include particles that contribute to ambient PM_{10} concentrations, and also far coarser particles. There are no 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. Construction dust can also affect ecosystems through deposition that acts as a barrier physical to photosynthesising plants, and through the effects of its chemical constituents on sensitive ecological receptors.

4.2.8 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)

4.2.9 Permanent risks to local air quality can result through changes in the alignment of road centrelines and road edges to a position closer to sensitive human and ecological receptors, and also 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 can affect ambient air quality and there might be an increase in diesel powered HGV and LGV traffic that could result in an increase to PM and NO_2 levels.

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

Risk to Ecosystems

4.2.11 All ecological receptors within the study area are exposed to the risk of increased concentrations of ambient NO_X and nitrogen deposition of vehicle exhaust gas pollutants and are therefore potential constraints to the scheme.

4.2.12 Ecosystems are generally affected by the deposition of nitrogen, affecting the balance of nutrients available. Changes in the levels of nutrient nitrogen can favour those plants that will thrive in a high nutrient environment, and thus out-compete those that favour low nutrient environments. Dust deposition can also act as a physical light barrier and block plant stomata. However, the risk to the health of ecological receptors from temporary construction dust deposition is considered to be low because the impacts are likely to be temporary and transient. The Nene Washes Ramsar/SAC/SPA/SSSI area is considered to be exposed to these risks and can be considered to have very high sensitivity because of the very limited potential for substitution.

4.2.13 Deposition of sulphurous compounds and their acidic effects is no longer considered a risk due to the removal of sulphur from road fuels.

Compliance Risk (EU Directive on Ambient Air Quality 2008/50/EC)

4.2.14 The Compliance Risk is the likelihood that the scheme may cause the EU air quality limit values to be exceeded either at the scheme location or at locations on the local Compliance Risk Road Network as affected by the scheme. The latest UK air quality compliance report available described in the PCF Stage 1 EAR states that the Eastern non-agglomeration area in which the scheme is located, did not meet the EU mean annual average limit values for NO_2, but did comply with other thresholds. Accordingly, there is the risk that the scheme may contribute negatively to compliance risk 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 Ancient Monuments within the study area.

Recorded Archaeological Sites

4.3.3 There are no World Heritage Sites recorded within the study area. There are six archaeological records within the study area in the Cambridgeshire County Council Historic Environment Records (CHER), which are shown in PCF Stage 1 EAR Figure 2.5.1 and represent remains from the early medieval period through to the modern era. They vary considerably in size and complexity, from early medieval and post-medieval activity related to agriculture and drainage of the fens. The remaining historical structures include the railway viaduct of the Industrial era that dominates Guyhirn and the five historic structures related the Second World War.

Unrecorded Archaeological Remains

4.3.4 The known archaeological site within the study area and the waterlogged nature of the landscape suggests that there is high potential for further buried archaeological remains to survive.

Listed Buildings

4.3.5 There are four Grade II listed buildings in the study area, as outlined in Table 4-2 with the features identified by their map reference numbers in Figure 2.5.1 of the PCF Stage 1 EAR.

Table 4-2: Listed Buildings within the Study Area

Map ref.	NHLE No.	UID No.	Grade	Description
7.	1125896	48179	II	Church of St Mary Magdalene, High Road, Guyhirn
8.	1125898	48183	II	War Memorial within grounds of St Mary Magdalene Church, High Road, Guyhirn
9.	1310300	48091	II	Toll House, March Road, Rings End
14.	1125895	48178	II	Ashtree Farmhouse, High Road, Guyhirn

Undesignated Historic Buildings and Structures

4.3.6 The CHER includes a railway viaduct and five structures dating to the Second World War within the study area as shown in PCF Stage 1 EAR Figure 2.5.1.

Registered Parks and Gardens and Registered Battlefields

4.3.7 There are no Registered Parks and Gardens or Registered Battlefields within the study area.

Conservation Areas

4.3.8 There are no conservation areas within the study area.

Historic Landscape Character Areas

4.3.9 Cambridgeshire County Council (CCC) has withdrawn its historic landscape character (HLC) dataset from the public due to concerns about its content. The following information about the HLC for the study area was obtained through consultation with the Historic Environment Team Manager at the Council.

4.3.10 The study area is within the Cambridgeshire Silt Fen Historic Character Area. For most of the last 10,000 years (Flandrian period), fenland deposits have created the peat fen and silt fen, much of which survives in waterlogged conditions that promotes excellent preservation. Areas of fenland were drained and enclosed by private owners from the early medieval period onwards, resulting in extensive areas of pasture. Earthen banks were created to protect the silt fens and rivers became canalised to prevent damage to the silt land flood banks. Drainage formed a pattern of regular, rectangular fields still predominant on the present landscape. Post-medieval drains, banks and wind pumps were later replaced from the 1820s by steam pumps. The modern landscape is dominated by regularly shaped fields, mostly for arable crop production, surrounded by regular, straight drainage ditches.

Key Constraints

4.3.11 There are four Grade II listed buildings within the study area which are assigned a medium value due to their designated status and their regional importance. The scheme has the potential to have an adverse impact either directly on them or indirectly on their settings.

4.3.12 There are twelve further archaeological and historical structures recorded in the study area. They vary considerably in size and complexity, from early medieval and post-medieval activity related to agriculture and drainage of the fens, to the railway viaduct site of the Industrial era that dominates Guyhirn, to the five historic structures related the Second World War. These have been assigned a medium value because together they indicate that the area has been utilised from at least the early medieval period onwards, and the remains are of well-defined extent, date and significance to the local area and region.

4.3.13 There is the potential for encountering features and artefacts during construction, particularly as previous investigations in the area have revealed recorded archaeological sites. This potential increases with greater land take.

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 sensitivities 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 or gardens within the study area.

National Character Areas

4.4.4 The study area lies within National Character Area (NCA) 46; The Fens as shown in the PCF Stage 1 EAR Figure 2.6.1. The Fens (NCA) is a distinctive, historic and human influenced wetland landscape lying to the west of the Wash estuary, which formerly constituted the largest wetland area in England. The area is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The level, open topography, shapes the impression of huge skies which convey a strong sense of place, tranquillity and inspiration. One per cent of the NCA falls within the Norfolk Coast Area of Outstanding Natural Beauty, which is a large, low-lying, flat landscape with many drainage ditches, dykes and rivers that slowly drain towards the Wash, England's largest tidal estuary.

Local Landscape Character Area

4.4.5 The study area lies within the Fenlands Landscape Character Area and the PCF Stage 1 EAR Figure 2.6.2 shows the main landscape features. The guidelines describe the LCA as a landscape of contrast and variety. It is a large open landscape characterised by continuous change as the characteristics of one fen merge into the next. The open landscape provides distant views where the scattering of clumps and individual trees merge to produce a more densely tree covered horizon. In the expansive landscape, isolated agricultural buildings, farmsteads and loose-knit villages are often prominent against a background of a constantly changing sky.

Landcover, Pattern and Texture

4.4.6 The land immediately surrounding the existing A47 Guyhirn junction is predominantly agricultural land. These fields shape the linear pattern of the landscape, along with the River Nene which follows an almost straight course across the fields. Woodland is sparse and most of the trees grow on the roadside verges or as riverside vegetation in the floodplain of the river. This lineal distribution of trees screens many views in the area, including views of the current road alignment from the surrounding residential clusters. There are no ancient trees within the study area.

4.4.7 From the west of the Fen Road Bridge, the river follows an east-northeast direction, running parallel to a canalised diversion (Morton's Leam) along a wide floodplain, allowing the natural conditions for many habitats to develop (see section 4.5 for further details).

Scale and Appearance

4.4.8 As noted, the area comprises part of the River Nene floodplain (shown in Figure 4-1) and is surrounded by medium to large sized agricultural fields, characteristic of the area. Guyhirn junction appears as a knot of linear elements surrounded by small clusters of buildings (shown in Figure 4-3), however the extensive nature of the landscape around can still be perceived from the area.

Figure 4-1: Confluence of the River Nene and the Morton's Leam from Fen Road Bridge looking South

Figure 4-2: View of the River Nene looking West-Southwest from the Public Rights of Way (PRoW) coming from Fen Road

Figure 4-3: Properties in High Road, View from PRoW looking South West

Tranquillity

4.4.9 The study area lies within rural Cambridgeshire. Development is limited and the wider area offers a tranquil atmosphere. However, the A47 and A141 converge within the study area and both roads are heavily trafficked (shown in Figure 4-4). Street lighting is present on the approach to the A47/A141 Guyhirn junction which interrupts the tranquillity of the area.

Figure 4-4: View from A47 Fen Road Bridge looking west

Cultural

4.4.10 There are no landscape designations within 2km of the scheme, but there are a number of listed buildings within the study area as described in section 4.3 Cultural Heritage. The area is characterised by medium to large fields which are bounded to the carriageway by fences and vegetation. There are few stone walls within the immediate area and little hedgerow to contribute to the historic landscape.

4.4.11 There are some buildings in High Road built in the traditional style of the area (tiled roofs, bricked of painted walls) but most of the buildings in Guyhirn are more modern and built with the aesthetic of modern rural developments.

Human Interaction

4.4.12 Because Guyhirn is located directly on the junction of two A roads, the A47 and the A141, there is a high volume of traffic at the junction, which dominates human interaction in the area. There is a coffee shop, a restaurant and an inn in Guyhirn village, easily visible and accessible from the road. There are PRoWs and pedestrian tracks along the main roads and along the River Nene that facilitate non-motorised users through the area.

Visual Receptors

4.4.13 Views within the study area are generally open as a result of the flat agricultural land and limited woodland cover. A zone of visual influence has not yet been defined for the junction improvements, however from a site walkover in June 2016 the following receptors are considered to have a view of the existing A47 (PCF Stage 1 EAR Figure 2.6.3 shows the

potential visual receptors in summer and PCF Stage 1 EAR Figure 2.6.4 shows the potential visual receptors in winter):

- Properties along either side of the local access March Road experience varying views of the A47 and A141 looking east and west. A line of deciduous woodland runs in front of the properties at the northern end and so more open views of the A47 and A141 will be experienced in winter with restricted views in summer when the trees are in leaf;
- Four commercial properties and one residential property on Fen Road have direct views of the junction;
- A group of residential properties on Gull Road experience restricted views of the A47 looking south. A small embankment runs immediately to the south of the properties with a line of mature deciduous woodland which will restrict summer views;
- A group of residential and commercial properties on High Road experiences oblique views of the existing A47 looking south. The road here is raised as it passes the properties and so views of the carriageway are more limited;
- There are two footpaths, which are also PRoW, on both sides of the river. These closely follow the roads and also have open views of them.

Key Constraints

4.4.14 There are no landscape designations within the vicinity of Guyhirn junction. The study area predominantly contains flat agricultural land. Land take from such prime agricultural land is considered to be a constraint to any improvement option. Woodland and vegetation are limited and there are no constraints from ancient trees. However, the limited areas of trees and woodland belts are important features in the existing landscape and accordingly, landscape features are considered to have a moderate to low sensitivity to change.

4.4.15 There are a number of visual receptors within the study area which are a mix of residential and commercial properties and hold varying views of the A141 and A47. Residential receptors are the most sensitive receptors to any visual change in the junction arrangement along with users of the PRoW network close to the roads and are considered to have a high sensitivity.

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 desktop study and fieldwork undertaken as part of a Preliminary Ecological Appraisal (PEA) carried out by Amey ecologists in winter and summer 2016.

Baseline Conditions

Designated Sites

4.5.2 As described in the PCF Stage 1 EAR, online sources identified five statutory designated nature conservation sites within 2km of the junction. The sites are detailed in Table 4-3, with their distance from the existing junction and the qualifying/notifying features, and shown in the PCF Stage 1 EAR Figure 2.7.1.

Table 4-3: Designated Sites

Designated Site	Distance from A47 Guyhirn Roundabout at closest point (km)	Reason for Designation
Nene Washes Ramsar	0.04km south west	The Nene Washes complex of sites is associated with the River Nene, which floods the area seasonally providing an important flooded grassland habitat for a wide range of bird species. The SAC is designated for its population of spined loach *Cobitis taenia* associated with Morton's Leam. The SPA/Ramsar is designated for its assemblage of breeding and non-breeding birds including ruff *Philomachus pugnax*, spotted crake *Porzana porzana*, Bewick's swan *Cygnus columbianus*, black-tailed godwit *Limosa limosa*, pintail *Anas acuta* and shoveler *Anas clypeata*, and qualifies under Article 4.2 of the Birds Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.
Nene Washes SPA	0.04km south west	
Nene Washes SAC	0.13km south west	
Nene Washes SSSI	0.04km south west	Designated for its washland habitat, essential to the survival nationally and internationally of populations of wildfowl and waders during the breeding season and winter. The ditches hold a rich flora which includes uncommon species of aquatic plant.
Ring's End LNR	0.45km south east	An 11 hectare site which runs from the village of Ring's End to Twenty Foot River. The site contains extensive reedbeds, three large ponds and small areas of scrub. Extensive reeds and open water sheltered by scrub create a valuable retreat for wetland birds and water vole *Arvicola amphibius*.

4.5.3 No statutory sites designated for bats or birds were found within an extended 10km search area, in addition to those listed above.

4.5.4 Online sources identified three non-statutory designated nature conservation sites within 2km of project extents and the sites are shown in Figure 2.7.1 of the PCF Stage 1 EAR.

Habitats

4.5.5 Priority Habitat Inventory Data indicate that four Biodiversity Action Plan (BAP) priority habitats are present within the 2km study area; coastal and floodplain grazing marsh, lowland fens, lowland mixed deciduous woodland and traditional orchards. Although not indicated in the Priority Habitat Inventory, field surveys indicate that reedbed priority habitat is also present.

4.5.6 Table 4-4 shows the habitat types found within the Phase 1 survey area (as shown in the PCF Stage 1 EAR Figure 2.7.2).

Table 4-4: Habitats

Habitats within Study Area	
Broadleaved woodland, including semi-natural and plantation	Dense and scattered scrub
Scattered trees	Species-poor hedgerows
Semi-improved neutral grassland	Improved grassland
Amenity grassland	Arable

Habitats within Study Area	
Tall ruderal	Swamp (reedbed)
Running water	Standing water

Protected and Notable Species

4.5.7 Following the Phase 1 Habitat Survey and records search, the study area has the potential to support the following protected and notable species:

- Amphibians - 3 ponds were subject to eDNA survey and all results were negative. The survey results, in combination with a lack of local Great Crested Newt (GCN) records, indicate that GCN are absent from the survey area.
- Birds - observations during the ecological surveys along with records indicate:
    - Extensive bird records with species of various levels of protection. Many of the records are of wetland birds, such as swans, geese and wildfowl, associated with the Nene Washes.
    - Suitable habitat for breeding and wintering birds including reedbeds, grassland, woodland, hedgerows and scrub. Bird nests were frequently observed in woodlands and scrub near to the Guyhirn junction and a barn owl nest box was located at the Ring's End pump house. Vegetated ditches and reedbed support good numbers of breeding warblers, while semi-improved grassland and arable fields are suitable for ground-nesting birds such as skylark *Alauda arvensis*.
    - Wintering bird survey recorded 49 species, of which nine are Red listed Birds of Conservation Concern. Two of the species observed in the survey area are listed on Schedule 1 of the Wildlife and Countryside Act 1981: marsh harrier *Circus aeruginosus* seen hunting over Guyhirn Reedbed CWS, and redwing *Turdus iliacus* observed in the Nene Washes fields. The wintering birds observed within the survey area were mostly those of farmland and woodland habitats, rather than waders and wildfowl associated with wetlands and open water on the Nene Washes.
    - Breeding bird survey recorded 51 species, of which ten are Red listed Birds of Conservation Concern. Two Schedule 1 species were recorded: a pair of marsh harrier and at least three Cetti's warbler *Cettia cetti* territories being held in reedbeds and hedgerow to the south-west of the roundabout. Other notable breeding species include turtle dove *Streptopelia turtur* and cuckoo *Cuculus canorus* both heard singing in scrub/reedbed near the roundabout during the Phase 1 habitat survey.
- Invertebrates – records of three notable species, including the aquatic beetle Gyrinus paykulli which is nationally scarce. Habitats such as reedbed and semi-improved neutral grassland have potential to support communities of aquatic and terrestrial invertebrates, including dragonflies and butterflies noted during site surveys.
- Badger - suitable habitat for badger was identified with two active badger setts with associated pathways and foraging signs recorded during the survey.
- Bats - twelve areas of habitat and buildings were identified on site with potential to support roosting bats as shown on PCF Stage 1 EAR Figure 2.7.4.
- Otter and Water Vole - water features within the survey area generally have low potential to support otter and water vole and the presence of American mink Neovision vison in the Nene catchment is likely to have impacted on water vole populations in the area.
- Reptiles - results of the initial survey confirm that grass snake Natrix natrix and common lizard Zootoca vivipara are present in low numbers in the vicinity of the existing junction. Common toad Bufo bufo has also been recorded.

Invasive Species

4.5.8 Invasive species within the area include mature stands of Japanese knotweed *Fallopia japonica* (the area has been mapped by an ecologist and is currently being treated by the relevant authorities) and invasive aquatic plants Canadian waterweed *Elodea Canadensis* and Nuttall's waterweed *Elodea nuttallii* in Morton's Leam at Ring's End. The non-native invasive Chinese mitten crab *Eriocheir sinensis*, American signal crayfish *Pacifastacus leniusculus* and American mink are also known to be present within the lower River Nene catchment.

Key Constraints

4.5.9 Table 4-5 identifies the ecological features within the study area and provides an indication of their value (as explained in detail in the PCF Stage 1 EAR). Key constraints are those of regional, national and international value.

Table 4-5: Ecological Features

Ecological Feature	Resource Valuation
Designated sites	
Nene Washes Ramsar	International
Nene Washes SPA	International
Nene Washes SAC	International
Nene Washes SSSI	National
Ring's End LNR	County
All CWS	County
Habitats	
Priority habitats	County
Running water	County
All other habitats	Local
Protected/ notable species	
Bats	Regional
Badger	Local
Reptiles	Local
Breeding bird species	Regional
Wintering bird species	County
Water vole	County
Otter	County
Spined loach	National
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 4-6 identifies the materials use and potential waste that are likely to arise from the scheme.

Table 4-6: Materials Use and Waste Production

Project Activity	Material use	Potential waste arisings
Site remediation / preparation / earthworks	Site clearance may 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 may 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) may 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 may have its own cost benefits and may 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.	The existing road and roundabouts may be taken up and removed. There may also be properties that may be demolished and removed if they lie beneath the scheme. 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	This scheme may require a large amount of materials in order to construct, most obvious of which is the materials required to construct the new widened carriageways, cycle ways and footpaths. 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 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	Materials should be ordered as and when required to minimise storage times on site. This will prevent deterioration of materials and reduce wastage 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 a potential for road planings to contain coal tar which would be classified as hazardous waste and would require disposal at a hazardous landfill site. 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

Project Activity	Material use	Potential waste arisings
	pedestrian crossings which will be a mixture of a segregated cycle lane and shared cycleway / footway.	site or from a materials reclamation centre it would reduce the impact
Operational / maintenance	The material resources and waste post construction cannot be estimated at this stage. 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 During PCF Stage 1 there was insufficient information to accurately forecast waste streams that will be produced on the site as the scheme design was still in development. Therefore, local landfill capacity as a whole was reviewed. The Environment Agency has information on the nearest active landfill sites to the scheme, as summarised in Table 4-7.

Table 4-7: Nearest Waste Infrastructure

Name of Site	License Number	Distance	Type of site
March Landfill East Waste, Hundred Road, March, PE15 8QN	EAEPR\EA/EPR/ZP3790NA/V002	5km	A02: Other Landfill Site taking Special Waste (Hazardous)
Mill Drove Blackborough End, Norfolk, PE32 1SQ	EAEPR\EA/EPR/EP3499NT/V002	29.5km	A04: Household, Commercial & Industrial Waste Landfill (Non-hazardous)
Frimstone Blackborough End, Norfolk, PE32 1SW	EAEPR\EA/EPR/EP3898NE/A001	29.7km	A05: Landfill taking Non-Biodegradable Wastes (Non-hazardous)
Eye North Eastern Landfill Biffa Waste Services Ltd,	KP3638AJ	16.7km	Inert waste
Dogsthorpe Landfill Site Welland Road, Dogsthorpe, Peterborough, PE1 3TD	XP3134NX	19.5km	Inert waste

4.7 Geology and Soils

Introduction

4.7.1 This section describes the constraints from geology, soils and materials within the study area.

Baseline Conditions

Designated Sites

4.7.2 There are no sites within the study area that are designated for their geological or geomorphological importance. The nearest site lies 2.5km north east of the study area at 'Adventurers' Land', a SSSI and Geological Conservation Review site designated for its studies of Flandrian age sea-level fluctuations.

Geomorphology

4.7.3 The area has undergone continual transformation since the last ice age 10,000 years ago, as with each relative change in sea level the balance between saltmarsh, fen, bog and woodland has altered. Large scale drainage work in the Fenland stems from the human desire to manage these potentially productive lands. The geological landscape within the study area is relatively stable and is highly modified by human interference.

Bedrock Geology

4.7.4 Bedrock deposits underlying the area comprise the West Walton Formation and Ampthill Clay Formation (undifferentiated mudstone), with the Oxford Clay Formation (mudstone) lying to the west as shown in the PCF Stage 1 EAR Figure 2.11.1**.** These sedimentary bedrocks formed approximately 156 to 161 million years ago, in the Jurassic Period, in local environments previously dominated by shallow seas with mainly siliciclastic sediments (comprising of fragments or clasts of silicate minerals) deposited as mud, silt, sand and gravel.

Superficial Geology

4.7.5 Superficial deposits underlying the area are indicated to comprise Tidal Flat Deposits (clay and silt), superficial deposits formed up to 3 million years ago, in the Quaternary Period (shown in PCF Stage 1 EAR Figure 2.11.2) in a local environment previously dominated by shorelines.

Soils

4.7.6 The European soil description describes soils in the study area as Quaternary marine or estuarine clay or silt with a clay to clayey loam texture and are described as heavy to medium east of the Guyhirn junction and medium (silty) to light (silty) to heavy to the west as shown on PCF Stage 1 EAR Figure 2.11.3.

4.7.7 According to the Cranfield Soil and Agrifood Institute, three soilscapes lie within the study area; soilscape 21 (loamy and clayey soils of coastal flats with naturally high groundwater), soilscape 23 (loamy and sandy soils with naturally high groundwater and a peaty surface) and soilscape 27(fen peat soils).

4.7.8 Land use outwith developed areas is rough grazing along the river and watercourse edges, grazing within the Nene Washes Complex and arable agricultural elsewhere. Natural England's Agricultural Land Classification map (PCF Stage 1 EAR Figure 2.11.4) shows that the majority of the study area has been classified as Grade 1 (excellent) with the Nene Washes complex as Grade 3 (good to moderate).

Mining Resources

4.7.9 The study area does not lie within an area requiring a Coal Authority Licence. There are no active or historic quarries within the study area. There are no extractable mineral deposits noted in the Cambridge and Peterborough Minerals and Waste Development Plan. Based on the high quality agricultural land in the area, and the high value landscape, it is considered unlikely that there will be considerable extractable mineral resources in the area.

Hydrogeology

Aquifers and Groundwater Vulnerability

4.7.10 The British Geological Society (BGS) indicates Guyhirn junction to be underlain by the West Walton Formation, Ampthill Clay Formation and Kimmeridge Clay Formation (Undifferentiated) aquifer which essentially contains no groundwater. The western extent of the study area is underlain by the Kellaways Formation and Oxford Clay Formation (Undifferentiated), which again essentially contains no groundwater. This concurs with the Environment Agency data.

4.7.11 The BGS also reveals that the study area lies within an area of concealed aquifers of limited potential (regions without significant groundwater). These are dated to the quaternary period, consisting of coastal and fluvial alluvium. Specifically, sands and gravels in such deposits may contain limited supplies of groundwater, but this is likely to be susceptible to saline contamination in coastal areas. The Environment Agency indicates that the nearest groundwater source protection zone is approximately 12km from the junction. Further detail on groundwater is provided in section 4.10 Road Drainage and the Water Environment.

Groundwater Wells

4.7.12 The BGS indicates there are three water wells within the study area. It is not known if water is currently being extracted from these wells.

Groundwater Dependent Terrestrial Ecosystems

4.7.13 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. The Nene Washes Complex lies adjacent to the scheme. It has been designated as a Ramsar site, SPA, SSSI and SAC as well as an RSPB reserve. Considering the groundwater aquifers in the area, it is considered unlikely that the Nene Washes Complex is a GWDTE.

4.7.14 In addition, section 4.5 Nature Conservation indicates there are coastal and floodplain grazing marsh, lowland fens, deciduous woodland, traditional orchard and reedbed BAP Priority Habitats (England). These areas are likely to be dependent on the River Nene, and are also unlikely to be GWDTE.

Contaminated Land

Historical Map Review

4.7.15 A review of historical OS maps was undertaken and revealed that there are no indications of industrial land use within the study area. Current potential contaminative land uses include livestock farms, landfill sites, former railway land and a coal yard.

Landfill Sites

4.7.16 A list of registered landfills compiled by the Environment Agency shows that two landfill sites lie within the study area. Guyhirn landfill lies around 300m to the north west of the junction and has ceased operation (licence held for non-biodegradable waste). A further landfill lies at Thorney Road, which has also ceased operation and held a licence for inert waste.

Petroleum Sites

4.7.17 There is a petroleum filling station (currently operated by Shell UK Ltd) on Fen Road, 400m west of existing Guyhirn junction. There will also likely be petroleum tanks sited on the agricultural properties within the study area; e.g. Gaul Tree farm, Bank Side farm, Bank farm and Ring's End farm.

Key Constraints

4.7.18 The geological and soil features and their sensitivities are summarised below in Table 4-8 Those features with a medium or higher sensitivity are considered to be key constraints.

Table 4-8: Key Constraints Geology and Soils

Feature	Sensitivity
Designated sites	Not defined
Geomorphology	Low
Superficial and bedrock geology	Low
Soils	Medium
Mineral Resources	Not defined
Hydrogeology	Low / medium
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 The DfT states that the two directional Annual Average Daily Traffic (AADT) for the A47 South Brink is 22,267 as of 2015. The two directional AADT on A47 Fen Road is 17,955 and the A141 March Road has a two directional AADT of 17,106. From these figures, it is likely that the A47 is the dominant source of noise in the area.

4.8.4 Traffic noise along the A47 at Guyhirn was mapped by Defra and can be viewed on the England Noise Map Viewer website as described in the PCF Stage 1 EAR. Daytime noise levels along the A47 and A141 are 75dB $L_{Aeq,16h}$. Residential properties along B1187 Gull Road and High Road will experience daytime noise levels from road traffic between 55-65dB $L_{Aeq,16h}$ and night time levels less than 50dB L_{night} (as at September 2016).

4.8.5 Defra identified two Noise Important Areas (NIAs) within the study area (shown on PCF Stage 1 EAR Figure 2.8.1**)** due to the high levels of traffic. Noise Important Areas (NIAs) are defined by Defra as areas where the top 1% people affected by noise in England reside. The NIAs are as follows:

- ID 11362 is located along the A47 Fen Road at the junction to High Road. The area encompasses one residential property which is situated within a depression surrounded by dense vegetation; and
- ID 11363 is located to the south of the A47 roundabout along A141 March Road. It consists of rows of residential properties and a restaurant. The area is open with views of the flat rural landscape and the nature conservation areas to the west.

4.8.6 Noise sensitive receptors (NSRs) are receptors that are potentially sensitive to noise and vibration. They include dwellings, hospitals, community facilities and designated sites (including Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special

Scientific Interest (SSSIs), Areas of Outstanding Natural Beauty (AONBs), World Heritage Sites, Ramsar Sites and public rights of way.

4.8.7 Sensitive receptors within the study area are shown on the PCF Stage 1 EAR Figure 2.8.1 and include:

- Residential properties – Rivendale, Cobble House, Bank House, Sunrise Cottage, Sunset Cottage, Nene House, The Vicarage and includes those off local access March Road High Road, Homelands, Nene Close, Woodland Gardens, The Bungalows and Riverside Close;
- Guyhirn Church of England Primary School;
- St Magdalene's Church;
- Oliver Twist Public House; and
- Nene Washes complex (SAC, SPA, Ramsar and SSSI).

4.8.8 From a review of aerial imagery, OS Maps and the OS AddressBase Premium it can be concluded that there are approximately 188 residential properties, 6 community facilities, 6 commercial/Industrial facilities and one public inn located within the study area.

Field Survey

4.8.9 A road traffic noise survey was carried out at four locations within the study area (shown in PCF Stage 1 EAR Figure 2.8.1). The survey locations were chosen based on their proximity to sensitive receptors as well as within Noise Important Areas (NIAs). During the survey it was observed that predominant noise sources within the area include road traffic noise from the A47 and A141, farming activities with generally low noise levels from the River Nene. Further away from the A47 junction natural sounds become more dominant such as birdsong and the natural wind.

4.8.10 Noise levels measured close to the roundabout along local access March Road behind the dense vegetated screening are approximately 56dB $L_{Aeq,15min}$ compared to 66dB $L_{Aeq,15min}$ south of the roundabout with no screening. During the site visit it was noted that a flood defence embankment is sited in between the A47 South Brink approach and High Road and this will perform as a noise barrier for the sensitive receptors along High Road.

Key Constraints

4.8.11 Sensitive receptors within the study area include approximately 188 residential receptors, 6 community facilities (in particular Guyhirn Primary School and playing field, Community Hall, Guyhirn Church of England Primary School and the Oliver Twist Public Inn) and the Nene Washes complex which are all considered to be of high sensitivity to changes in noise levels.

4.8.12 The residential receptors along local access March Road will be affected by any improvement which may result in land take and removal of the dense tree line (approximately 25m in depth) from the road boundary will have a detrimental effect on noise levels along Fen Road to the east of the roundabout.

4.8.13 The two Noise Action Planning Important Areas will require consideration. The presence of NIAs within the study area is a constraint to all improvement options. Even if the scheme has no significant impacts on noise levels, the presence of NIAs means that mitigation must be considered to reduce the noise levels at these areas. Consultation with the operational teams will be undertaken to understand what plan's they may have with regard the NIA's and to agree where the scheme can deliver mitigation However, mitigation will only be included within any scheme design if it provides value for money.

4.9 People and Communities

Introduction

4.9.1 The aim of this section is to identify the key features and constraints in the study area in relation to people and communities including vehicle travellers, non-motorised users (pedestrians, equestrians and cyclists) and land use (private property, community land, development land, agricultural land). It is informed by desk study and a site walkover undertaken by Amey surveyors 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

Pedestrians, Cyclists, Equestrians and Community Effects

Public Rights of Way

4.9.3 There are three Public Rights of Way within the study area as shown in PCF Stage 1 EAR Figure 2.10.1, two of which are footpaths which are overgrown and poorly maintained. The third is a bridleway, described in further detail in paragraph 4.9.5.

4.9.4 These public rights of way, with the exception of the bridleway, are largely unsuitable for use by bicycle.

Cycle Routes

4.9.5 There is one cycle route in the study area. Route 63 follows the Graysmore Drove Road to the east of the site in winter (just outside the study area), while in summer use of another route along the Long Drove track is available. No users were identified during the site walkover.

Equestrians

4.9.6 Long Drove track is a bridleway that connects to the A141 March Road approximately 850m south of the existing roundabout and appears to be well maintained.

Footways

4.9.7 There are footways to the west and south (although only consistently to the west) of the existing junction and no provision on the A47 north. A footway also links the residential area to the east of the junction to the footway infrastructure surrounding the roundabout. There are dropped kerb crossing points at various locations around the roundabout, however these are difficult to use safely and NMUs need to wait for long periods to cross the road as a result of the volume and speed of traffic. Footways in the area are generally very narrow, extremely close to traffic and unpleasant to use.

4.9.8 There are also footways on one side of High Road and B1187 Gull Road. The surfacing is of reasonable condition although the level of use was observed as being generally low.

4.9.9 All footways are within the catchment area for the local primary school and so may be used by vulnerable users.

Other Infrastructure

4.9.10 The bridge identified on the PCF Stage 1 EAR Figure 2.10.1 allows agricultural traffic and potentially NMUs to cross Morton's Leam.

4.9.11 An additional footpath was observed to run from Twenty Foot Road to the south of the junction, north west along the dismantled railway embankment to the local nature reserve (LNR) although there does not appear to be any access to the LNR from Ring's End itself.

Community Facilities and Community Land

4.9.12 There are a small number of community facilities within the study area, including one primary school, a village hall, a place of worship, shops and services and some recreational facilities as shown in the PCF Stage 1 EAR Figure 2.10.1. Most of the community facilities are concentrated along High Road and towards the west of the study on the A47 Fen Road which means that NMUs are likely to use a mix of the footways and public rights of way to travel between residential areas and community facilities.

Land Use

Private Property

4.9.13 There are approximately 188 residential properties within the study area concentrated in Guyhirn village, March Road and High Road. A number of commercial properties are also located within the study area (some of which can also be considered to be community facilities, or are associated with agricultural land).

Community Land

4.9.14 The following areas of community land were identified:

- the former Mary Magdalene's Church, however information gathered during a site survey in June 2016 suggests that this land may be designated for future development;
- a playing field used by children attending Guyhirn Church of England Primary School, and
- allotment gardens situated on Gull Road.

4.9.15 No Registered Commons or Registered Village Greens were identified within the study area, however open grassy areas with public access are common.

Development Land

4.9.16 No NSIP's had been submitted to, or granted by, the Secretary of State within 20km of Guyhirn junction at the end of PCF Stage 1. At the time of writing (Nov 2016) there were 66 district council planning applications within the 600m study area, nine of which are located immediately adjacent to the improvement area and consequently represent a potential constraint. These are largely for individual housing developments of one or two properties along with a proposal to demolish the railway arches.

Agricultural Land

4.9.17 The majority of land within the study area is agricultural as shown in the PCF Stage 1 EAR Figure 2.11.4 and appears to be used for the cultivation of cereals, fodder and vegetables. Land between Morton's Leam and the River Nene is classed as being of good to moderate quality (Grade 3), while the rest of the agricultural land within the study area is considered to be of excellent quality or Grade 1. There are four areas covered by Environmental Stewardship Agreements, with three areas at entry level and one area designated for both entry level and upper level stewardship.

4.9.18 It is possible that this area is also used for livestock, as cattle and horses were also observed to the south of the dismantled railway embankment and between the A47 Fen Road and the River Nene. The commercial premises identified off High Road, behind the village hall, is a stable, with associated paddock.

4.9.19 Field accesses were identified at numerous locations, many providing access directly off the A47. Various access points were also identified off High Road, behind, and often sharing access with residential or commercial premises.

Vehicle Travellers

Driver Stress

4.9.20 The DfT states that the two directional Annual Average Daily Traffic (AADT) for the A47 South Brink is 22,267 as of 2015. The two directional AADT on A47 Fen Road is 17,955 and the A141 March Road has a two directional AADT of 17,106. Congestion around the roundabout is common with the roundabout itself being relatively small, limiting emerging opportunities. Problems on approach roads were observed during the site visit and examples of reverse priority were witnessed at the A47/B1187 junction to the west of the roundabout. Similar levels of difficulty are experienced in emerging from local access March Road to join the A141, particularly when turning right. Each of these factors, particularly in the context of relatively high traffic flow will also contribute to driver stress.

View from the Road

4.9.21 Views of the surrounding landscape from the road are largely obscured by mature vegetation. The only section of the existing road network within the study area where relatively open views can be obtained is from the existing bridge of the River Nene through a gap in the vegetation allowing drivers to look eastwards.

Key Constraints

4.9.22 The need to preserve NMU mobility and access to community facilities is a key constraint for the scheme. The sensitivity of the local NMU network is considered to be high given the possibility of vulnerable users of such routes and facilities, and the national importance of PRoWs.

4.9.23 In terms of land use, the scheme will be constrained by the need to conserve high quality agricultural land and community land, which is of high sensitivity. Similarly, local development land, although generally small in scale and low in sensitivity, may also represent a constraint to the scheme, either in terms of land-take or access.

4.9.24 Key areas of community land are those likely to be used by vulnerable groups or frequently by a significant number of people and include the playing fields associated with Guyhirn Church of England Primary School, the school itself and other facilities such as the Children's Indoor Play Area off B1187 Gull Road, all of which are of high sensitivity.

4.9.25 The scheme has the potential to influence views from the road which have a medium sensitivity. Driver stress is likely to be high and the junction improvements are likely to lead to reductions in levels of driver stress.

4.10 Road Drainage and Water Environment

Introduction

4.10.1 The purpose of this section is to describe the road drainage and water environment within the study area, to highlight the sensitive receptors and to identify any constraints associated with the scheme.

Baseline Conditions

Topography

4.10.2 The study area is extremely flat and low-lying with elevations rarely exceeding 1m and dropping below sea level in places.

Surface Water Features/Abstractions

4.10.3 The existing Guyhirn junction is situated within a complex surface water regime as shown in PCF Stage 1 EAR Figures 2.91 and 2.9.2. The River Nene is a heavily modified tidal watercourse and flows on a very shallow gradient that is managed for numerous purposes including flood management and navigation (fishing was also observed during the site visit). The watercourse is heavily integrated into the system of field drains, pools and ponds which comprise the drainage system for much of the surrounding farmland. The most recent cycle of the 2015 Anglian River Basin Management Plan gave the Nene an overall status of moderate, with moderate ecological potential. The river is heavily silted and can be seen flowing upstream during high tide. A culvert also outfalls into the Nene from under the A47, north of the existing bridge.

4.10.4 Morton's Leam is a man-made watercourse, dating to the 15th century and thought to have been constructed to alleviate flooding in the local area. It has an overall WFD status of moderate and moderate ecological potential and is protected from the effects of the tide and the silty, saline waters of the Nene by a remotely operated Environment Agency sluice gate.

4.10.5 The North Level Main Drain to the north east of the junction connects to the Nene at Sutton Bridge and has an overall status of moderate and a moderate ecological potential. The North Level Pumped Areas 2 and 3 run parallel to the Nene between Peterborough and Guyhirn and have a moderate overall and ecological classification. The South Holland Main Drain runs close to the northern edge of the catchment before joining the North Level Main Drain, and has a moderate overall status and moderate ecological potential.

4.10.6 The area also lies within the North Level Internal Drainage Board (IDB) District. A North Level IBD pumping station (containing two pumps) is located to the east of the existing junction connected firstly to a surge chamber and then to an outfall into the Nene. The pumping station is operated by the Waldersey Internal Drainage Board.

4.10.7 There are approximately 75 abstraction points within the Lower Nene catchment, with three of these being taken from the Nene (considered a tidal source) and around 50 from surface waters. The catchment interacts with numerous large towns and cities and provides drinking water for their associated populations.

4.10.8 Much of the Lower Nene catchment to the south and east of the existing Guyhirn junction is included within a surface water Nitrate Vulnerable Zone (NVZ).

Groundwater Features/Abstractions

4.10.9 Groundwater in the study area belongs largely to secondary shallow superficial aquifers, closest to the existing Guyhirn junction to the north-west and south. These groundwater bodies are of low productivity, sitting within coastal and fluvial alluvium formations. Groundwater in the area is susceptible to pollution from pesticides, fertilisers and saline contamination in coastal areas.

4.10.10 The catchment contains several groundwater protection zones, however the closest of these lies approximately 12km to the south west of the existing junction. Similarly, there are a number of intermediate to high vulnerability aquifers within the Lower Nene catchment; the closest being 2km to the south of the existing Guyhirn junction.

4.10.11 Also within the study area, Geoindex maps identify a large number of water wells, the closest of which lies approximately 300m to the north of the existing junction. Additionally, the

Environment Agency identifies approximately 75 water abstraction points within the Lower Nene Catchment, around 20 of which make use of groundwater resources.

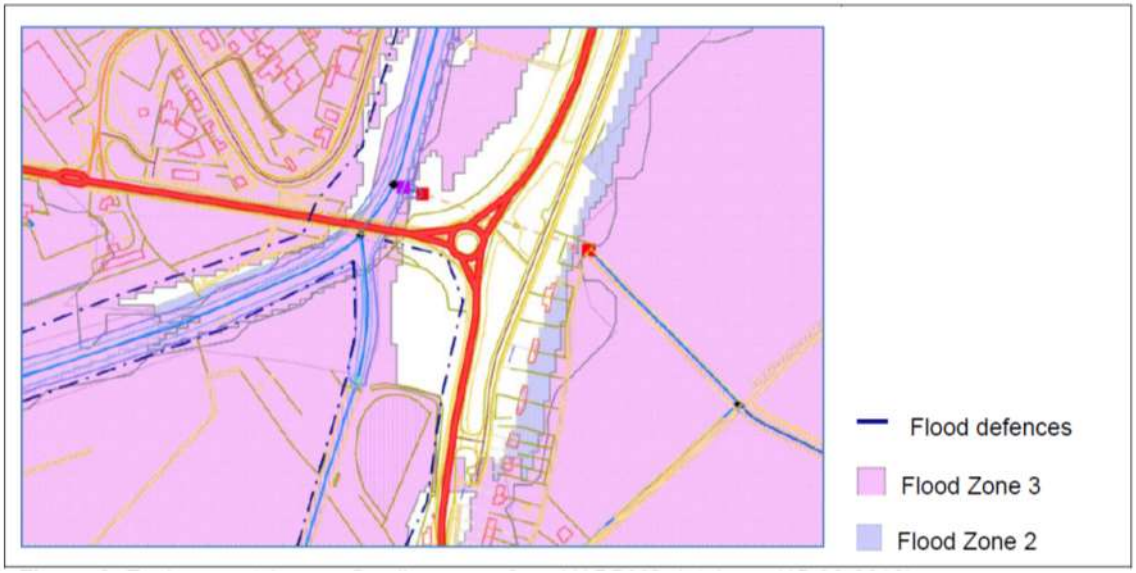
Aquatic Ecology

4.10.12 Aquatic ecology is described in section 4.5 Nature Conservation and Biodiversity.

Flooding

4.10.13 The majority of the land within the study area is located within Flood Zone 2 and 3. Flood Zone 2 consists of areas assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year. Flood Zone 3 comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. See Figure 4-5 below.

Figure 4-5: Environment Agency flooding areas



Source: Environment Agency website

4.10.14 There are areas of surface water flooding within the fields surrounding the junction, however the risk of surface water flooding is low to very low.

4.10.15 The study area is included within a flood warning and flood alert area. There are substantial flood defences in the area surrounding the existing junction, with large embankments in place along much of the Nene, including the A47 itself which forms part of the tidal defences. A notable feature of these defences is the sluice gate on Morton's Leam controlled remotely by the Environment Agency. The area between the Nene and Morton's Leam (Whittlesey (Nene) Washes) is designated as a reservoir under the Reservoirs Act (1975) as a result of its role as a flood storage area for the region.

4.10.16 The HADDMS identifies one historic flood event within the study area; occurring in 2011 immediately to the south west of the existing roundabout. This event had a severity of 3 (on a scale of 1-10). HADDMS also indicates that the study area is susceptible to flooding from superficial groundwater deposits.

Key Constraints

4.10.17 Overall the sensitivity of the surface water environment is very high. Any development of the Guyhirn junction will be constrained by the need to minimise impacts on the flow patterns, physical geomorphology or transportation regimes of the surface water bodies outlined above.

4.10.18 The study area contains additional constraints such as the pumping station, surge chamber and associated culvert/outfall to the east of the Nene, where the local Internal Drainage Board will need to be consulted on any changes to the current setup.

4.10.19 Groundwater in the study area is generally of low productivity. However, the prevalence of groundwater abstractions and water wells suggests that it does represent an important resource, likely to be used for agriculture, in some areas. Therefore the sensitivity of groundwater is medium. This represents a significant constraint where the construction of new structures (requiring excavations for foundations or subsurface drainage) is concerned.

4.10.20 Flood risk is also a major constraint with over 100 properties protected by existing flood defences, including the A47 embankment. Accordingly, the sensitivity is considered to be very high.

4.10.21 A map indicating the key environmental constraints of the site can be found in Appendix 4 - HE551493-AME-EGN-GJFIXB-DR-EN-0001.

5 Accessibility & Integration

5.1 Existing NMU Provision

5.1.1 There is a footway currently provided on both sides of the A47 Fen Road. The northern footway ends at the traffic island on the A47 South Brink arm adjacent to the roundabout. A dropped kerb is present here where users can cross the A47 South Brink to join a pathway that leads through the existing landscape buffer (woodland) and down on to the local access March Road. On the A141 March Road a footpath is only present on the western side of the road and extends south beyond the vicinity of the junction.

5.1.2 NMU provisions are also described in section 4.9.7 above.

5.2 Existing Access to Transport Provision

Rail & Bus Services

5.2.1 There are few public transport services within the vicinity of Guyhirn junction.

5.2.2 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.

5.2.3 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.

5.2.4 The closest train station to Guyhirn is located in March, approximately 6.5km away.

5.2.5 There are a number of bus services that operate end to end along the A47 corridor. First Group operates the Excel X1 service along the A47 corridor connecting Peterborough, King's Lynn, Norwich, Great Yarmouth and Lowestoft and this service stops (in both directions) at Guyhirn at the Shell garage on the A47 Fen Road to the west of the junction.

5.2.6 Guyhirn is also served by bus route 46, operated by Stagecoach Norfolk. This service runs between Kings Lynn, Wisbech and March. It has a number of stops in the village of Guyhirn and also on the A141 March Road to the south of the junction.

5.3 Existing Severance

5.3.1 Community severance can be defined 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 east and south east of the junction on local access March Road, it can be difficult to access Guyhirn and the services in the village. NMU's use local access March Road and cross the A47 South Brink at the dropped kerb and splitter island on the approach to the roundabout before walking west over the River Nene bridge until a cutting allows access to the Gull Road / High Road which leads into the village.

5.3.3 The River Nene is also a natural feature that impedes travel east to west or vice versa in the area. The A47 Fen Road River Nene bridge is the only crossing of the River Nene in the vicinity.

The nearest alternative crossing is in Wisbech approximately 9km away to the north east or another crossing approximately 12.5km away to the south west on the B1040 North Side road.

5.4 Integration

Transport Interchange

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

Land-Use Policy

5.4.2 Fenland is predominantly rural in nature and is dominated by agricultural use. See section 2.3.7 for further detail on the Fenland District Council Local Plan (2014) and sections 4.9.13 – 21 for further detail on land use in the area.

6 Maintenance

6.1 Introduction

6.1.1 This chapter focusses on the existing approach to maintenance of the A47 trunk road and the highways within the scheme study area during PCF Stage 1.

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.

6.1.4 Side roads connecting with the A47 trunk road are maintained by Cambridgeshire County Council.

6.2 Asset Condition

6.2.1 Asset condition has been taken from Highways England databases (HAPMS) and information from the Area 6 Maintenance Contractor.

6.2.2 Available information during PCF Stage 1 indicates that the pavement was in generally good condition, with some localised instances of rutting, structural condition issues and areas of higher Polished Stone Value (PSV) or High Friction Surfacing (HFS) required, based on SCRIM results. Embankment settlement and cracked pavement on A47 Fen Road on either side of the River Nene bridge should be investigated further; this area has a concrete base, which may be difficult to repair if this has cracked.

6.2.3 The inlet kerbs on the bridge deck were mostly blocked with vegetation. Most of the kerb units showed damaged with fractures.

6.2.4 According to the latest Principal Inspection Report (2003), the bridge is in good condition, although it does highlight areas of surfacing break-out at the expansion joints.

6.2.5 The Principal Inspections for the embankments adjacent to Guyhirn roundabout were last carried out in 2009, and so are overdue as HAGDMS states a 5 year Principal Inspection frequency.

6.2.6 The embankment settlement on either side of the River Nene Bridge has resulted in settlement of the Vehicle Restraint System (VRS) adjacent to the bridge, so that it is below desired height. Further to this there is no connection between the carriageway VRS and the bridge parapet.

6.2.7 Fencing and lighting provisions need to be investigated further in future stages of the current programme.

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 has the following planned maintenance activities in the area of the Guyhirn junction:

- A47 Guyhirn roundabout pavement resurfacing in 2017/18
- Resurfacing of pavement on A47 South Brink in 2017/18
- Resurfacing of pavement on A47 Fen Road in 2019/20

6.3.4 The local roads are maintained by CCC and form part of the Transport Delivery Programme (last updated April 2016) which details major capital works planned until 2019. There are no major capital works planned for the area around Guyhirn junction at this time.

6.4 Strategic Diversion Routes

6.4.1 Strategic diversion routes (routes 6 & 7) for works requiring closures along the A47 trunk road have been provided by Area 6 Maintenance Contractor and are included in Appendix 5 & 6.

6.4.2 The junction at Guyhirn is an important junction for the diversion of traffic if sections of the A47 are closed.

6.4.3 If any work is required on the bridge or the road on the A47 Fen Road that requires a closure, then a lengthy diversion route would be implemented (Route 6, Appendix 5). Westbound traffic travelling from the A47 South Brink would be required to continue south along A141 March Road until the signalised junction at A605 (Hobbs Lot). Traffic would then need to travel in a south westerly direction along the A605 until the Fletton Interchange in Peterborough approximately 23km away. Here traffic is required to use the A1139 to travel north until the Whitepost Roundabout where users can re-join the A47 at the junction with the A15. In total, this is approximately a 30km diversion.

6.4.4 Users wishing to travel eastbound on the A47 to Guyhirn junction from Peterborough would be required to use the described diversion route in reverse.

6.4.5 If the A47 South Brink is required to be closed for works (Route 7, Appendix 6), traffic travelling from Wisbech (westbound) would be required to leave the A47 at the A1101 Wisbech roundabout (10km north east of Guyhirn junction) and travel in a south easterly direction towards Denver/Downham Market on the A1101 Wisbech Road. The A1101 Wisbech Road changes to the A1122 Downham Road where it crosses the drainage channel. Traffic continues on this road until the A1122/A10 roundabout. They are then required to travel south on the A10 until Ely where they then follow the A142 in a westerly direction until this meets the A141 at Chatteris. Traffic can then travel north on the A141 to Guyhirn junction to re-join the A47 and continue their journey towards Peterborough. In total this is approximately an 82.5km diversion.

6.4.6 Eastbound traffic wishing to travel between Peterborough and Wisbech and beyond (e.g. Kings Lynn), on the A47 via the Guyhirn junction would have a similarly lengthy diversion if the A47 South Brink is required to be closed at Guyhirn junction for any works. From the Guyhirn junction, traffic is required to travel south on the A141 March Road towards March (and then via Chatteris, Ely & Downham Market), following the above described route in reverse until the A1122/A10 roundabout at Downham Market. Users will then be required to continue north on the A10 until the A10/A149/A47 Hardwick junction at Kings Lynn where they can re-join the A47, but this is still 20km north east of Wisbech. In total this is approximately a 100km diversion (to get to Wisbech).

6.4.7 The significant diversion routes described in this section are a key consideration for buildability of the proposed improvements which is discussed in Chapter 13.

7 Planning Factors

7.1.1 There are a number of developments that have been taken into consideration and used in the traffic modelling and included in the uncertainty log for the scheme in the Peterborough area, further information can be found in the PCF Stages 1 & 2 Traffic Forecasting Reports (document references: Stage 1 A47 IMPS1-AME-GJ-ZZ-DO-J0029, Stage 2 A47 IMPS2-AMY-GJ-ZZ-DO-J0029).

7.1.2 There are no known proposed developments that will constrain the Scheme options as at the end of PCF Stage 1.

7.1.3 Planning considerations for PCF Stage 2 are discussed in Chapter 32.

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. They include:

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)
- A47/A12 Corridor Feasibility Study (February 2015, published by DfT March 2015)
- Highways Agency Area 6 Quarterley Safety Report (Q4 2014), Skanska, January 2014
- A47 Alliance Business Case (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)
- A47 Thorney to Wisbech Walton Highway Study 2015 – Cambridgeshire County Council & Fenland District Council
- Peterborough City Council, A47 Alliance, A47 Peterborough and Cambridgeshire, Case for Improvement Evidence and Wider Economic Benefits, January 2014.
- Peterborough (City Council) Draft Local Plan 2016

Local Enterprise Partnership

- A47 Strategic Route Gateway to Growth (2014 published by A47 Alliance by NEWANGLIA Local Enterprise Partnership for Norfolk and Suffolk)
- Greater Cambridge Greater Peterborough Enterprise Partnership Strategic Economic Plan 2014

9 Description of Route Options

9.1 Route Option Development

9.1.1 The RIS announced the A47 / A141 Guyhirn junction improvements as *"the creation of a new, larger junction linking the A47 and A141*".

9.1.2 As part of the PCF Stage 0 review, the announced solution contained in the RIS was considered in more detail and, representative potential options that solve the transport problem were developed, which were:

- Option 1: Enlarged Roundabout
  - The existing roundabout is to be enlarged and widened symmetrically over the existing roundabout.
  - The alignment would consist of 3 lane entries and 2 lane exits on each arm.
- Option 2: Movement of Enlarged Roundabout
  - The existing roundabout is to be enlarged and moved to a new position.
  - The alignment would consist of 3 lane entries and 2 lane exits on each arm.
- Option 3: Movement of Existing Roundabout with Free Flow Left Lanes
  - The existing roundabout ICD would be maintained but moved to a new position, with a free flow left turn lane from A47 Fen Road to A47 South Brink, and a free flow left turn lane from the A47 South Brink to A141 March Road, to be installed.

9.1.3 The Solutions Assessment Report (SAR0) summarised the PCF Stage 0 process and demonstrated that the potential options will resolve the transport problem in so much that they will increase the junction capacity at Guyhirn and reduce congestion. It is also assumed that by bringing the junction up to the current design and geometric standards, including improved signage and visibility that will be developed in later PCF stages, this will likely allow for safer movement of traffic through the junction.

9.1.4 Based on the findings in the SAR0, it was recommended that the scheme be progressed directly to PCF Stage 1 where further options would be developed in addition to those above.

9.1.5 In PCF Stage 1, the representative potential options were considered in more detail and, 8 potential options that solved the transport problem, were developed.

9.1.6 The 8 potential options were developed and progressed during PCF Stage 1 which were discussed at an Optioneering Workshop which took place on 1 February 2016, involving technical experts from engineering, traffic and environment disciplines. Prior to the workshop, a constraints map was created showing key constraints and features in the locality. Lines of possible route and junction options were drawn on the constraints map avoiding key constraints. These line drawings were developed into feasible high level engineering drawings.

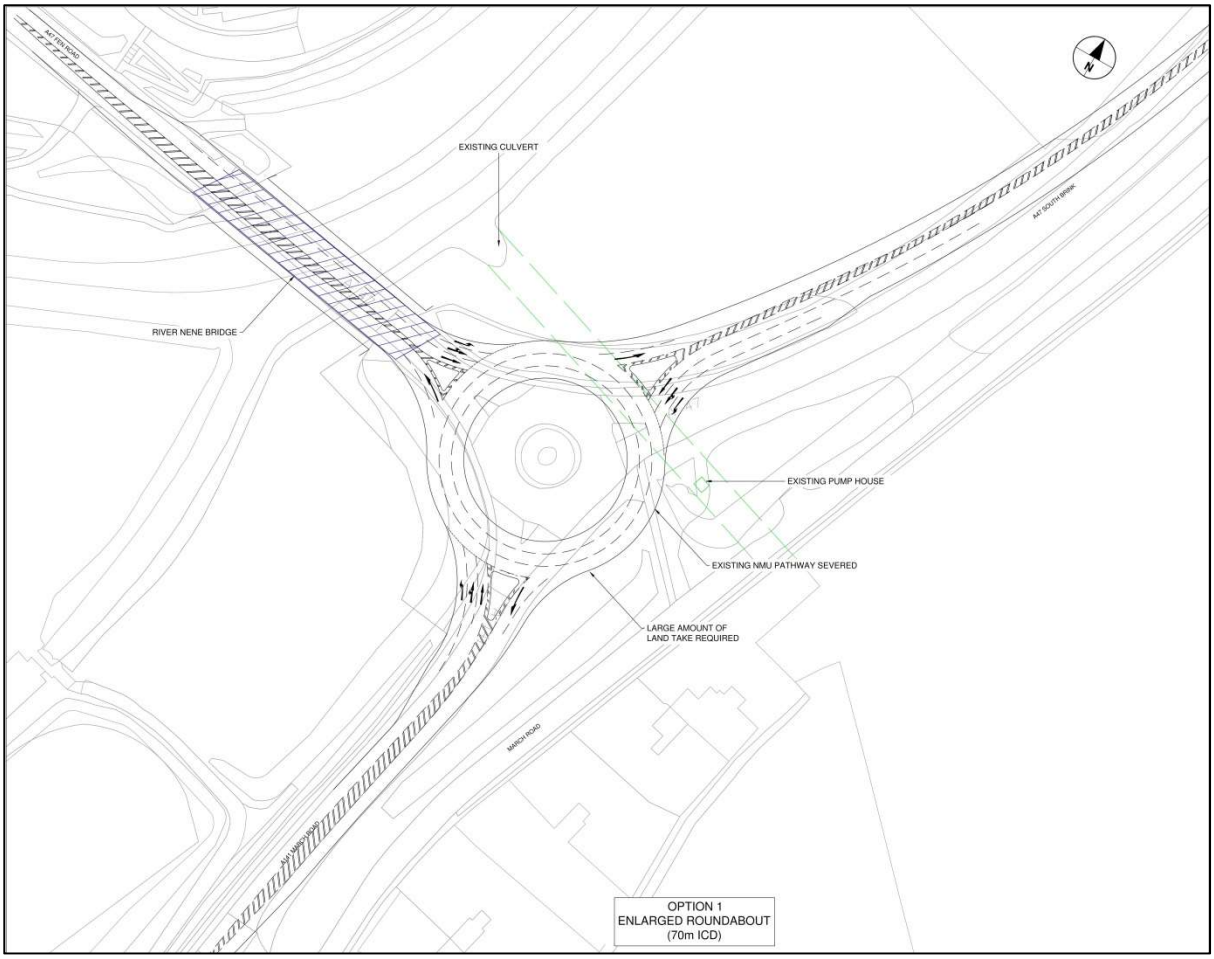
9.1.7 The potential options that are presented below are representative, based on the information available mid-way through PCF Stage 1, and take account of major constraints that may limit those options. This report will review the potential impacts of the solutions, based on the level of information available at this time, in the sections that follow.

9.1.8 Each of the 8 options is described in more detail below.

9.2 Guyhirn Roundabout Option 1

9.2.1 This option was progressed from PCF Stage 0 and involves an enlarged 70m ICD roundabout, designed concentrically over the existing roundabout. Three lane approaches have been included on all arms. The northern arm's horizontal alignment has been designed "offline" to facilitate the required deflection angles at the roundabout. This option would entail widening the existing River Nene bridge to accommodate the additional traffic lane. See Figure 9-1.

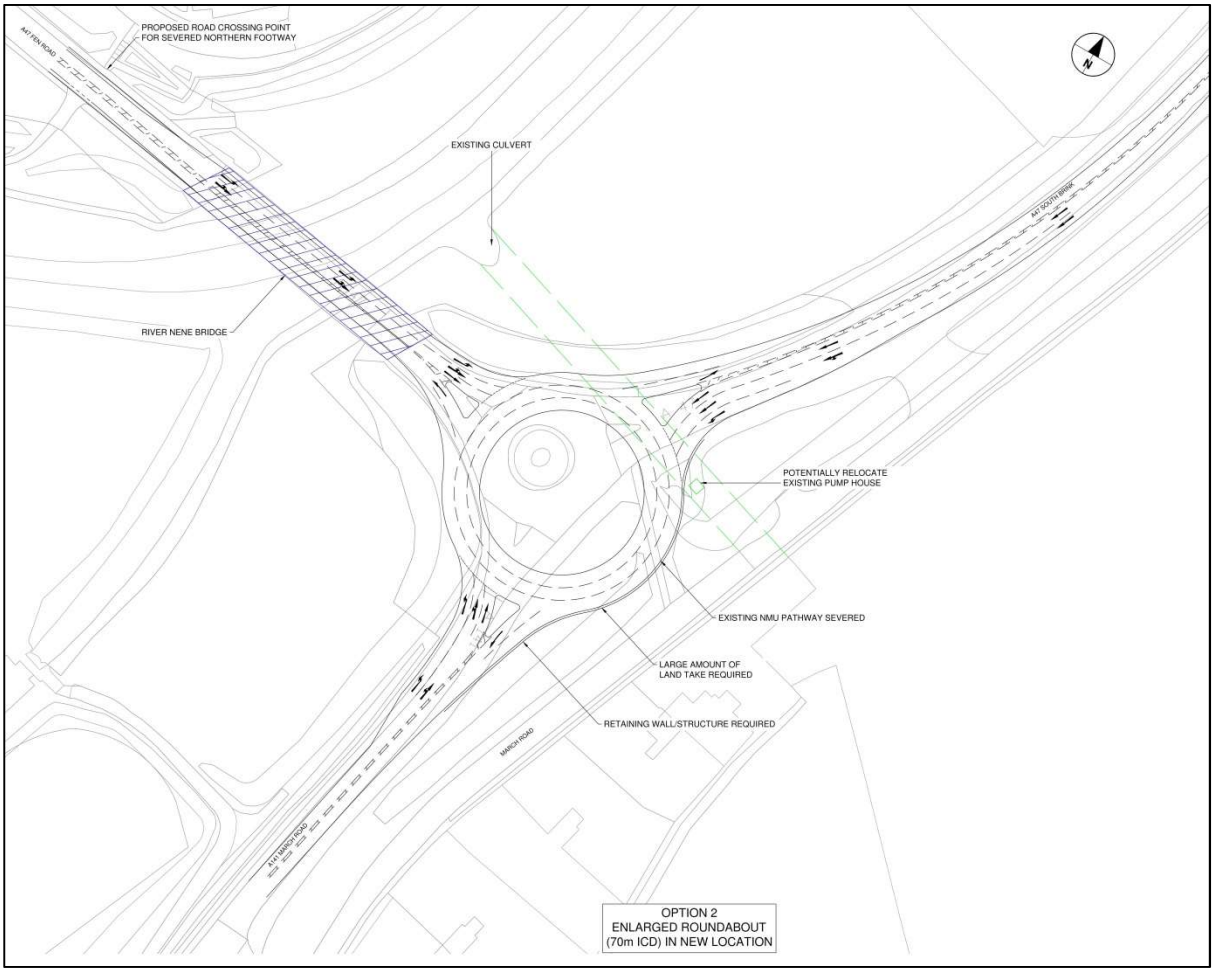
Figure 9-1: Option 1



9.3 Guyhirn Roundabout Option 2

9.3.1 This was progressed from PCF Stage 0 and involves an enlarged 70m ICD roundabout, designed non-concentrically to the existing roundabout with an overall shift of the horizontal alignment to the east, towards the local access March Road. Three lane approaches have been included on all arms. This option would require carriageway widening within the existing bridge extents but did not require physical widening of the bridge itself. See Figure 9-2.

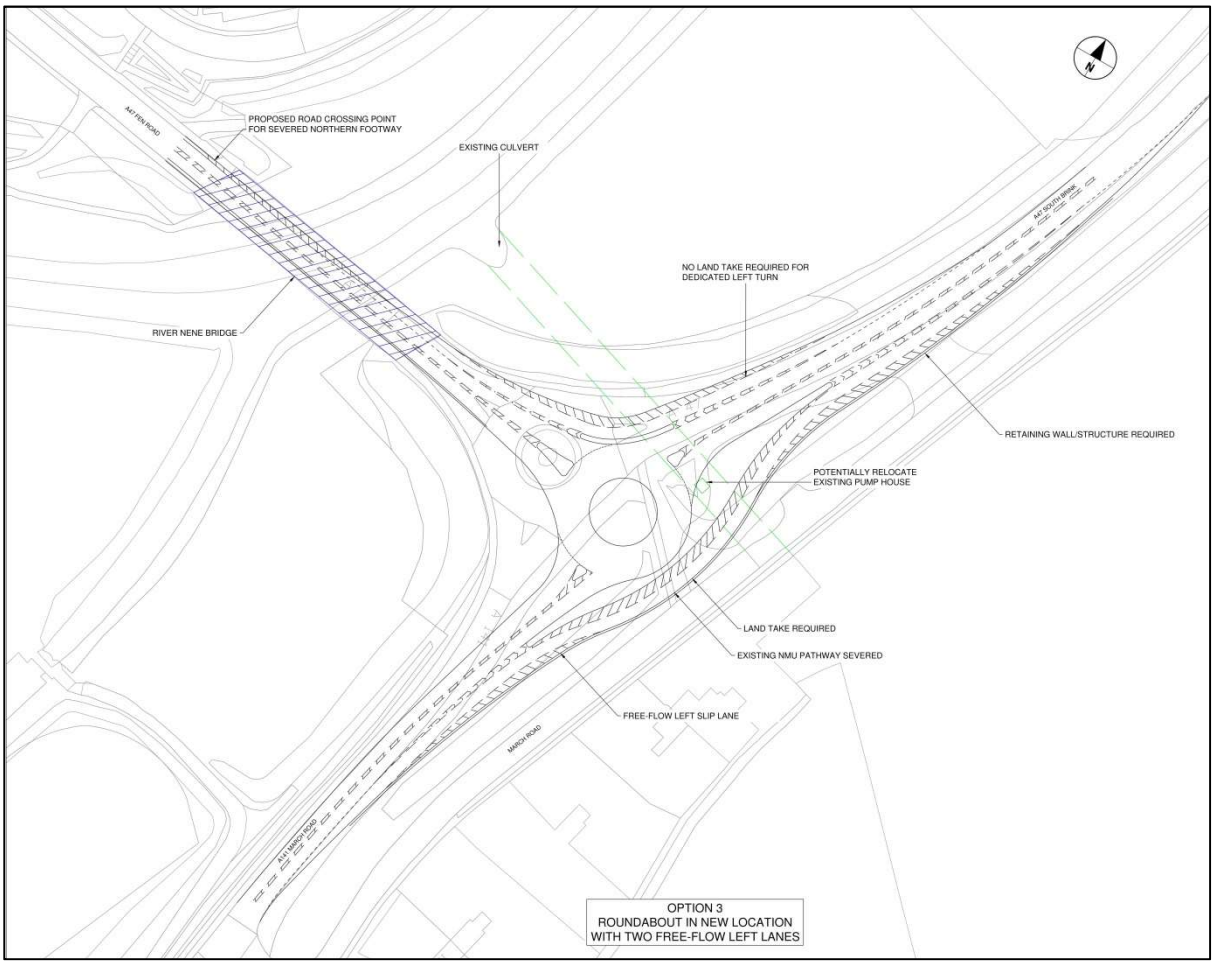
Figure 9-2: Option 2



9.4 Guyhirn Roundabout Option 3

9.4.1 This was progressed from Stage 0 and involves an overall shift of the roundabout horizontally to the east while maintaining the existing roundabout dimensions. Free flow left turn lanes were proposed for the southbound traffic on A47 South Brink Road and for northbound traffic on A47 Fen Road. See Figure 9-3.

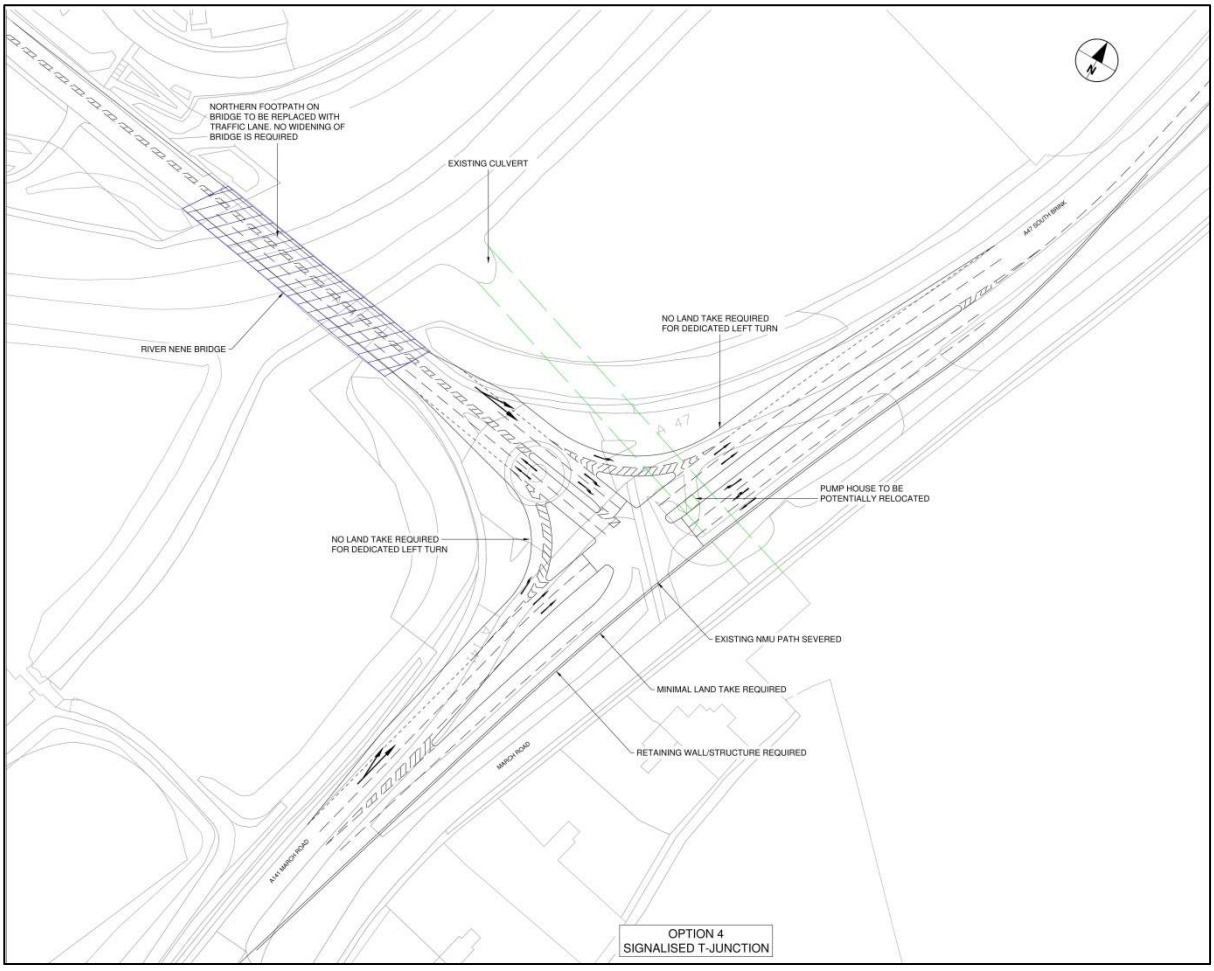
Figure 9-3: Option 3



9.5 Guyhirn Roundabout Option 4

9.5.1 This option involves a signalised T junction replacing the existing roundabout. The junction consisted of dedicated left turns on the eastbound approach on the A141 March Road and the northbound approach on A47 Fen Road. The junction was also moved further to the east towards the local access March Road. No widening of the existing bridge was required. See Figure 9-4.

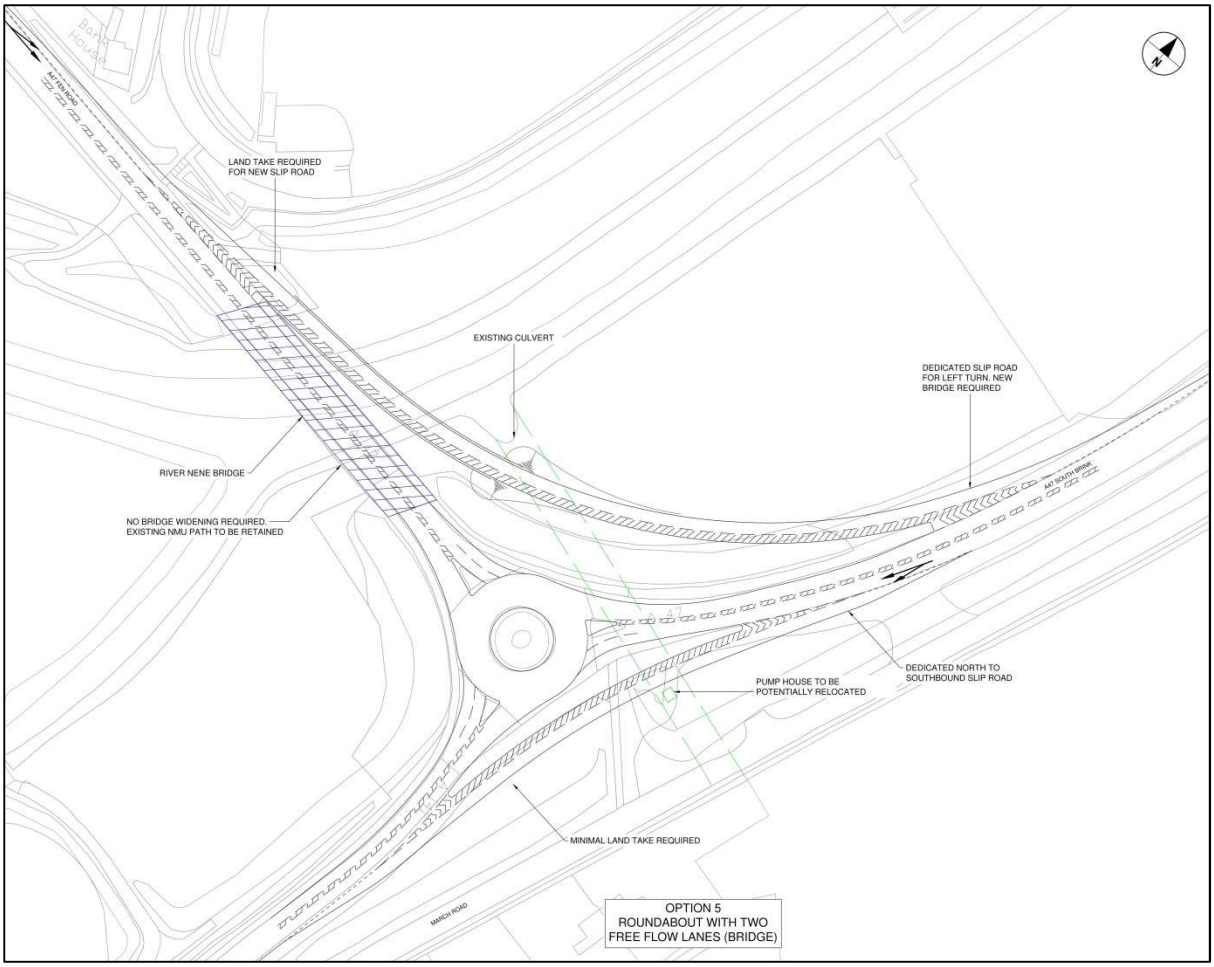
Figure 9-4: Option 4



9.6 Guyhirn Roundabout Option 5

9.6.1 This option comprises a roundabout with the same dimensions and in the same position as the existing, with two new bypass slip roads for the north to southbound traffic on A47 South Brink and the west to eastbound traffic on A47 Fen Road. A new bridge over the River Nene would be required on A47 Fen Road to accommodate the new carriageway. No widening works were envisaged for the existing bridge. See Figure 9-5.

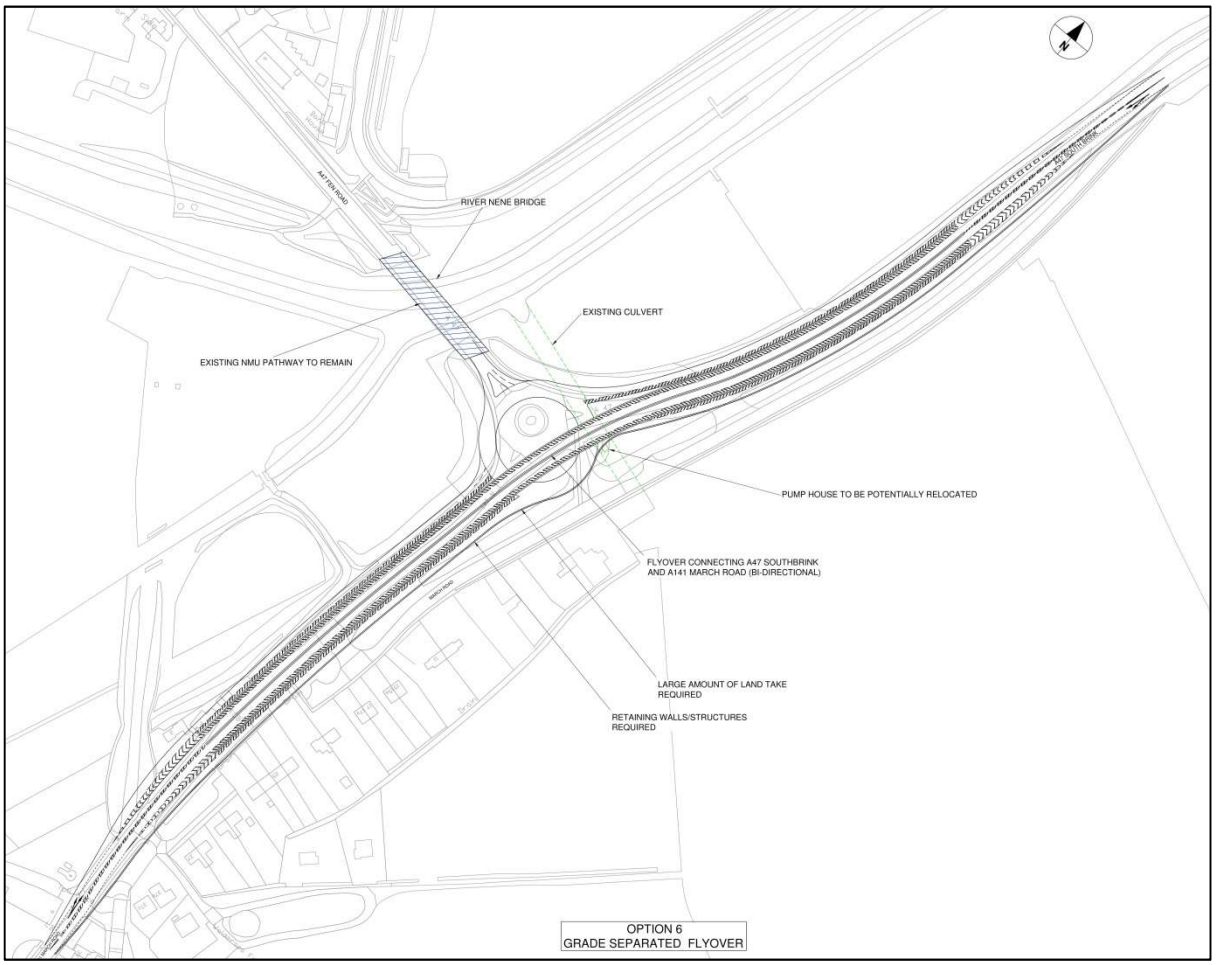
Figure 9-5: Option 5



9.7 Guyhirn Roundabout Option 6

9.7.1 This involves moving the existing roundabout to the east and creating a grade separated junction by the construction of a bi-directional flyover connecting the A47 South Brink and A141 March Road. A large amount of land take would be required on the eastern side of the roundabout to accommodate the flyover. See Figure 9-6.

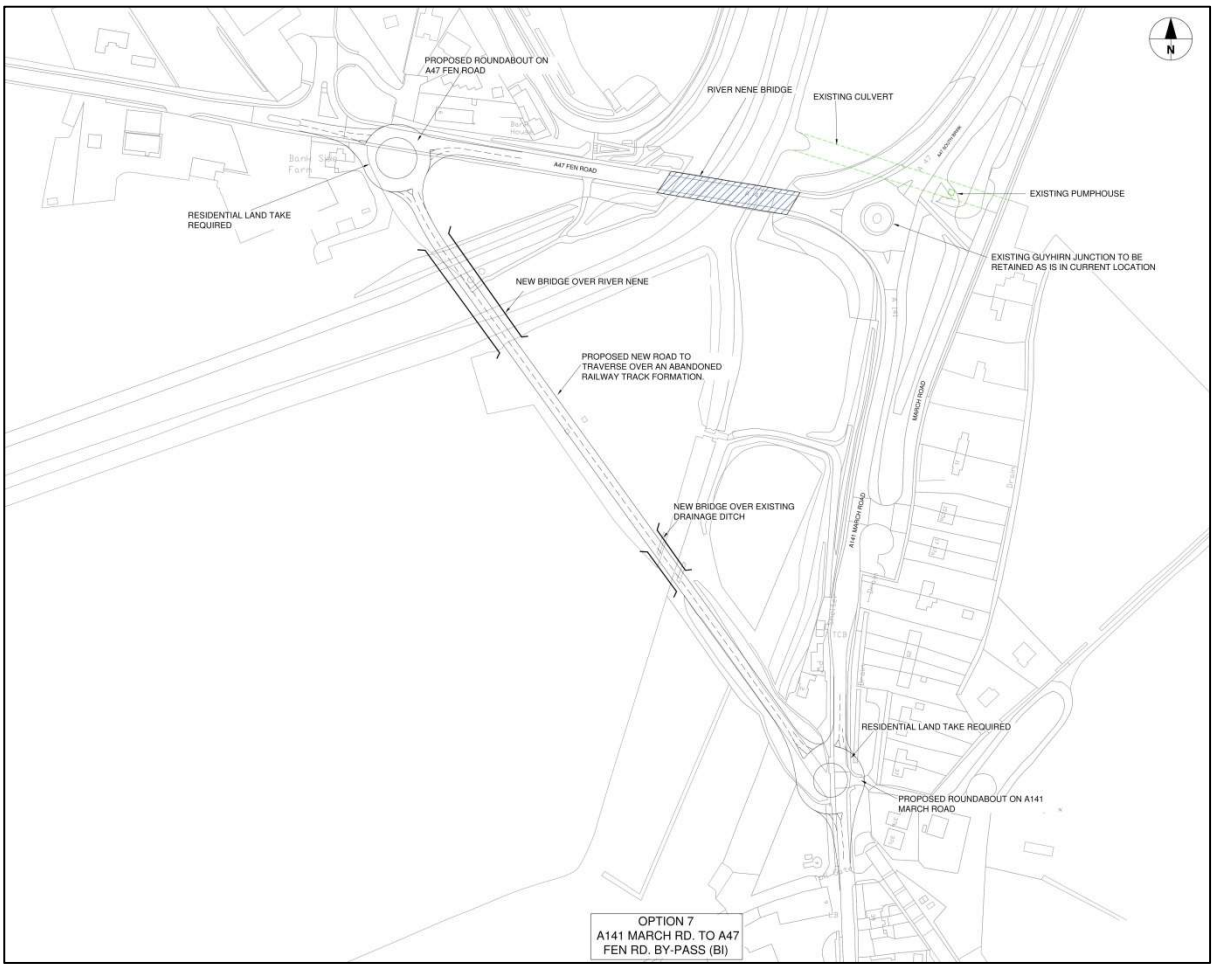
Figure 9-6: Option 6



9.8 Guyhirn Roundabout Option 7

9.8.1 Retaining the existing Guyhirn junction in the current location, this option also provided a new roundabout on A47 Fen Road to the west of the existing bridge and a new roundabout on the A141 south of the existing Guyhirn junction. The new roundabouts were joined by a new single carriageway link which provides direct access from A47 Fen Road to A141 March Road and vice-versa (by-passing the existing Guyhirn roundabout). The new link follows the line of an abandoned railway track. This option requires the construction of two new bridges and possible residential land take at the locations of the proposed roundabouts. See Figure 9-7.

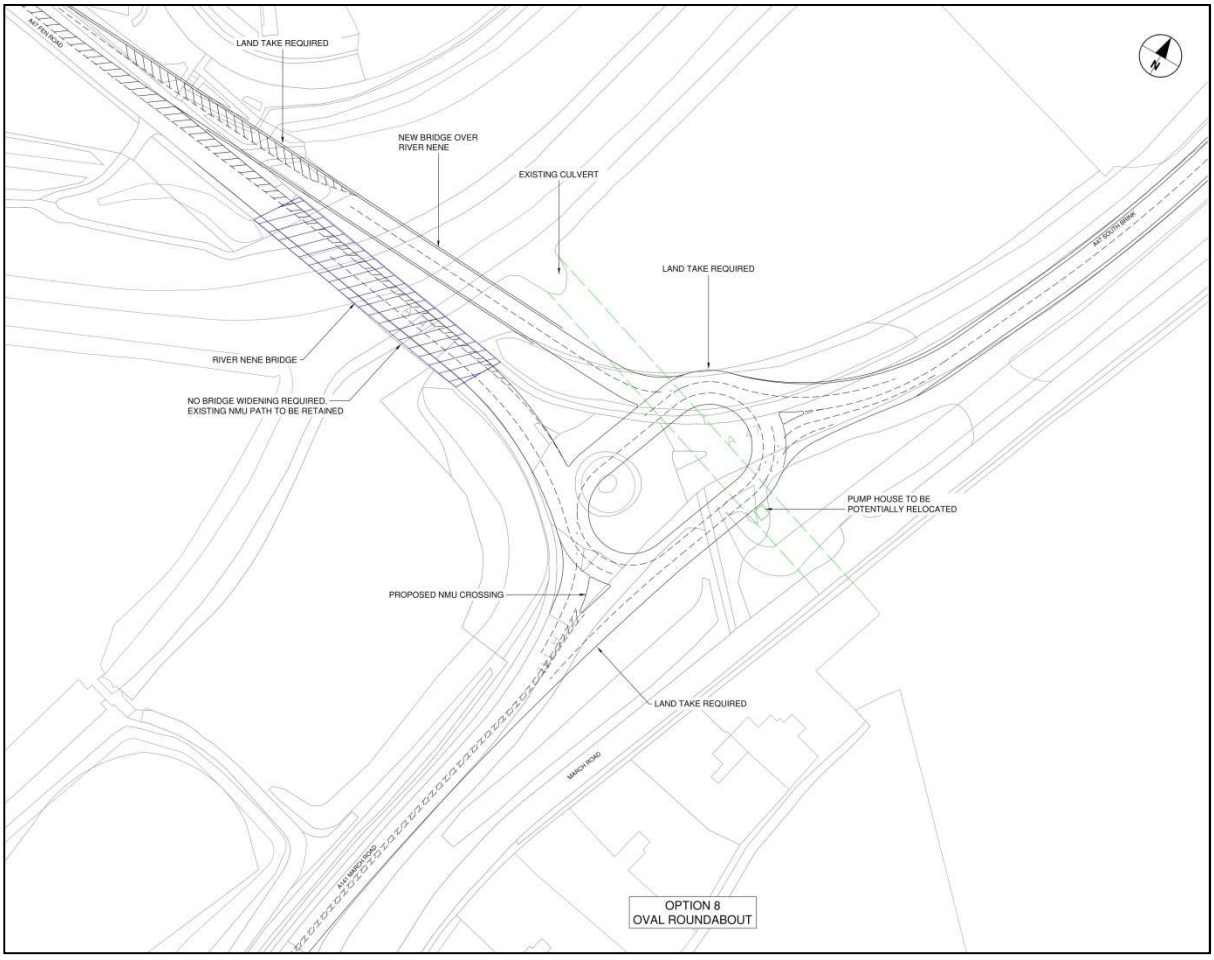
Figure 9-7: Option 7



9.9 Guyhirn Roundabout Option 8

9.9.1 This option comprises a new elliptical roundabout with two lane approaches on A141 March Road and A47 Fen Road and a three lane approach on the A47 South Brink Road. Land take would be required to accommodate the enlarged roundabout. Construction of a new bridge over the River Nene north of the existing bridge would be required to accommodate the eastbound approach on the A47 Fen Road. This option would not require widening the existing bridge. See Figure 9-8.

Figure 9-8: Option 8



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 options was undertaken.

10.1.2 Initial assessments were made of the options using DfT's Early Assessment and Sifting Tool (EAST) and the Highways England KPIs. These are described briefly in the sections below.

10.1.3 In order to further inform these assessments, key features of the options were identified qualitatively in terms of Capacity Assessment, Highway Engineering, Environment and Buildability / Maintenance. Key features were identified using the desktop information and previous work undertaken on the representative solutions in previous stages. The key features are presented in tables 10-2 to 10-9 below.

10.1.4 Due to the importance of junction options addressing existing and/or forecasted capacity issues, key features of Capacity Assessment were informed by the junction modelling software programs ARCADY and LINSIG (Option 4 only) which were used to complete a high level assessment of the various junction options. The modelling program was used to highlight if the proposed junction improvements addressed the capacity issues sufficiently based on traffic flows forecast at PCF Stage 0.

10.1.5 The initial assessment was made using the aforementioned software programs due to the non-availability (at the time) of the SATURN model described in Chapter 12.

10.2 EAST (Early Assessment and Sifting Tool)

10.2.1 The EAST is a DfT decision support tool that forms the initial part of their Transport Business Case. It is a high level assessment of the different options to discard any 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:

- Overall
- Strategic
- Economic
- Managerial
- Financial
- Commercial

10.2.3 A copy of the EAST based criteria that gives further detail about the assessment is in Appendix 7.

10.2.4 The full EAST summary table can be found in Appendix 8 – EAST Sifting A47 Guyhirn.

10.2.5 Looking at the completed EAST, at PCF Stage 1, there was insufficient detail to discount options from further assessment as the EAST is at a strategic level only.

10.2.6 However, it showed that Options 1 & 2 appeared favourable with positive outcomes in the strategic, economic & managerial criteria whilst Options 3, 5, & 6 tended to perform poorly in the strategic and economic criteria.

10.2.7 The remaining options (Options 4, 7 & 8) did not show much differentiation between them and it was difficult to draw any absolute conclusions from the results.

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 KPI's were developed to ensure that schemes that Highways England deliver, achieve their strategic outcomes.

10.3.2 Each Option was appraised and scored from 1 to 5 where 1 was poor and 5 was good. The overall score was a rounded average of the eight assessed KPI's scores, which were then ranked accordingly.

10.3.3 A summary table of the KPI assessment is shown below in Table 10-1 below.

Table 10-1: KPI 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	4	4	3	3	4	4	3.8	2
2	4	4	4	4	4	3	4	4	3.9	1
3	3	2	1	1	4	2	2	4	2.4	6
4	4	3	4	4	3	4	4	4	3.8	2
5	3	2	1	1	2	3	2	4	2.3	8
6	3	2	1	1	3	3	2	4	2.4	6
7	4	4	2	4	1	4	4	4	3.4	5
8	4	4	4	4	2	4	4	4	3.8	2

10.3.4 Similar to the EAST tool, the KPI assessment did not identify a clear differential between options. However, it did show an emerging trend and grouping of options. It showed that overall, Options 3, 5 & 6 were less favourable than the remaining options, which matched the result from the EAST assessment.

10.3.5 The key KPI 's that showed differentiation between the options were:

- 'Supporting the smooth flow of traffic' was considered to reflect the capacity and operation of the junction in future years and the scoring reflects its performance in this regard. Further traffic assessment detail is provided below (sections 10.4 & 10.5).
- 'Encouraging economic growth' was considered to reflect the local potential for the options to support development in the area and the scoring reflects its performance in this regard.
- 'Delivering better environmental outcomes' was considered to reflect the local environmental conditions and impacts of the options and the scoring reflect its performance in this regard. Further environmental assessment on options selected to progress can be found in Chapter 16.

10.3.6 Both the EAST and KPI assessments showed some differentiation between options. However neither in their own right was considered to provide sufficient differentiation to identify which options should be taken forward or discounted.

10.3.7 In order to provide further differentiation, and to support the above KPI's, additional key criteria below were assessed. The outcomes of these assessments is shown in the below tables 10-2 – 10-9.

10.3.8 These additional criteria were determined as being appropriate to compare junction options.

10.3.9 Please refer to section 10.4 for further detail on capacity assessments (traffic).

Table 10-2: Option 1 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Has a significant impact solving and meeting the identified problems and objectives.	• Modelling suggests that the congestion is reduced. • Modelled to operate under predicted flows in 2036. • Junction operates satisfactorily.	STRUCTURAL: • Substructure extensions to the bridge – North & South including extensions to cofferdams, sheet piles & installing new large foundations. • Demolition of parts of the existing north & south side wingwalls. • Removal of existing edge parapet and breakout of deck slab and concrete parapet plinths north & south side. • Temporary edge protection parapets need to be installed on north & south sides. GEOTECHNICAL: • Bridge widening leading to overload of foundations. • Differential settlement between widened embankments and bridge / existing road and pavements. • Extensive filling in flood plain. • Embankment settlement. • Settlement of pump house culvert. • No retaining wall required along the east edge of the roundabout. DRAINAGE: • Widening will require new drainage and pollution control. • Extra area of carriageway will require attenuation. • Likely adverse impact on existing pump station and pumped drain. • Impact on existing flood defence. DESIGN STANDARDS: • Potential obstruction on eastern approach by bridge parapets but since the bridge would need to be widened this may be designed to improve/mitigate obstruction for Stopping Sight Distance LANDTAKE: • Land Take from Environment Agency on the west - Plots No. 5 • Possible Land Take from the Crown Estate for bridge widening – Plot's 31; 33 and 34	• Increased noise for local access March Road. • Potentially direct impacts to the Nene washes complex due to the bridge widening activities. • Potentially severe impacts on biodiversity. • Potential impact to the flood plains north and south of the current roundabout. • Reduction in driver stress. • No effect on regional landscape. • Minimal impact on air quality.	• Traffic disturbance from long construction period. • Construction works within the River Nene. • Bridge works will have major buildability issues. • Major TM implications during construction. • Maintenance shouldn't be an issue – build into design in future stages. • New bridge would be preferable to widening the existing structure. • Potential diversion of services in the North footpath

10.3.10 Option 1 solved the capacity issues in the modelled years and achieved the objectives of the Scheme. The assessments highlighted key environmental issues which included expected significant impacts on the local designated sites, although it would have minimal effect on the landscape and air quality. This option included the widening of the bridge which would be a relatively significant engineering task but was likely to not affect the existing surge chamber.

Table 10-3: Option 2 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Has a significant impact solving and meeting the identified problems and objectives	• Modelling suggests that the congestion is reduced. • Modelled to operate under predicted flows in 2036. • Junction operates satisfactorily.	STRUCTURAL: • Assessment of structure required for traffic lanes extending over existing north verge. Possible need for bridge strengthening works • No widening of the bridge subject to suitable lane widths used GEOTECHNICAL: • Low retaining wall required along east edge of roundabout • Differential settlement between widened embankments and existing road pavements • Minimal differential settlement between embankments and bridge • Retaining wall relatively low – will minimise impact on property • Minimal filling on flood plain and hence settlement issues DRAINAGE: • Extra area of carriageway will require attenuation • Adverse impact on existing pump station and pumped drain • No impact on existing flood defences • No new work within flood plain DESIGN STANDARDS: • Potential visibility departure on A47 Fen Road LANDTAKE: • Less Land Take from Environment Agency on the east side - Plots No. 5	• Increased noise for local access March road • Potential to effect biodiversity – Particularly wildlife corridors • Potential to impact River Nene during construction • This option has the potential to impact the culvert running beneath the northern roundabout access. • NMU link severance • Driver stress reduction • No effect on regional landscape • Minimal impact on air quality	• Potential diversion of services in the North footpath • Construction works within the River Nene. • Major TM implications during construction.

10.3.11 Option 2 solved the capacity issues in the modelled years and achieved the objectives of the Scheme. Environmental impacts were lower than in Option 1 due to no existing bridge structure works being required, although it was recognised that there could still be an impact on the designated sites in the area and particularly the River Nene. Engineering issues related to the impact on the existing surge chamber but widening of the carriageway should be possible without the need to alter the existing bridge structure.

Table 10-4: Option 3 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Very small overall impact in solving and meeting the identified problems and objectives	Initial modelling indicates that this option does not operate satisfactorily under predicted flows in 2036.	STRUCTURAL: • No expected bridge works GEOTECHNICAL: • Major roadworks required along east edge of roundabout • Large area requiring pre-loading along east side of roundabout and A47 South Brink • Differential settlement between widened embankments and existing road pavements • Settlement of pumphouse culvert • No bridge widening • Minimal differential settlement between embankments and bridge • Minimal filling on flood plain DRAINAGE: • Extra area of carriageway will require significant attenuation • Adverse impact on existing pump station and pumped drain • No impact on existing flood defences • No new work within flood plain DESIGN STANDARDS: • **Does not meet the traffic capacity requirements** (no departures developed as a result). LANDTAKE: • Land Take from the Environment Agency on the east - Plot No. 5	• Increased noise for local access March road • Potential to effect biodiversity – Particularly wildlife corridors • NMU link severance • Visual and aesthetic amenity impacts with the tree shelterbelt removed • This option has a lower potential to directly impact the River Nene and the floodplains than option 1 or 2 as its construction works do not lay within their footprints. However, the culvert running beneath the northern roundabout access will likely be impacted. • Driver stress reduction • Minimal impact on air quality .	• Potential diversion of services in the North footpath • Construction works within the River Nene. • Major TM implications during construction.

10.3.12 Option 3 does not solve the traffic problems in the modelled years and only provides a minimal contribution to the achievement of the described objectives. The Environment assessment showed this to be more favourable than Options 1 and 2 as the potential impact on sensitive designated sites is reduced as there are not expected to be works within these areas. There were impacts on the local landscapes and local residents however. Engineering issues focussed on the impact on the surge chamber and potential for significant earthworks.

Table 10-5: Option 4 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Has a significant impact solving and meeting the identified problems and objectives from an overall scheme context but may have some operational performance issues with the dedicated left turn lane between A47 Fen Road and A47 Southbrink Road	Modelled against flows calculated in stage 0+ and shown to operate under predicted flows in 2036 in the AM peak and to just exceed the capacity threshold of 85% in the PM peak (RFC of 87%)	STRUCTURAL: • Assessment of structure required for traffic lanes extending over existing north verge. Possible need for bridge strengthening works Same as option 2 • No widening of the bridge subject to suitable lane widths used. GEOTECHNICAL: • Relocation of pumphouse and culvert required. • Possible increased loading in bridge. • Minimal new earthworks and associated settlement issues. • Large area requiring pre-loading along east side of roundabout and A47 South Brink • Retaining wall on eastern edge near local access March Road DRAINAGE: • Adverse impact on existing pump station and pumped drain • No impact on existing flood defences • No new work within flood plain • Little extra attenuation needed DESIGN STANDARDS: • Potential visibility departures to the auxiliary diverge LANDTAKE: • Land Take from the Environment Agency on the east – Plot No. 5	• Increased noise for local access March road • NMU link severance • Driver stress reduction • No effect on regional landscape • Minimal impact on air quality • Low impact on biodiversity	• Maintenance of Traffic Signals • Potential diversion of services in the North footpath • Construction works within the River Nene. • Major TM implications during construction.

10.3.13 Option 4 solved the capacity issues in the modelled years and achieved the objectives of the Scheme. Environmental impacts were lower than in the other options as there would be minimal impact on the designated sites, although the landscape buffer to the east of the junction would be reduced impacting the residents on the local access March Road. Engineering issues were mainly around the need for departures from standards for the new junction arrangement. However, there would be no works to the existing bridge structure, although it was recognised that there could still be an impact on the designated sites in the area, particularly the River Nene due to widening of the carriageway on the bridge.

Table 10-6: Option 5 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Very small overall impact in solving and meeting the identified problems and objectives	Initial modelling indicates that this option does not operate satisfactorily under predicted flows in 2036.	STRUCTURAL: • Existing north side verge would be disrupted to west of existing bridge • Existing bridge would not be affected. GEOTECHNICAL: • Relocation of pumphouse and culvert required? • New earthwork across floodplain – settlement issues • New bridge requiring deep piled foundations • Effect of new bridge on existing west abutment foundation • New earthworks offline except at tie ins • May not need a retaining wall along east edge DRAINAGE: • Extra area of carriageway will require significant attenuation • New crossing of river • Adverse impact on existing pump station and pumped drain • Relatively little new work within flood plain • Minimal impact on existing flood defences DESIGN STANDARDS: • **Does not meet the traffic capacity requirements** (no departures developed as a result). LANDTAKE: • Secretary of State for Transport – Plot No.4 on Land Registry drawing • Environment Agency - Plot No.5 on Land Registry drawing • Environment Agency - Plot No.16 on Land Registry drawing • The Queen's Most Excellent Majesty in Right of Her Crown – Plot No. 31 on Land Registry drawing • The Queen's Most Excellent Majesty in Right of Her Crown – Plot No. 33 on Land Registry drawing	• Increased noise for local access March road • NMU link severance • Visual and aesthetic amenity impacts • This option has the potential for major impacts to the River Nene and the floodplain • Driver stress reduction • Minimal impact on air quality	• New bridge would be built off line • Construction works within the River Nene.

10.3.14 Option 5 did not solve the traffic problems in the modelled years and only provided a minimal contribution to the achievement of the described objectives. From an Environment perspective, the issues were focussed on the construction of a new bridge within the flood plain and the potential to adversely affect the River Nene and the surrounding designated sites. The construction of a new bridge was a key engineering constraint, although it could be potentially built offline, along with the impacts on the existing River Nene bridge.

Table 10-7: Option 6 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Very small overall impact in solving and meeting the identified problems and objectives	Initial modelling indicates that this option does not operate satisfactorily under predicted flows in 2036.	STRUCTURAL: • Lane realignment required • The new elevated link could comprise both retained fill and viaduct • To gain the required headroom above the roundabout, it can be expected that the elevated link would need to be circa 180m long • Existing bridge would not be affected GEOTECHNICAL: • Deep piled foundations required across existing roundabout and along approach ramps with associated traffic management issues • No impact on existing bridge foundations • Minimal new earthworks and associated settlement DRAINAGE: • Extra area of carriageway will require significant attenuation • Adverse impact on existing pump station and pumped drain • No impact on existing flood defences • No new work within flood plain DESIGN STANDARDS: • **Does not meet the traffic capacity requirements** • Potential departures from geometric standards LANDTAKE: • Environment Agency – Plot No. 5 Richard Anthony Spencer Glen – Plot No. 22 – possible demolition of existing property • Elleen Rosa Taylor – Plot No. 23 - possible demolition of existing property • Environment Agency – Plot No. 28	• Increased noise as highway will be elevated • This option will move the traffic to a higher elevation, which may result in a deterioration in overall air quality in the local area particularly from dust deposition • There would be major impacts on the local landscape with the level of impact dependant on the height of the flyover • Impact on biodiversity is likely • Driver stress reduction • Minimal impact on air quality • This option is unlikely to directly impact the water environment	• Major TM implications during construction.

10.3.15 Option 6 did not solve the traffic problems in the modelled years and only provided a minimal contribution to the achievement of the described objectives. Environmental concerns are focussed on the elevated road which is likely to adversely affect the local landscape, air quality and the visual impacts for the local residents on local access March Road. Engineering concerns the complex nature of constructing a grade separated flyover and the impacts on the existing surge chamber.

Table 10-8: Option 7 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Has a significant impact solving and meeting the identified problems and objectives	Initial modelling indicates that this option does not operate satisfactorily under predicted flows in 2036. However with some adjustments to the individual roundabout layouts it may be possible for this option to have sufficient capacity for 2036 flows.	STRUCTURAL: • Two new bridges required • Viaduct may be required between bridges (300m long) • Deep pile construction required GEOTECHNICAL: • New embankment across floodplain requiring preloading and surcharge or ground treatment • Deep piled foundations required • Potential contamination associated with old railway track DRAINAGE: • Extra area of carriageway will require significant attenuation • Significant work within flood plain • Impact on existing flood defences • New crossings of rivers • No impact on existing pump station and pumped drain DESIGN STANDARDS: • Potential departures from geometric standards LANDTAKE: • Secretary of State for Transport – Plot No. 9 • North Level District Internal Drainage Board – Plot No.17 – Possible demolition of • property • Richard Anthony Spencer Glen – Plot No. 22 • Secretary of State for Transport – Plot No. 29 • Environment Agency – Plot No. 28 • Insufficient Land Registry information to the east of the proposed southern roundabout	• Increased noise for properties adjacent to new roundabouts • This option has the potential to impact the Nene Washes Complex in a major way through the construction of the two slip road bridges within the River Nene flood plain and lowland fens area. • There would be major visual and amenity impacts on the local landscape particularly to properties to the south Guyhirn and all properties within Ring's End • This option is likely to directly impact not only the River Nene, but also Morton's Leam and their associated flood plains. • There will be impacts through a requirement to provide new pedestrian crossing points at the two new roundabouts. • Minimal impact on air quality • This option is unlikely to directly impact the water environment • There may be a slight improvement in air quality surrounding the current A47 roundabout junction, as some east – south traffic would be diverted via the new roundabouts.	• Existing bridge would not be affected. • New bridges to be built offline • Two new bridges required (if not a continuous bridge structure) • New embankment across floodplain (if not a continuous bridge structure) requiring • preloading and surcharge or ground treatment • Works largely removed from existing road and bridge

10.3.16 Option 7 did not solve the traffic problems in the modelled years but did provide a positive contribution on the described objectives. The Environmental concerns were focussed on the significant impact to the designated sites in the area due to the construction of two new bridges and new carriageways within these areas. Engineering concerns are focussed on the complex nature of construction of new bridges which would require deep pile foundations.

Table 10-9: Option 8 – Further Assessment

Objectives	Capacity Assessments	Engineering	Environment	Buildability/Maintenance
Has a significant impact solving and meeting the identified problems and objectives	• Modelling suggests that the congestion is reduced. • Modelled to operate under predicted flows in 2036. • Junction operates satisfactorily	STRUCTURAL: • Existing north side verge will be disrupted GEOTECHNICAL: • Settlement of pumphouse culvert likely • New earthworks in floodplains, potential settlement issues • Deep piled foundations for new bridge required • New bridge may affect existing west abutment foundations DRAINAGE: • Extra area of carriageway will require significant attenuation • Adverse impact on existing pump station and pumped drain • New crossing of river • Relatively little new work within flood plain • Minimal impact on existing flood defences DESIGN STANDARDS: • Departure from standard – exit radius on A141 March Road • Departure from standard for entry path curvature for A47 Fen Road and A47 Southbrink Road • Departure from standard for Circulatory Carriageway Width Ratio on A141 March Road LANDTAKE: • Secretary of State for Transport – Plot No.4 on Land Registry drawing • Environment Agency - Plot No.16 on Land Registry drawing • The Queen's Most Excellent Majesty in Right of Her Crown – Plot No. 31 on Land Registry drawing • The Queen's Most Excellent Majesty in Right of Her Crown – Plot No. 33 on Land Registry drawing	• Increased noise for local access March road • Potential for negative impact on River Nene and biodiversity • Severance of NMU link • No overall change to air quality • Reduced driver stress	• New bridge to be constructed offline • New earthworks mostly offline except at tie-ins

10.3.17 Option 8 solved the capacity issues in the modelled years and achieved the objectives of the Scheme. Environmental concerns were focussed on the requirement to construct a new bridge within the existing flood plain and impacts on the River Nene, along with the reduction of the landscape buffer to the east. Engineering concerns were focussed on the impacts to the existing surge chamber and the construction of a new bridge, although this could potentially be built offline.

10.4 Initial Traffic Assessment

10.4.1 It is recognised that traffic assessments are a key consideration when assessing junctions.

10.4.2 Therefore, following the KPI assessments above, a more detailed traffic assessment was undertaken to look at the key KPI of 'supporting the smooth flow of traffic', discussed in the below section.

10.4.3 To assess the performance of each design option, their performance was tested using future year traffic flows, interpolated from present year flows using traffic growth forecasts.

10.4.4 The options were tested at 2021 traffic levels, which represents the planned scheme opening year, and a design year of 2036.

10.4.5 To predict car traffic growth between the base and future years, growth estimates from the National Trip End Model (NTEM) as presented in TEMPro were used. TEMPro version 6.2 was used in the initial assessment. Forecasts for goods and passenger service were obtained from the National Transport Model (NTM) as output in the bi-yearly Road Traffic Forecasts (RTF). Outputs from the 2015 RTF were used to generate forecasts.

10.4.6 The 2021 and 2036 forecast flows predicted from this process are shown in Table 10-10 with figures reported in PCUs. The percentage of heavy goods vehicles within this traffic is shown in Table 10-11.

Table 10-10: Forecast 2021 and 2036 turning counts at Guyhirn (PCUs)

2021 AM Peak	A47 N	A141	A47 W
A47 N	0	430	795
A141	545	0	445
A47 W	692	494	79

2021 PM Peak	A47 N	A141	A47 W
A47 N	0	526	721
A141	442	3	514
A47 W	767	463	55

2036 AM Peak	A47 N	A141	A47 W
A47 N	0	507	938
A141	641	0	523
A47 W	813	582	93

2036 PM Peak	A47 N	A141	A47 W
A47 N	0	625	854
A141	526	4	611
A47 W	912	551	66

Table 10-11: Forecast 2021 and 2036 HGV splits at Guyhirn as percentage of all traffic

2021 AM Peak	A47 N	A141	A47 W
A47 N	0.0	11.4	11.9
A141	9.2	0.0	10.9
A47 W	14.1	6.5	8.9

2021 PM Peak	A47 N	A141	A47 W
A47 N	0.0	5.1	7.7
A141	6.2	48.7	4.1
A47 W	8.0	4.3	4.0

2036 AM Peak	A47 N	A141	A47 W
A47 N	0.0	10.9	11.5
A141	9.2	0.0	10.9
A47 W	14.1	6.5	8.9

2036 PM Peak	A47 N	A141	A47 W
A47 N	0.0	4.9	7.4
A141	6.2	48.7	4.1
A47 W	8.0	4.3	4.0

10.5 Initial Traffic Analysis

10.5.1 The design options were tested in ARCADY, with the exception of Option 4 which was tested in LINSIG as it is signalised. Each junction was tested in isolation, excluding effects on the link approaches; in the case of Option 7, all three junctions were tested separately.

10.5.2 For the purposes of isolated junction design analysis, Options 1 and 2 were effectively identical given their approximately identical geometrics. Therefore a single model was used to test both options simultaneously. The same approach was used with Options 3 and 5, which despite having significantly different approach and segregated left turn designs had identical configurations for Guyhirn junction itself.

10.5.3 The measure of junction performance used is the Reserve Flow to Capacity (RFC). RFC has been converted from the output Degree of Saturation for the LINSIG option. The maximum RFCs and vehicle delays occurring in the same timeslice are shown in Table 10-12 below. RFCs greater than 0.85 (approaching saturation capacity) are shown in yellow and RFCs greater than 1 (junction over capacity) are shown in red.

Table 10-12: Guyhirn junction design operational analysis at 2021 forecast traffic volumes

Design	2021 AM Peak		2021 PM Peak		2036 AM Peak		2036 PM Peak	
	RFC	Delay (s)	RFC	Delay (s)	RFC	Delay (s)	RFC	Delay (s)
Options 1/2	0.67	5.5	0.66	4.9	0.84	11.0	0.83	9.1
Options 3/5	1.232	350.6	1.195	300.4	1.615	978.5	1.599	938.6
Option 4	0.769	26.0	0.741	28.1	0.833	30.0	0.819	32.9
Option 6	0.892	21.0	0.850	16.8	1.047	107.8	1.016	76.6
Option 7	0.782	11.3	0.846	15.1	0.918	27.2	1.011	73.6
Option 8	*Not tested at 2021 traffic levels*				0.931	48.7	0.925	31.8

10.5.4 The results can be summarised thus:

- Option 4 showed the lowest overall degree of saturation of all the tested options, with delays limited to no greater than 33 seconds on the busiest arm in the 2036 PM peak, however U-turns were excluded from the assessment;
- Options 1 and 2 performed adequately with more than 15% reserve capacity at 2036 traffic levels. These options had lower average delays per vehicle than Option 4 as there were no signals holding traffic;
- The ARCADY results for Option 8 suggested that design was approaching reserve capacity in the both the 2036 peak periods, with slightly longer delays of up to 49 seconds;
- Options 7 exceeded its capacity in the 2036 PM peak resulting in over-capacity delays: while the results are reported for the main roundabout in this design, the roundabout on the A141 at Ring's End also suffers over-capacity delays in the PM peak;
- Option 6 failed to operate satisfactorily at 2036 traffic levels with over-capacity queues observed in both peak periods resulting in delays of up to two minutes;
- Options 3 and 5 were well over capacity at 2036 traffic levels resulting in very significant queues and delays of the order of 15 minutes.

10.5.5 Options 1, 2, 4 and 8 therefore performed satisfactorily at projected 2036 traffic levels.

10.6 Conclusions

10.6.1 The constraints of the site meant that all options would potentially impact on the sensitive designated environmental sites that surround the Guyhirn junction. All but the bypass option (Option 7) created issues with noise and vibration and reduction of the landscape buffer to the east. Any works that would be required to have construction within the designated sites or new works over the River Nene were considered to be less favourable than others.

10.6.2 Option 4 was favourable from an environment perspective, closely followed by Option 2 due to lower impacts on the surrounding designated sites.

10.6.3 Considering the traffic modelling and capacity constraints, Options 1, 2, 4 & 8 all performed well in traffic terms. The remaining options (3, 5, 6 & 7) all performed poorly in traffic terms in the design year (2036).

10.6.4 From an engineering perspective, those options that did not require structural work to the bridge, or the construction of a new bridge, were considered favourable (Options 2, 3, 4 & 5). All options were likely to require significant drainage works and affect the surge chamber to the east and/or the culvert running under the A47 South Brink.

10.6.5 Buildability was also considered with all options expected to require significant traffic management for the works. Those options that did not require new bridges or works to the existing bridge were favourable, although some new bridges could potentially be built offline (Options 7 & 8). Further consideration of detailed buildability constraints will be investigated at later stages and is also discussed in section 13.11 of this report.

10.6.6 The initial assessments carried out in regards to the KPI's and EAST tool described earlier in this chapter, also showed a similar outcome and an emerging hierarchy which grouped options and supports the findings from technical disciplines. This showed Options 3, 5 and 6 were less favourable, whilst Options 1, 2 and 8 were more favourable.

10.6.7 At the point of sifting, no economic data was available to assess the options as no cost estimates had been sought from Highways England at this stage. This followed at a later date (see Chapter 18).

10.6.8 Based on this initial assessment a ranking table was produced (see Table 10-13 below) which was to be presented and discussed at the Options Review Meeting (ORM) where a decision would be made on which options should progress. Further detail is described in Chapter 11.

Table 10-13: Initial Options Ranking Table

Option	Ranking
No 2 Enlarged roundabout (70m ICD) in new location	1
No 4 Signalised T Junction	2
No 8 Oval roundabout	3
No 1 Enlarged roundabout, symmetrically in current location	4
No 3 Roundabout in new location with 2 free flow left lanes	5
No 5 Roundabout with 2 free flow left lanes, new bridge	6
No 6 Grade Separated flyover	7
No 7 A141 March Road to A47 Fen Road Bypass	8

11 Options Ranking, Sifting and Review

11.1 Options Review Meeting (ORM)

11.1.1 The initial options assessments undertaken as described in Chapter 10, were presented to an Options Review Panel at the ORM which took place on 1 June 2016. The panel comprised senior representatives from Highways England, Amey and AECOM.

11.1.2 The ORM had the objective of considering the information presented from the assessments and sifting exercise (described in Chapter 10) carried out to date (June 2016) and deciding which options should progress.

11.1.3 The overall rankings were presented to the review meeting and included in the table 10-13 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.

11.1.4 Information presented at the ORM can be found in Appendix 9.

11.2 Options Selected for Further Assessment

11.2.1 Taking all the above assessments described in Chapter 10 above, the options being recommended for progression and presented to the panel were Options 2, 4 & 8.

11.2.2 The panel were in agreement that Options 2 and 8 should progress based on the assessment information presented.

11.2.3 Option 4 was discussed at some length. The assessment ranked this alongside Option 8 in terms of benefits and solving the described problem. It performed well in terms of traffic but excluded 'U-turns' at the junction.

11.2.4 There was a discussion during the meeting regarding the exclusion of U-turns and the fact that this was a necessary traffic movement as vehicles were unable to turn right out of B1187 Gull Road onto the A47 Fen Road (modified junction created due to incidents at this location), meaning they had to use the roundabout in order to travel west towards Peterborough.

11.2.5 It was also discussed that Option 4 would require significant land take and loss of mature trees, thus considerably reducing the existing landscape buffer between the roundabout and the residents on local access March Road.

11.2.6 Considering the key limitations of Option 4, the main one being that the B1187 Gull Road was out of scope, the provision of a signalised junction (replacing the roundabout) was not considered a viable solution at Guyhirn. The panel agreed that Option 4 should be discounted from further consideration.

11.2.7 There was further discussion regarding Option 1 and if it was in fact preferable to reconstruct or widen the existing bridge rather than take significant amounts of land and mature trees to the east of the existing junction. It was acknowledged that Option 1 had also performed well during the assessments in that it solved the capacity issues at hand.

11.2.8 In light of these discussions, the panel felt that an option that performed in traffic terms but did not involve the loss of the landscape buffer to the east which acts a barrier to the residents on local access March Road (even if it requires the widening of the bridge) should also be taken forward as a comparison (Option 1).

11.2.9 It was therefore agreed the options that should be taken forward for further assessment were:

- Option 1 – Enlarged roundabout including bridge widening works
- Option 2 - Enlarged roundabout repositioned to the east, requiring no bridge widening works
- Option 8 - Oval roundabout, including a new bridge structure to take traffic from A47 Fen Road onto the A47 South Brink towards Wisbech

11.2.10 A summary of the overall discussions held at the ORM on each option is included below in Table 11-1.

Table 11-1: Summary of route options to be taken forward for further assessment

Option	Overall Rank from assessment	Option to be taken forward for Options Estimate and further assessment	Overview of Key reasons
Option 1	3	Yes	Solves the traffic problem in the forecast years. Requires River Nene bridge widening but lessens impact to the existing landscape buffer to the east. Will allow cost comparison with new bridge structure (Option 8).
Option 2	1	Yes	Best performing option in terms of traffic and solves the problem in the forecast years. No bridge widening required.
Option 3	5	No	Performs poorly in traffic terms & would have negative impacts on the local residents particularly in local access March Road.
Option 4	4	No	Performs well in traffic terms but significant land take required, departure from standards for junction realignment and environmental concerns regarding loss of habitats and woodland. Does not allow U-turns for traffic leaving B1187 Gull Rd (out of scope) / form of junction unsuitable.
Option 5	6	No	Performs poorly in terms of traffic, requires a new bridge structure that would impact the surrounding environment designated sites and local residents negatively.
Option 6	7	No	Performs poorly in terms of traffic and has increased environmental concerns due to noise, air pollution and visual impact.
Option 7	8	No	Performs in terms of traffic but only addresses one of the conflict points. Significant impact on the local surrounding environment designated sites and would require the construction of 2 new bridges.
Option 8	2	Yes	Solves the traffic problem in the forecast years. New bridge structure required but could be built offline, no works required to existing bridge structure.

12 Traffic Analysis of Sifted Options

12.1 Introduction

12.1.1 This section will describe the assessments carried out on the three options progressed from the ORM from a traffic perspective, during PCF Stage 1.

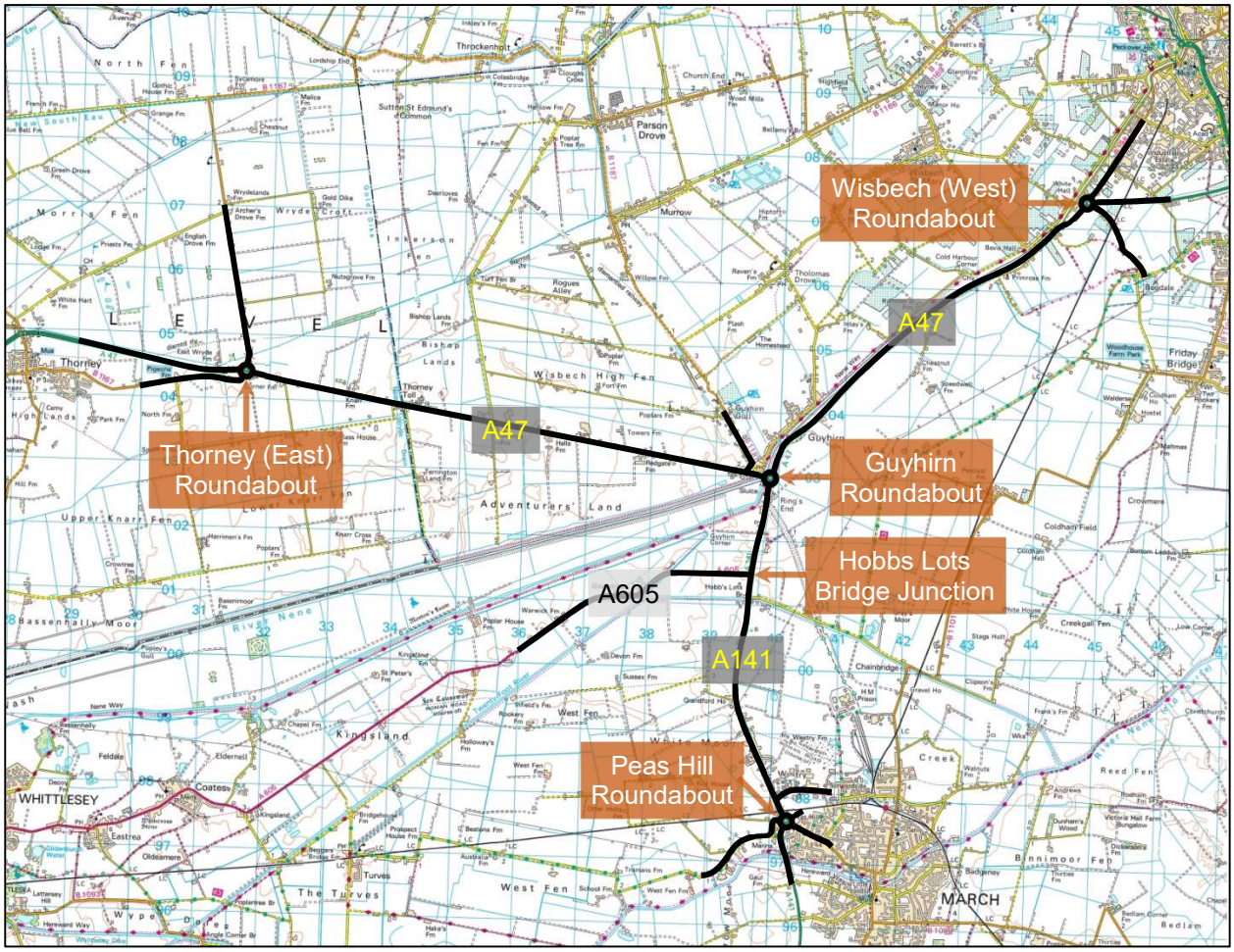
12.2 Modelling Approach

Model Scope

12.2.1 As per section 3.3, it was not appropriate to assess the Scheme using an existing model and so to progress the scheme through PCF Stage 1, a new SATURN model of Guyhirn Roundabout and downstream roundabouts was constructed to a 2015 base year. The model was constructed from manual classified turning count data obtained primarily in June 2015. A separate model was specified for each of the AM peak, interpeak and PM peak periods, albeit with an identical network structure with only signal timings at the A141/A605 junction at Hobbs Lots Bridge and input matrices differing by time period.

12.2.2 The model constitutes Guyhirn Roundabout itself in addition to the next major downstream junction in each direction on the A47, to the east of Thorney and the west of Wisbech respectively. Two other major junctions on the A141 south of Guyhirn Roundabout have been included and two minor priority junctions have been added to aid the model's consistency and correctly induce U-turning traffic at two of the roundabouts. The model extents are shown in Figure 12-1.

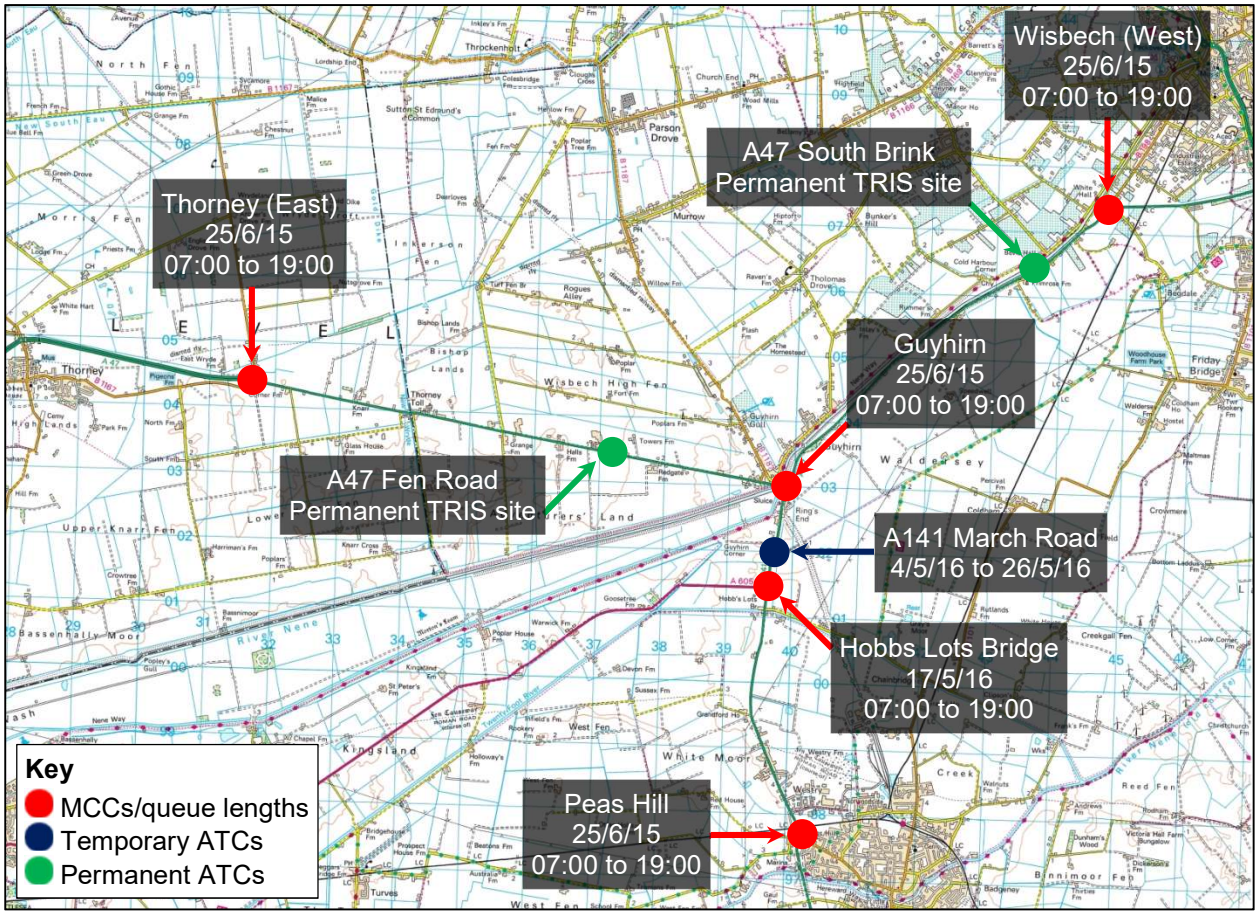
Figure 12-1: Geographical model coverage



Traffic Data Collection

12.2.3 Manual Classified Counts (MCCs) were used to measure traffic volumes and movements at each junction. Automated traffic counts (ATCs) independently measured inter-junction volumes for validation purposes; these were either bespoke surveys or taken from HE's Web Traffic Information System (TRIS). Journey time data was used measure travel times and the effects of congestion throughout the network, and queue length measurements were used to validate queueing behaviour in the model. The counts, locations and survey durations for each are shown in Figure 12-2.

Figure 12-2: MCC and ATC locations and durations for PCF Stage 1



12.2.4 Counts from different dates are not directly comparable due to traffic growth and the effects of seasonality, so all counts have therefore been normalised to a 2015 base. Normalisation factors have been derived by comparing the Average Annual Weekday Traffic (AAWT) volumes for the appropriate months as measured by the A47 Fen Road TRIS site.

12.2.5 No data collection was performed at B1187 Gull Road or Hostmoor Avenue junctions. Turning counts at these locations were estimated using the difference in flows between adjacent junctions.

12.2.6 Further information on traffic data collection is contained in the PCF Stage 1 Product, Traffic Data Collection Report, document reference A47 IMPS1-AME-GJ-ZZ-DO-J-0030.

Model Validation

12.2.7 The total trip production and attraction for each zone and vehicle class was determined using the MCC data. Vehicles which have entries and exits associated with zone connectors at the same junction are assigned their absolute flows as counted in the MCCs. It is assumed that all other vehicles progressing through the network select destinations proportionally. For each origin-destination pair its route through the modelled extents was examined and the demand for each was calculated using a formula which allows origin-destination pairs to be selected while providing good agreement with the total trip production and attraction at each:

$$T_{ij} = T_i \cdot \sum P(m)$$

- Tij represents the number of trips from zone I to zone J;

- Ti represents the total number of trips from zone I;
- P(m) represents the proportion of vehicles making each turning movement necessary to proceed along the route within the modelled extents.

12.2.8 The exception to the gravity model assignment is that no vehicles should journey between the Thorney (East) roundabout and the A605, as this represents an illogical route between any trip attractors on those roads. Journeys between these zones that would be generated in a fully proportional distribution have been reallocated proportionately to maintain consistency.

12.2.9 The SATURN model incorporated multiple user class assignment; demands were split across five vehicle classes, each of which was assigned an appropriate passenger car unit (PCU) value as shown in Table 12-1. The values selected are identical to those in the National Transport Model (NTM) and are reported in WebTAG Unit A5.4 "Marginal External Costs", Table A7.

Table 12-1: Guyhirn SATURN model vehicle classes and PCU values

User class	1	2	3	4	5
Vehicle type	Car	LGV	OGV1	OGV2	PSV
PCU value	1.0	1.0	1.9	2.9	2.5

12.2.10 Matrices were constructed using a gravity model based on the combination of turning counts at each of the major junctions. Modifications were made to the gravity model to accommodate illogical origin-destination pairs and reroute traffic accordingly.

12.2.11 The model was calibrated against a combination of independent link data and turning count data used to construct the model, and showed a very high level of calibration with almost all data achieving the WebTAG criteria comfortably. All journey time routes used in validation of the model achieved the WebTAG criteria for validation.

12.2.12 Given the high levels of calibration and validation, the model represented a robust forecasting tool to test the effect of junction improvements on the network. The PCF Stage 1 Local Model Validation Report (LMVR), document reference A47 IMPS1-AME-GJ-ZZ-DO-J-0031, further details the model construction, matrix formation, calibration and validation process. Copies of the model were then updated with the different design options for Guyhirn Roundabout substituted for the existing one for assessment purposes.

Forecasting Methodology

12.2.13 To predict car traffic growth between the base and future years, growth estimates from the National Trip End Model (NTEM) as presented in TEMPro were used. TEMPro version 7.0 was used to generate these forecasts. Each zone connector was assigned to an NTEM output area based on the likely origins and destinations of traffic proceeding through that zone connector.

12.2.14 The TEMPro traffic forecast growth factors are applicable only to cars. Forecasts for goods and passenger service vehicles have instead been obtained from the National Transport Model (NTM) as output in the bi-yearly Road Traffic Forecasts (RTF). Outputs from the 2015 RTF have been used to generate forecasts.

12.2.15 The RTF uses a scenario approach to forecasting with five forecasts varying by the method by which future trip rates are extrapolated from past ones. Scenario 1, with historic average trip rates, a positive and declining relationship between trip rates and income and a central estimate of macroeconomic growth, was used as it best represents a neutral reference case. Each O-D pair was assigned a growth rate appropriate for its realm (urban or rural) and road type (motorway, trunk, principal or minor).

Elasticity of Demand

12.2.16 Growth in traffic volume increases the user cost for each trip due to additional delay and congestion in the network. Using economic principles of supply and demand, an increase in cost will result in a decrease in supply (traffic); this represents users choosing to delay, reroute or abandon their trips due to this additional cost. The relationship between cost and travel is the elasticity of demand.

12.2.17 A logit incremental function was used to perform variable demand modelling (VDM) using the relationship:

$$T = \frac{2T^0}{1 + e^{\beta(c-c^0)}}$$

- T and T0 represent the number of trips in the forecast and base models respectively;
- c and c0 represent the cost of trips in the forecast and base models respectively;
- β is an elasticity parameter which determines the rate of change of trips relative to costs. The elasticity of demand at Guyhirn is relatively low given the lack of alternative routes, the use of the route by significant numbers of commuters and the relative lack of alternative public transport services. To reflect these observations the elasticity parameter β has been assigned a value of 0.001.

12.2.18 Further detail on the forecasting methodology, forecast generation and implementation of elastic demand modelling is contained within the PCF Stage 1 Traffic Forecasting Report, document reference A47 IMPS1-AME-GJ-ZZ-DO-J0029.

Modelling Constraints

12.2.19 The modelling constraints are governed by the quality and quantity of traffic data available from which to construct the model.

12.2.20 Onward routing data is not defined by the MCCs so a proportional gravity model representative of local conditions was used in lieu of this data.

12.2.21 The elasticity of demand was estimated using local observations, and assumes minimal traffic rerouting; however, these were assumptions and did not draw upon local data. The potential for rerouting could only be explored in a wider area model.

12.3 Modelling Outputs

12.3.1 The journey times through each junction in each of the Do-Minimum and Do-Something models were measured in each of the modelled time periods. The journey time associated with each junction was measured between the nodes closest to each junction arm which were common to the Do-Minimum and Do-Something models, allowing direct comparison between the options including where junction coding changes were made.

2015 Guyhirn Roundabout Performance

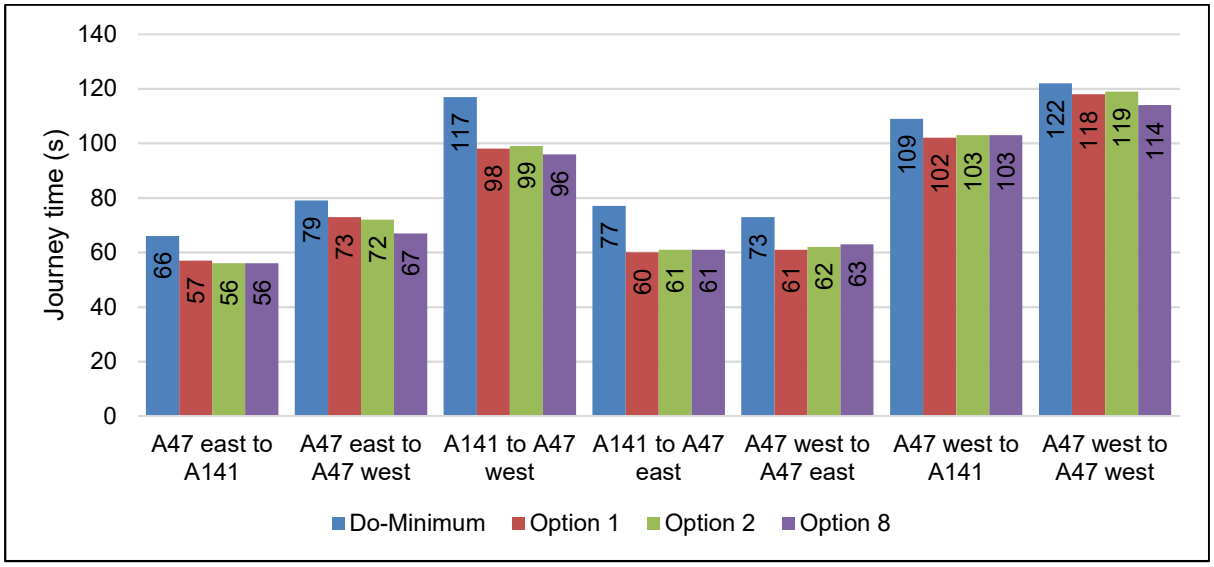
12.3.2 The modelled journey times through Guyhirn Roundabout was measured using outputs from the SATURN model. The journey time on each link, inclusive of stopline delays at Guyhirn Roundabout, was measured for all movements through the roundabout. Timing points for these journey time measures coincide with the maximum extent of the 40mph zone surrounding Guyhirn and Ring's End villages:

- A47 east: A47 South Brink approximately 110 metres north-east of the roundabout;
- A141: A141 March Road approximately 690 metres south of the roundabout;

- A47 west: A47 Fen Road approximately 760 metres west of the roundabout.

12.3.3 The total journey time through the roundabout is shown in Figure 12-3 for the AM peak period, Figure 12-4 for the interpeak period and Figure 12-5 for the PM peak period. Each figure shows the journey time in the Do-Minimum model and all three Do-Something options, summed for each movement through the roundabout with a non-zero flow, including the U-turn to and from the A47 west arm.

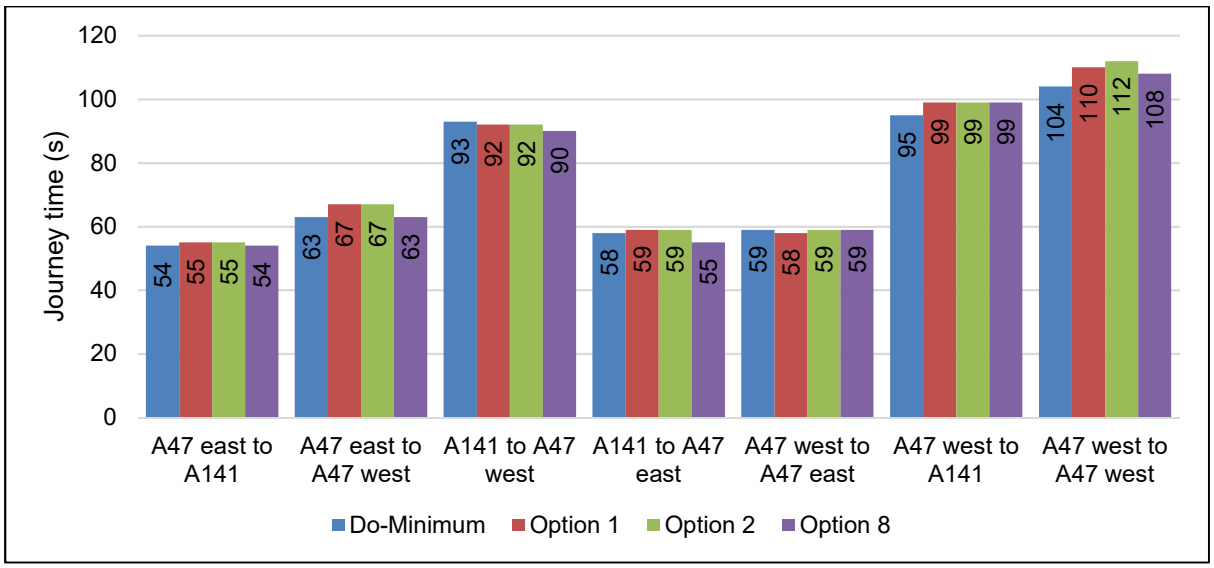
Figure 12-3: Journey times via Guyhirn Roundabout – 2015 AM peak period



12.3.4 In the base year Do-Minimum model, vehicles approaching Guyhirn Roundabout experienced transient delays, although the reserve capacity of the roundabout was not exceeded. These stopline delays are most prominent in the AM peak hour, reaching a maximum of 24 seconds for traffic approaching the roundabout from the A141 arm. By significantly reducing this delay in the Do-Something models, all journeys experience relative journey time savings of between 3 and 20 seconds.

12.3.5 The differences between the Do-Something options were small with different movements favoured by each. Comparative journey time differences are less than 8 seconds in all cases.

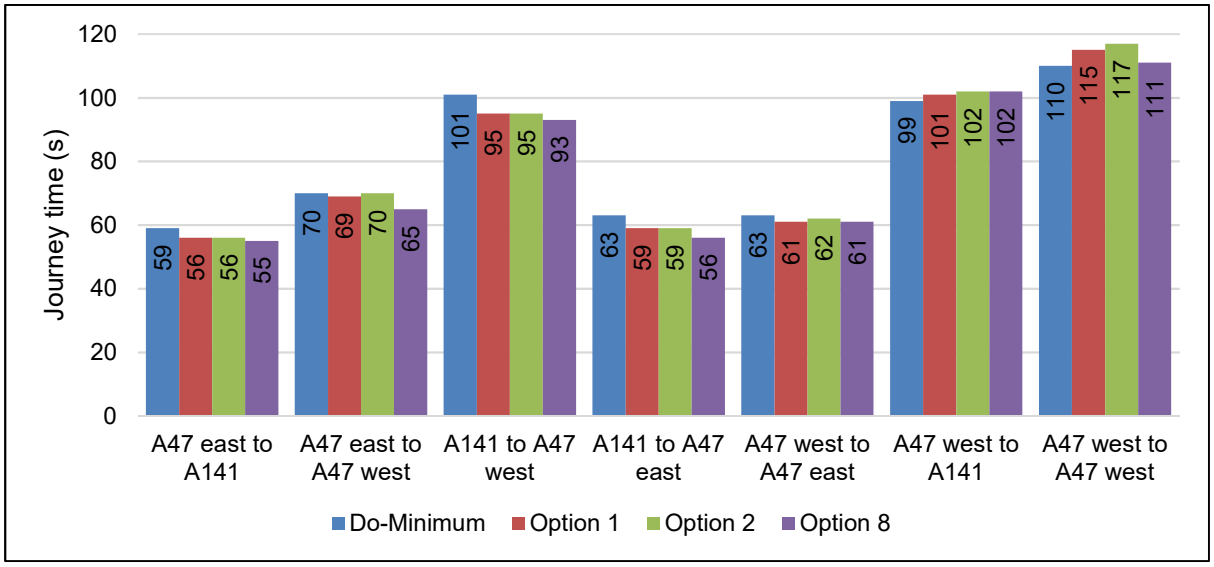
Figure 12-4: Journey times via Guyhirn Roundabout – 2015 interpeak period



12.3.6 There were few underlying delays in the Do-Minimum interpeak hour model and journey times were faster than those in the AM peak. Therefore, any small benefits in the Do-Something model were negated by the increase in time to circulate the larger roundabouts. The net result was there was mixture of small journey time benefits and disbenefits for each movement, although none were larger than 8 seconds compared to the Do-Minimum.

12.3.7 As with the AM peak Do-Something models, none of the three option designs differed in terms of journey times from the others by more than four seconds.

Figure 12-5: Journey times via Guyhirn Roundabout – 2015 PM peak period



12.3.8 The transient delays in the Do-Minimum PM peak model were reduced in the Do-Something models, resulting in small journey time savings, but these were mitigated by the increased circulatory distance on the redesigned junctions as with the interpeak data. The result was an intermediate performance between those of the Do-Something AM peak and interpeak models.

12.3.9 The relative performance of the junction options remains comparable to that seen in the AM peak and interpeak hours. Option 8 performed marginally better than Options 1 and 2 although there is no greater than 6 seconds' difference between journey times for each option.

2015 Other Junctions' Performance

12.3.10 In the SATURN base year model, all queues at Guyhirn Roundabout are transient, the modelled capacity of the junction was not exceeded in any time period and no traffic remained queued at the end of the modelled hour. All demand flow therefore reaches the junctions downstream from Guyhirn in the Do-Minimum and Do-Something models. These junctions' performance was therefore identical in all cases.

12.3.11 The ratio of volume to capacity at Guyhirn Roundabout is approximately 96% in the Do-Minimum AM peak base model. If this measure were to increase to over 100% due to traffic growth, over-capacity queues would form and the actual flow downstream from Guyhirn would be reduced. Increases in capacity at Guyhirn Roundabout in the Do-Something models would then result in increased downstream flows and an impact on the performance of downstream junctions.

2015 Conclusions

12.3.12 Where significant stopline delays occur in the Do-Minimum base year model, as observed particularly in the AM peak period benefits are achieved in the Do-Something models due to the increase in stopline capacity and therefore reduction of those delays. At other times, the

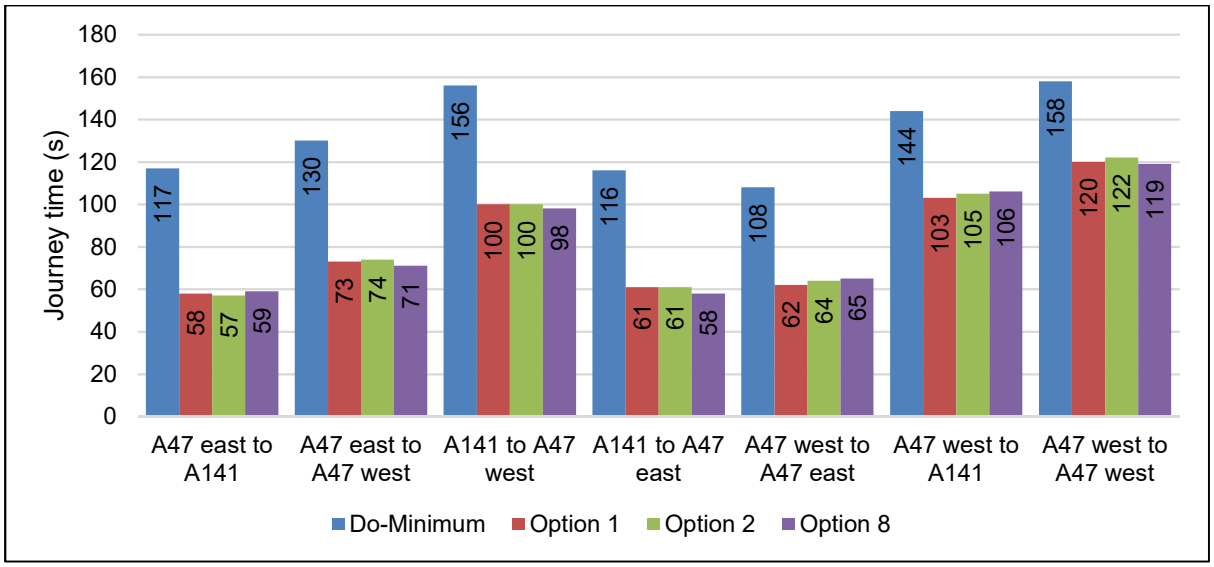
benefits are much smaller due to fewer underlying delays, and in the interpeak period where there were no significant Do-Minimum delays, journey times through the roundabout showed a small increase in the Do-Something scenarios due to increased time taken to circulate the larger roundabouts in the option designs.

12.3.13 The relative performance of the Do-Something models was similar. While the sum of benefits suggests a slight advantage for Option 8, their relative performance was not dependent on their capacities at these traffic levels as the capacities significantly exceeded demand; any variation was due to fine geometric details. As SATURN does not model individual junction design in detail, care should be taken in interpreting these results. It is anticipated that as traffic volumes increase, the Do-Something options will approach their saturation capacities and their relative performances will diverge.

2021 Guyhirn Roundabout Performance

12.3.14 The total journey time through Guyhirn Roundabout at 2021 traffic levels is shown in Figure 12-6 for the AM peak period, Figure 12-7 for the interpeak period and Figure 12-8 for the PM peak period, using the same methodology as described in paragraph 12.3.1.

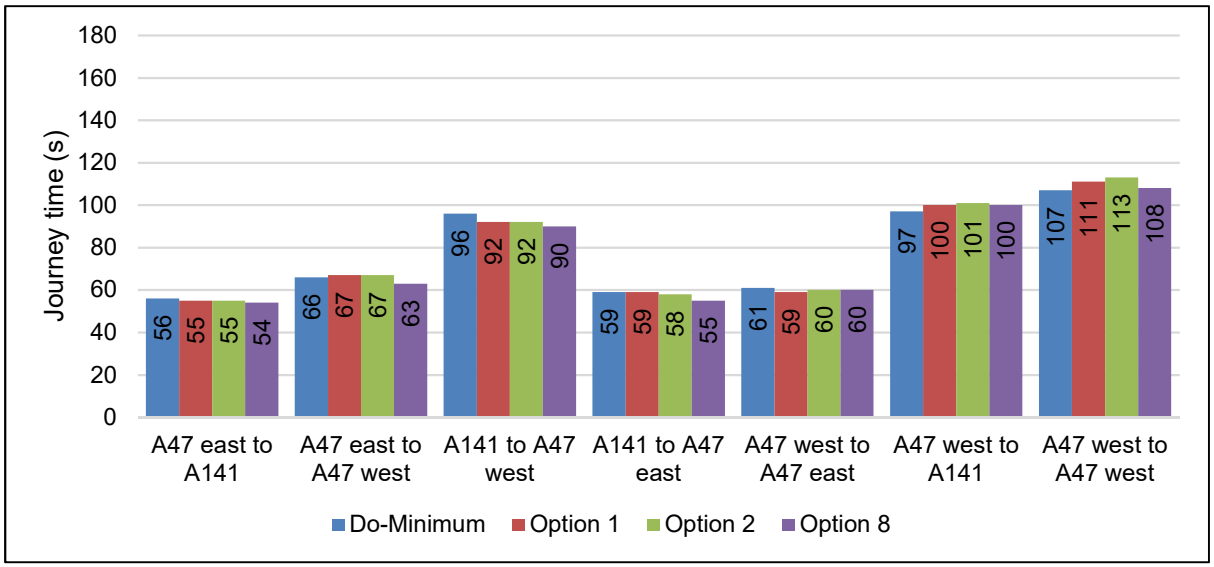
Figure 12-6: Journey times via Guyhirn Roundabout – 2021 AM peak period



12.3.15 In the 2021 Do-Minimum model, the capacity of all three entries to Guyhirn Roundabout was exceeded in the AM peak hour resulting in delays of around one minute for all vehicles. The ratio of volume to capacity is over 100% on all three arms so this queue builds throughout the modelled hour and a queue persists at the end of the hour. Queued vehicles therefore fail to progress through the junction within the modelled hour so the downstream flows are reduced.

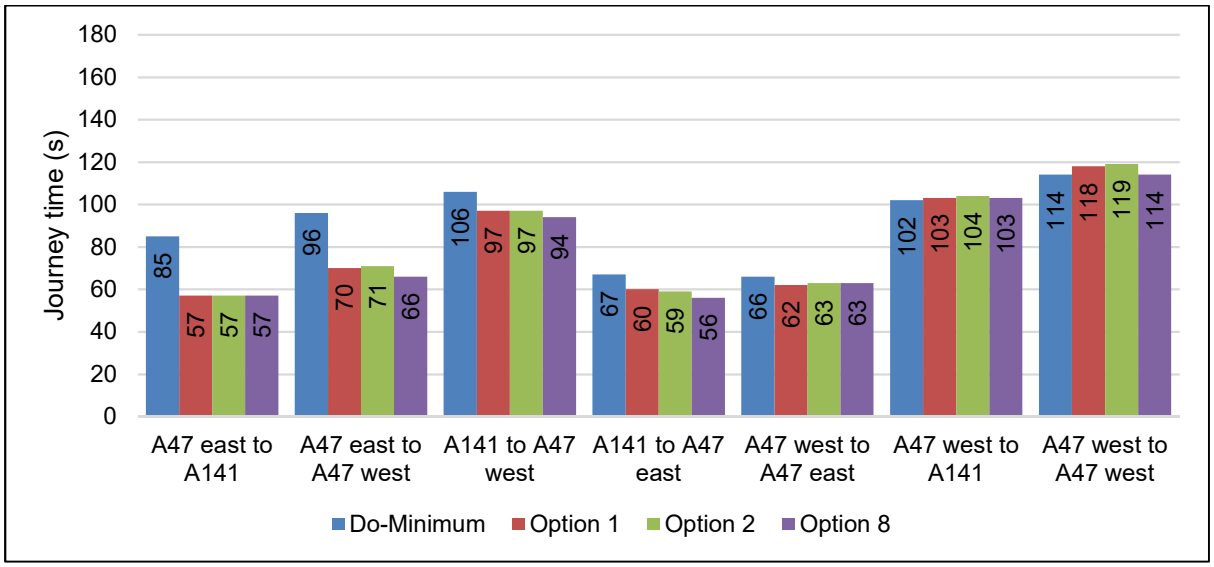
12.3.16 The journey time savings experienced at Guyhirn Roundabout in the AM peak Do-Something models are roughly proportional to the delays experienced in the base model, as each design had sufficient capacity to accommodate the anticipated traffic growth. As with the 2015 models, the relative performance of the three options is similar.

Figure 12-7: Journey times via Guyhirn Roundabout – 2021 interpeak period



12.3.17 There was sufficient capacity in the Do-Minimum model to accommodate the forecast traffic growth without inducing significant additional delay in the interpeak period. Junction behaviour was therefore comparable to that observed in the base year for the interpeak period; there were no significant delays in the Do-Minimum model so the dominant effect on Do-Something journey times is the amended junction geometry.

Figure 12-8: Journey times via Guyhirn Roundabout – 2021 PM peak period



12.3.18 The A47 east arm exceeded its capacity in the 2021 PM peak Do-Minimum model, resulting in delays of around 30 seconds and queues persisting to the end of the modelled hour. Transient queues were observed on the A141 arm which was very close to capacity, while the A47 west arm continued to flow with no significant stopline delay.

12.3.19 The journey time savings observed in the Do-Something PM peak models were again proportionate to the delays observed in the base model, which therefore concentrates benefits on vehicles approaching the roundabout on the A47 east arm.

2021 Other Junctions Performance

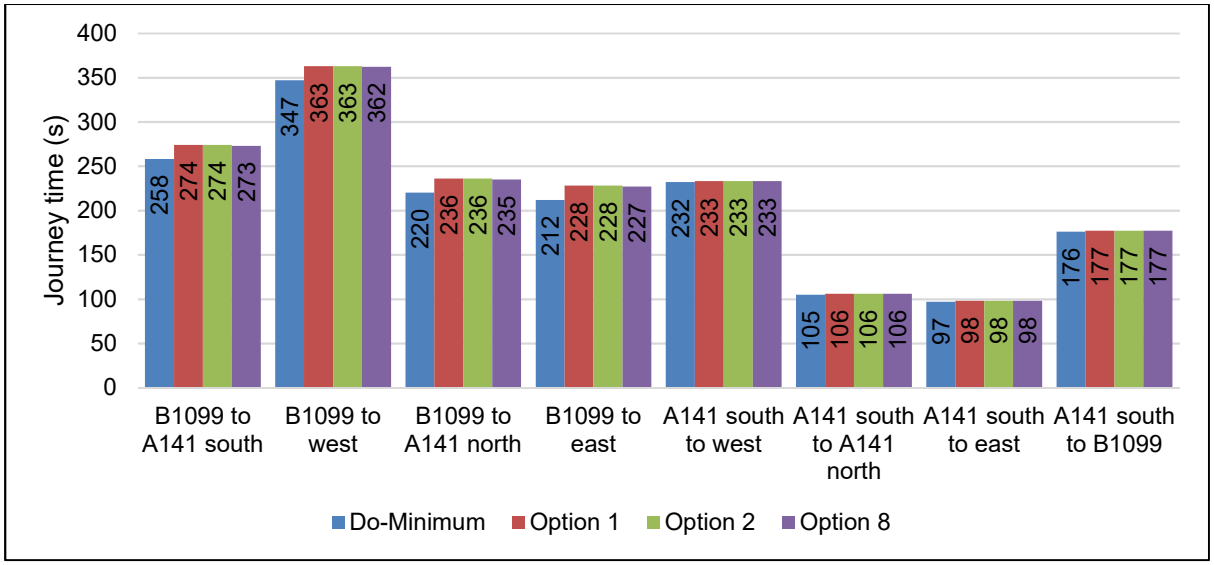
12.3.20 As described in paragraph 12.3.15, queueing in at Guyhirn Roundabout in the Do-Minimum 2021 AM peak model reduces traffic flow downstream of Guyhirn. With increased capacity in the Do-Something models these vehicles no longer queue there and proceed through the network, increasing downstream flows. Greater flows at the downstream junctions may induce additional opposing traffic and delays there, particularly where the junction is over capacity at present.

12.3.21 At 2021 traffic levels, Peas Hill Roundabout experiences over-capacity delays in the AM and PM peaks on both the B1099 and A141 south arms, resulting in stopline delays of 90 seconds and 20 seconds respectively in the 2021 Do-Minimum AM peak model.

12.3.22 The impact of increases in flow downstream of Guyhirn at Peas Hill roundabout in the Do-Something models was calculated by measuring the journey times for trips through the roundabout, using timing points in the March area:

- **A141 north:** A141 Wisbech Road approximately 310 metres north of the roundabout;
- **East:** Access to Meadowlands Retail Park approximately 60 metres east of the roundabout;
- **B1099:** B1099 Wisbech Road approximately 1,110 metres south-east of the roundbaout;
- **A141 south:** A141 Isle of Ely Way approximately 990 metres south of the roundabout;
- **West:** Whittlesey Road approximately 2.8 kilometres west of the roundabout.

Figure 12-9: Journey times via Peas Hill Roundabout – 2021 AM peak period



12.3.23 In the AM peak period, there are stopline delays of 90 seconds on the B1099 arm and 20 seconds on the A141 south arm (see Figure 12-9). The additional throughput at Guyhirn in the Do-Something models induces an additional delay of up to 16 seconds on the B1099 arm. The delay is the same in all three option models, as the number of vehicles released from the Guyhirn queue is identical in all three scenarios. This is a relatively small effect in comparison to the journey time savings at Guyhirn itself, and many of the vehicles from the B1099 proceed to Guyhirn and perceive those benefits.

12.3.24 Despite the increased throughput of traffic from Guyhirn in the PM peak Do-Something models, no significant changes to journey times occured at Peas Hill Roundabout at that time.

12.3.25 The relative performance of the other downstream junctions was effectively identical in both the Do-Minimum and Do-Something models. No over-capacity delays were experienced at any of the other downstream junctions in any of the three modelled hours at 2021 traffic volumes.

2021 Conclusions

12.3.26 Over-capacity delays are significant in the 2021 Do-Minimum model at Guyhirn Roundabout and result in give way line delays of up to 1 minute and 6 seconds. These delays are effectively eliminated in each of the Do-Something scenarios where the increased junction capacity is sufficient to accommodate the forecast traffic levels.

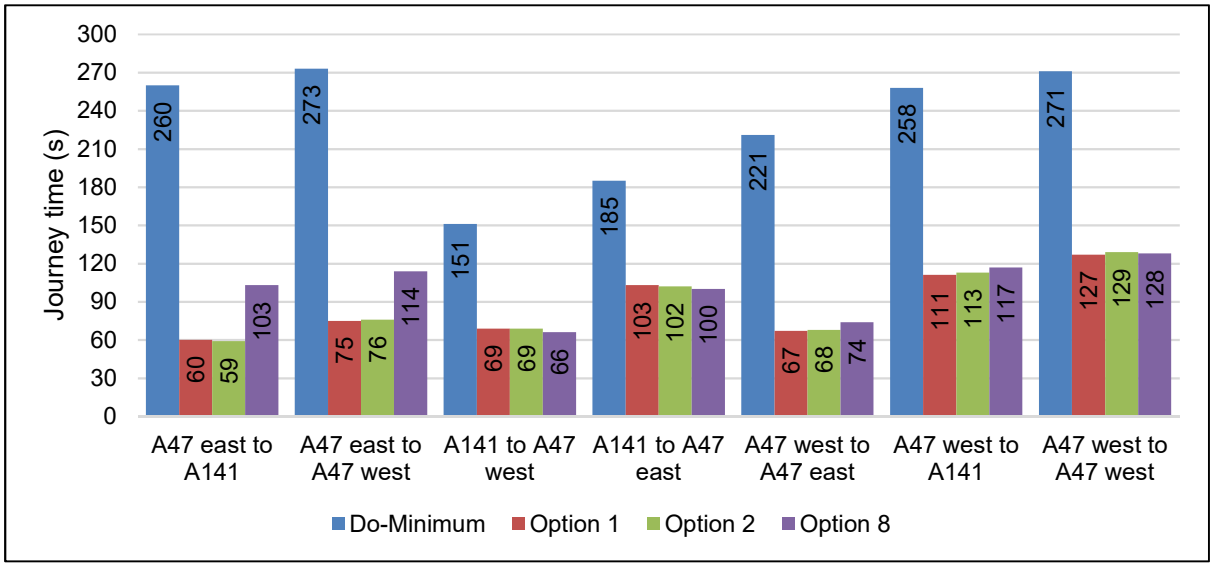
12.3.27 The removal of over-capacity delays at Guyhirn roundabout results in greater downstream flows in the Do-Something models. The number of junction arrivals at each downstream junction is therefore increased and this manifests as additional journey time disbenefits at the congested Peas Hill Roundabout of up to 16 seconds over and above its present over-capacity delays.

12.3.28 There is little difference between the Do-Something models with very small variations of the order of a few seconds which is not significant given the limitations of SATURN modelling in this field.

2036 Guyhirn Roundabout Performance

12.3.29 The total journey time through Guyhirn Roundabout at 2036 traffic levels is shown in Figure 12-10 for the AM peak period, Figure 12-11 for the interpeak period and Figure 12-12 for the PM peak period, using the same methodology as described in paragraph 12.3.1.

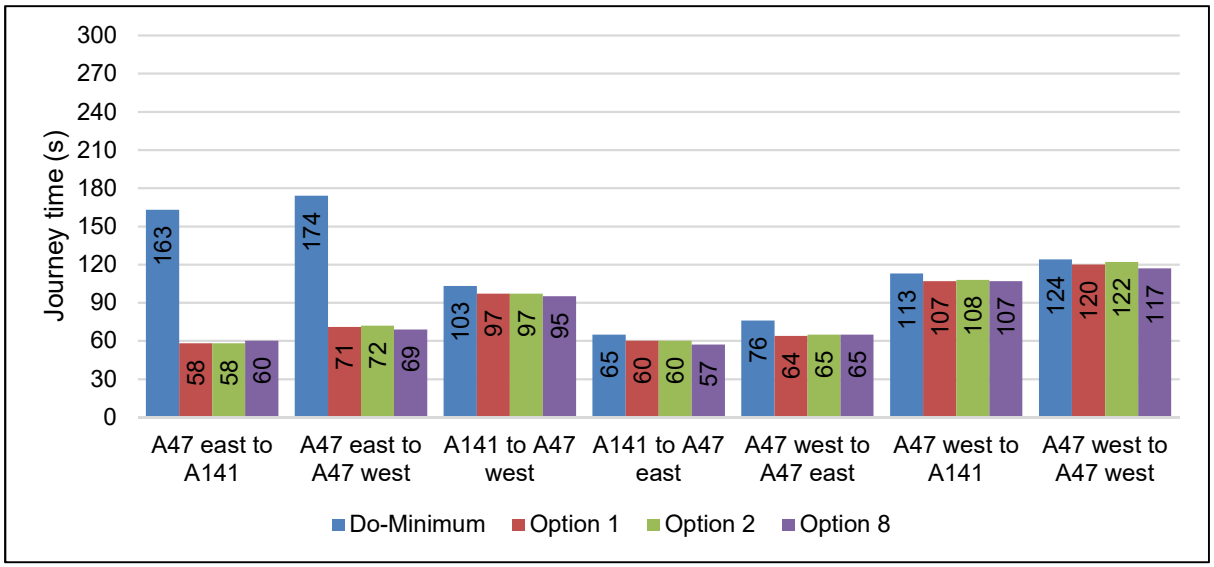
Figure 12-10: Journey times via Guyhirn Roundabout – 2036 AM peak period



12.3.30 The A47 east arm was far over capacity and large delays of up to nearly 4 minutes occurred due to significant traffic growth and increased circulatory traffic. The level of over-capacity delays on the other roundabout arms was smaller due partly to less opposing traffic than for the A47 east arm and due to the reduction in arrival traffic due to upstream congestion.

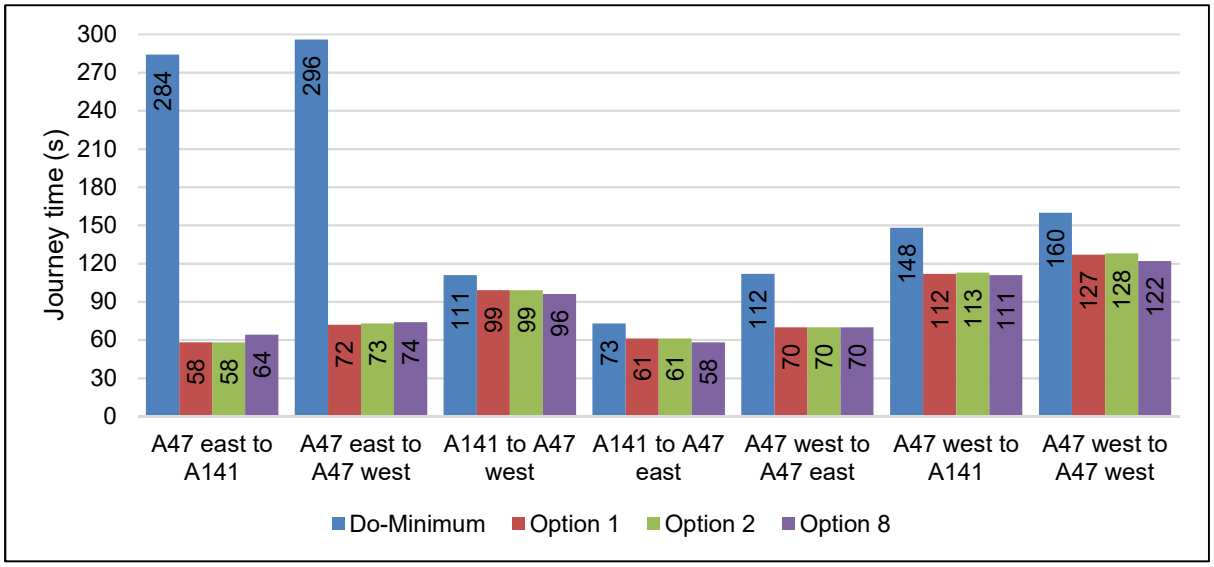
12.3.31 In Options 1 and 2 journey time savings were equivalent to the delays experienced in the Do-Minimum model as these designs had sufficient capacity to accommodate the forecast traffic growth. In Option 8 there were small over-capacity delays on the A47 east arm and although the delay was much smaller than that experienced in the Do-Minimum model, the overall journey time benefits in Option 8 were approximately 40 seconds less than in Options 1 and 2 for journeys from that arm.

Figure 12-11: Journey times via Guyhirn Roundabout – 2036 interpeak period



12.3.32 The A47 east arm was the only one with over-capacity delays in the interpeak model (see Figure 12-11), although the other two arms had significant transient queues (which clear before the end of the modelled hour). Each of the three Do-Something models eliminated these delays, resulting in journey time savings of up to 1 minute and 45 seconds for journeys from the A47 east arm. Smaller benefits of up to 12 seconds were seen on the other two roundabout arms due to reduction in transient delays.

Figure 12-12: Journey times via Guyhirn Roundabout – 2036 PM peak period



12.3.33 Both A47 arms were over capacity in the PM peak hour with very large delays to traffic from the A47 east arm(see Figure 12-12). These delays were effectively eliminated in the Do-Something models and benefits proportional to the current delays occurred in each; journey time benefits for movements from the A47 east arm were greatest at up to nearly 4 minutes.

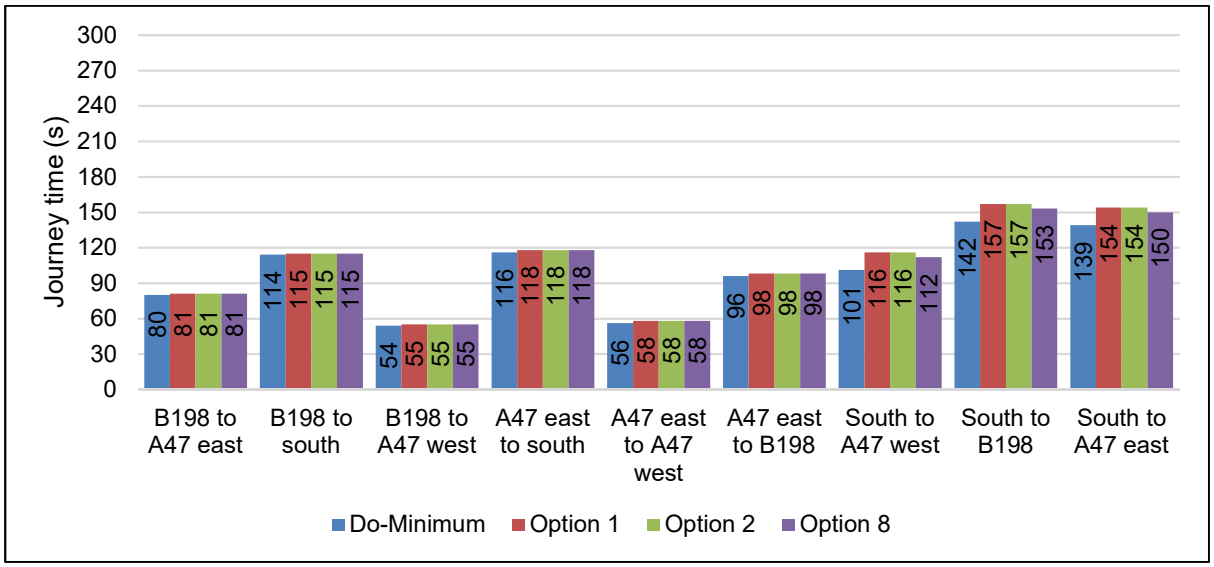
2036 Other Junctions Performance

12.3.34 Over-capacity delays, and hence restricted flows downstream, were observed in all three modelled time periods in the 2036 Do-Minimum models. Therefore, downstream flows were increased and impacts were transmitted to downstream junctions in all Do-Something models.

12.3.35 The forecast traffic increase to 2036 levels results in significant delays on three of the approaches to Wisbech (West) roundabout. Journey times through the roundabout are shown for the Do-Minimum and Do-Something models in Figures 12-13 for the AM peak period and 12-14 for the PM peak (no significant impacts were measured in the interpeak). The timing points through which the journey times were measured were:

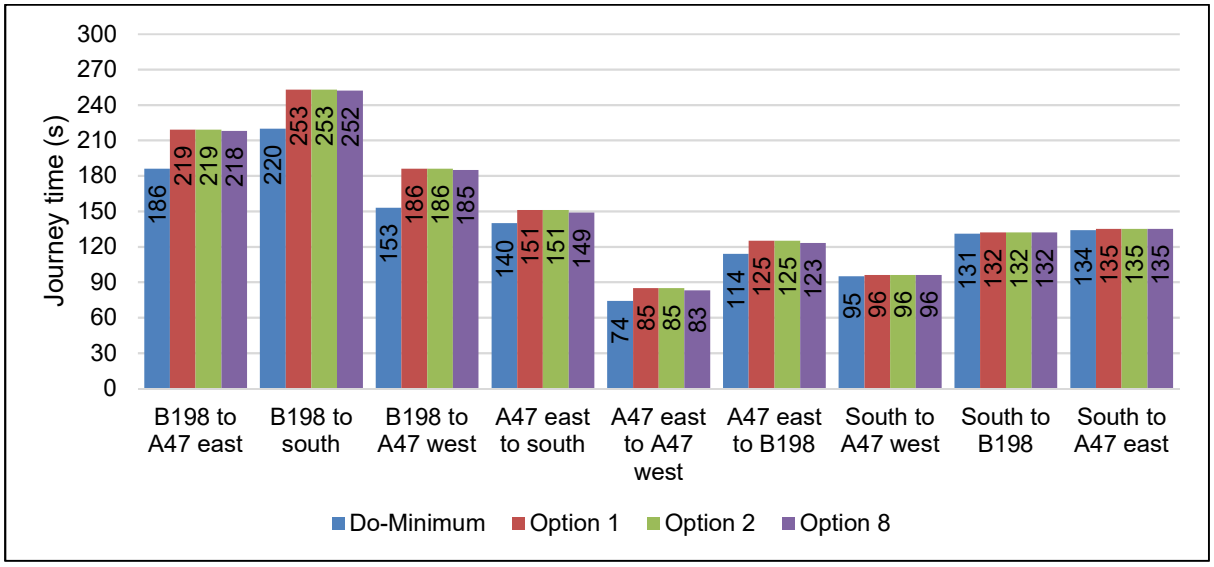
- **A47 west:** A47 Cromwell Road approximately 50 metres south-west of the roundabout;
- **B198:** B198 Cromwell Road approximately 640 metres north-east of the roundabout;
- **A47 east:** A47 Wisbech bypass approximately 640 metres east of the roundabout;
- **South:** Redmoor Lane approximately 1,330 metres south-east of the roundabout.

Figure 12-13: Journey times via Wisbech (West) Roundabout – 2036 AM peak period



12.3.36 In the AM peak, no additional delays result on the A47 western arm but the southern arm of the roundabout experienced additional delays of around 15 seconds (see Figure 12-12). These were transient delays owing to the low stopline capacity of this arm and did not result in over-capacity queues and downstream flow reductions. The impact on the B198 and A47 east arms was at most 2 seconds per movement.

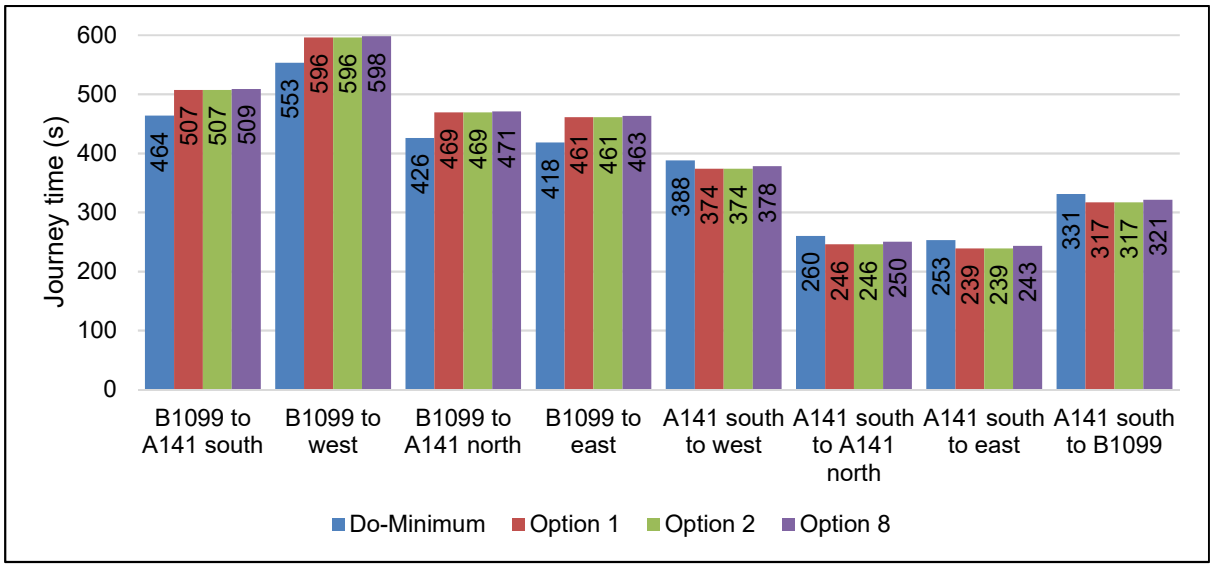
Figure 12-14: Journey times via Wisbech (West) Roundabout – 2036 PM peak period



12.3.37 The over-capacity delays observed in the design year PM peak Do-Minimum model were increased by up to 33 seconds for traffic entering the roundabout from the B198 and by up to 11 seconds for traffic from the A47 east arm (see Figure 12-14). With slightly lower overall flows due to elasticity of demand, the disbenefits were slightly smaller in Option 8.

12.3.38 The congestion and delays experienced at Peas Hill Roundabout at 2021 traffic levels were more acute in the 2036 design year models; the two over-capacity arms (B1099 and A141 south) queued to a greater degree and in all three time periods in the Do-Minimum model. The effect to Peas Hill of additional throughput at Guyhirn in the Do-Something models is shown in Figures 12-15 to 12-17.

Figure 12-15: Journey times via Peas Hill Roundabout – 2036 AM peak period



12.3.39 In the 2036 AM peak hour delays on the B1099 arm of the junction were increased by around 45 seconds compared to the Do-Minimum model. However, the reduction of throughput from the B1099 and the effects of reduced demand due to demand elasticity resulted in a relative journey time saving for traffic from the A141 south arm of up to 14 seconds compared to the Do-Minimum model. This arm still queued significantly but the queues are reduced slightly in the Do-Something models.

12.3.40 Although in Option 8 the increase in flow approaching Peas Hill Roundabout was smaller, the overall performance of the junction was slightly poorer. This may be due to different demands owing to elasticity or to complex interactions between junctions, potentially including Hostmoor Avenue junction.

Figure 12-16: Journey times via Peas Hill Roundabout – 2036 interpeak period

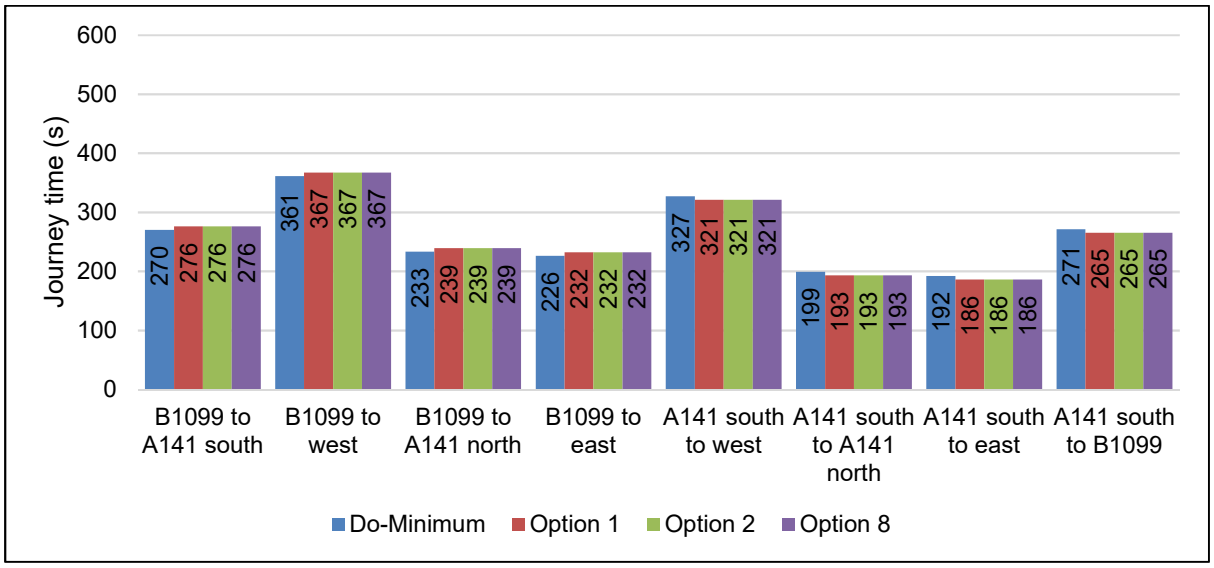
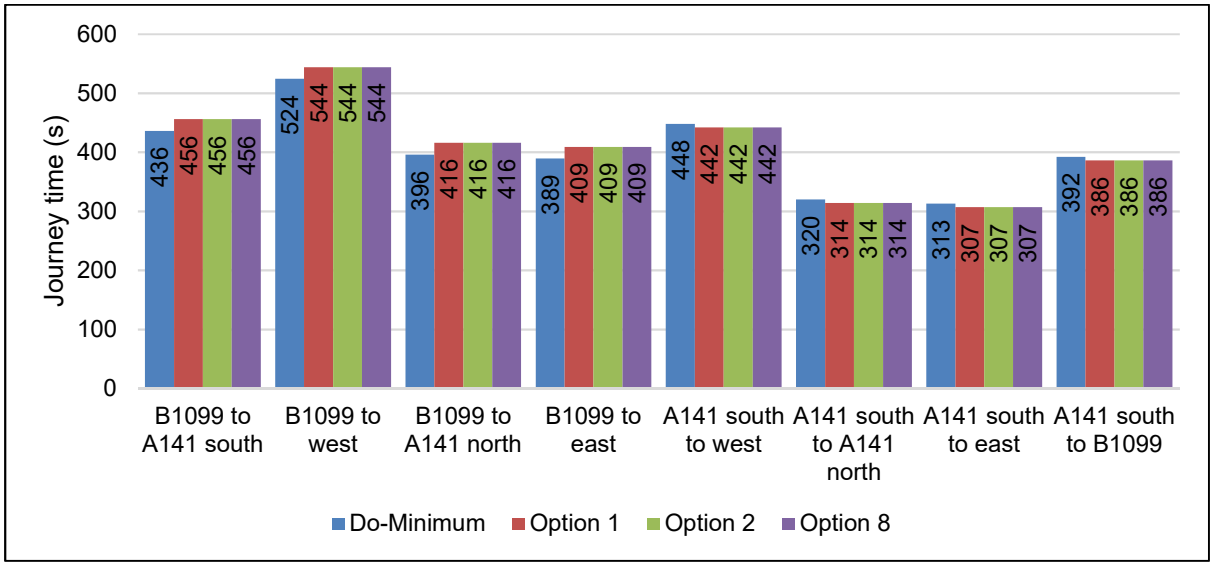


Figure 12-17: Journey times via Peas Hill Roundabout – 2036 PM peak period



12.3.41 The interpeak and PM peak Do-Something models show similar behaviour to that seen in the AM peak models but with a smaller magnitude of effects; a maximum delay increase of 20 seconds was observed in the PM peak and 6 seconds in the interpeak, while journey times from the A141 south showed a small improvement due to a reduction in opposing traffic from the B1099.

12.3.42 At 2036 traffic levels Thorney (East) Roundabout was the only junction which did not experience over-capacity delays in the base model, and as such there was no change in junction performance between the base and option models. There were over-capacity delays on the A605 arm of the signalised Hobbs Lots Bridge junction due to traffic growth exceeding the capacity of the arm of the junction given its green split. However, junction performance between the Do-Minimum and Do-Something models was identical as the limiting factor was the green time, not any opposing flows on the A141.

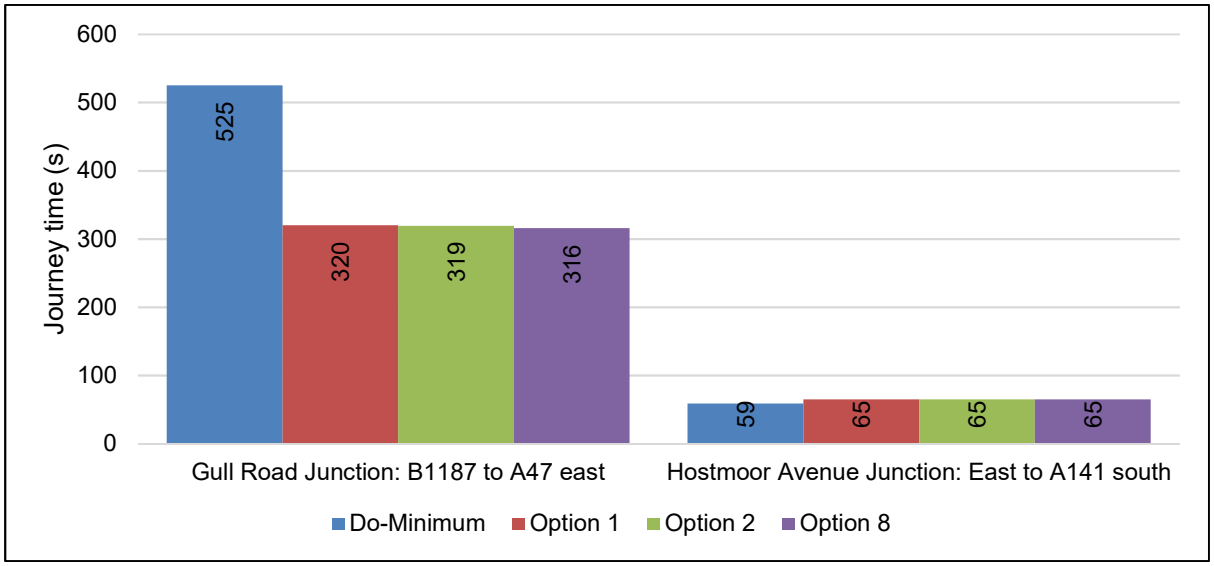
2036 Priority Junction Performance

12.3.43 Two minor junctions were included in the model to improve the simulation of traffic behaviour: at B1187 Gull Road on the A47 approaching Guyhirn Roundabout, and at Hostmoor Avenue on the A141 approaching Peas Hill Roundabout. At both junctions traffic that should turn right is banned from doing so and must turn left and use the associated roundabout to U-turn.

12.3.44 The performance of both left turns is affected by over-capacity queueing at 2036 design year traffic volumes. The nature of these queues and the effects of the option model on them relative to the base model are shown in Figures 12-18 to 12-20, using journey time routes which negotiate the left turns from the minor road to the major one, since the right turn from the minor road is banned in both cases:

- **Gull Road Junction:** From B1187 Gull Road approximately 170 metres north of the junction to the A47 Fen Road approximately 70 metres east of the junction;
- **Hostmoor Avenue Junction:** From Hostmoor Avenue approximately 510 metres east of the junction to the A141 Wisbech Road approximately 110 metres south of the junction.

Figure 12-18: Journey times via priority junctions – 2036 AM peak period



12.3.45 In the Do-Minimum 2036 AM peak models the capacity of B1187 Gull Road Junction was exceeded and queues formed back along B1187 Gull Road; this is replicated in the Do-Something models, all of which did not present any direct changes at the junction. However, in the Do-Minimum model the queue on the A47 back from Guyhirn Roundabout was long enough to block the exit from B1187 Gull Road and further reduce the junction's capacity. With this blocking back eliminated by the increased roundabout capacity in the Do-Something models, traffic from B1187 Gull Road experienced journey time savings of approximately 3½ minutes.

12.3.46 The increased throughput at Guyhirn in the Do-Something models resulted in additional opposing traffic for vehicles exiting Hostmoor Avenue and therefore small additional transient delays.

Figure 12-19: Journey times via priority junctions – 2036 interpeak period

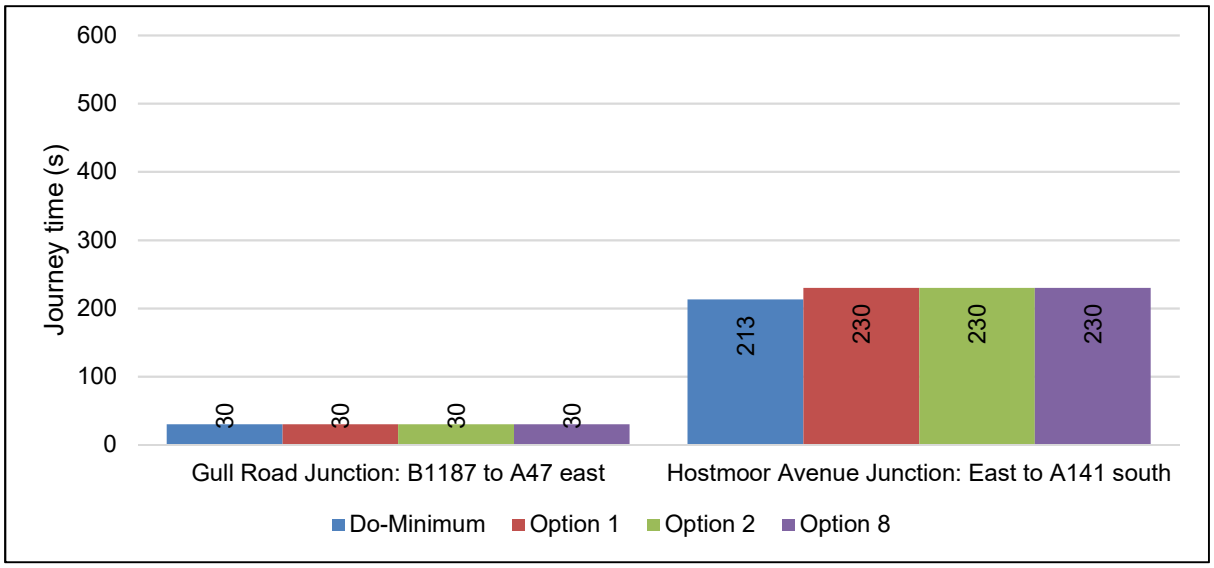
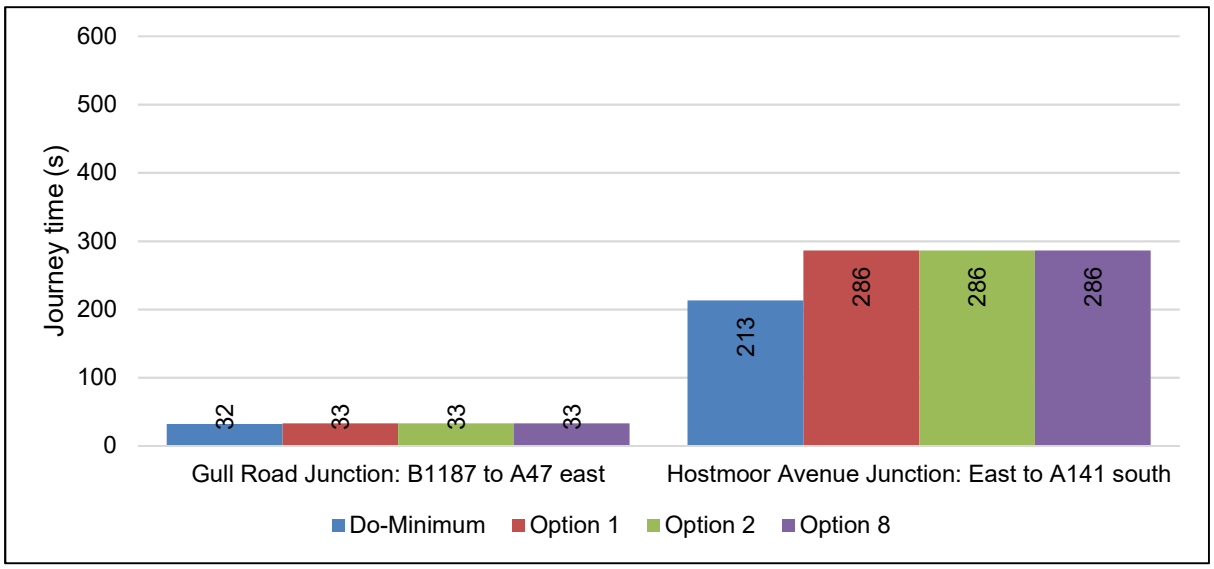


Figure 12-20: Journey times via priority junctions – 2036 PM peak period



12.3.47 In the interpeak and PM peak hours Hostmoor Avenue experienced over-capacity delays. Additional throughput at Guyhirn Roundabout in the Do-Something models resulted in more opposing traffic proceeding on the A141 southbound resulting in journey time disbenefits of 17 seconds in the interpeak and 73 seconds in the PM peak.

12.3.48 As described in the PCF Stage 1 LMVR for this scheme, the flows at B1187 Gull Road and Hostmoor Avenue junctions were not directly observed and instead were inferred from available data. Although care was been taken to create realistic behaviour based on the junction geometrics, any observations made at these junctions was not as robust as those for the major junctions in the model.

2036 Conclusions

12.3.49 When traffic levels were increased to those predicted in 2036, the Do-Minimum network shows significant strain and all junctions in the network excluding Thorney (East) Roundabout experience some over-capacity delay.

12.3.50 The Do-Something models have a highly positive effect on Guyhirn Junction performance and reduce delays there considerably at all times of day. The Options 1 and 2 models perform best with all significant queueing delay eliminated, whereas Option 8 reaches capacity in the AM peak and the journey time savings there were reduced. All three options resulted in significant queue length reductions on the A47 west arm of Guyhirn Roundabout (A47 Fen Road) in the AM peak which prevents the queue from blocking B1187 Gull Road junction, and thus vehicles from B1187 Gull Road experience large journey time benefits.

12.3.51 The additional throughput of vehicles at Guyhirn has knock-on effects for the downstream junctions in that the greater volumes of opposing traffic result in increased queues and delays for two arms Wisbech (West) Roundabout and one arm of Peas Hill Roundabout.

13 Engineering Overview of Sifted Options

13.1 Introduction

13.1.1 The following sections describe the engineering assessment completed during PCF Stage 1 and a comparison between the three options selected for further development as described in Chapters 10 and 11.

13.2 Highways and Alignment

Option 1

13.2.1 Please refer to drawing HE551493-ACM-HGN-GJ-DR-HE-00011 in Appendix 10.

13.2.2 This option created an enlarged roundabout at the same location of the existing roundabout and included the widening of the existing bridge to accommodate additional lanes on the A47 Fen Road. The option comprised a 70m ICD roundabout, designed concentrically over the existing roundabout. Three lane approaches were designed across all arms. The northern arm's horizontal alignment was designed "offline" to facilitate the required deflection angles required at the roundabout.

13.2.3 The A47 Fen Road approach arm widens from single lane to 2 no. 3.5m lanes on the widened bridge and widens further to 3 no. 3.0m lanes in east bound direction at the proposed roundabout. The exit on this arm comprises of 2 no. 3.5m lanes merging to one lane at the scheme extent. The bridge would need to be widened on both sides to accommodate the proposed lane layout.

13.2.4 The A47 South Brink Road approach arm widens from single lane to 2 no. 3.5m lanes and widens further 3 no. 3.3m lanes in south bound direction at the proposed roundabout. The exit on this arm comprises of 2 no. 3.65m lanes merging to one lane at the scheme extent to the North.

13.2.5 The A141 March Road approach arm widens from single lane 3 no. 3.3m lanes in the north bound direction at the proposed roundabout. The exit on this arm comprises 2 no. 3.65m lanes merging to one lane at the scheme extent to the South.

13.2.6 The circulatory carriageway of the proposed roundabout has three lanes and a consistent width of 10.95m.

13.2.7 This option would require land take and the relocation of footways with potentially the introduction of a signalised NMU pathway over the A141 March Road (see section 13.4 for further information).

Option 2

13.2.8 Please refer to drawing HE551493-ACM-HGN-GJ-DR-HE-00009 in Appendix 11.

13.2.9 This option is similar to Option 1 and also comprised a 70m ICD roundabout. However, in this option the roundabout was designed nonconcentric to the existing with an overall shift of the horizontal alignment to the east by 10.5m, towards the local access March Road. This option would require widening of the existing carriageway within the existing bridge footprint i.e. between the extents of the bridge parapets.

13.2.10 The A47 Fen Road approach arm widens from single lane to 2 no. 3.5m lanes on the existing bridge and widens further to 3 no. 3.16m lanes in east bound direction at the proposed roundabout. The exit on this arm comprises of 2 no. 3.76m lanes merging to one lane at the scheme extent. The widened carriageway is accommodated on the existing width of the bridge.

13.2.11 The A47 South Brink Road approach arm widens from single lane to 2 no. 3.81m lanes in the south bound direction at the proposed roundabout. The exit on this arm comprises of 3 no. 3.6m lanes merging to one lane at the scheme extent to the North.

13.2.12 The A141 March Road approach arm widens from single lane to 3 no. 3.34m lanes in the north bound direction at the proposed roundabout. The exit on this arm comprises of 2 no. 3.73m lanes merging to one lane at the scheme extent to the South.

13.2.13 The circulatory carriageway of the proposed roundabout has three lanes and a consistent width of 11.00m.

13.2.14 This option would require land take and the relocation of non-motorised user paths with potentially the introduction of a signalised NMU pathway over the A141 March Road (see section 13.4 for further information).

Option 8

13.2.15 Please refer to drawing HE551493-ACM-HGN-GJ-DR-HE-00010 in Appendix 12.

13.2.16 This option creates an enlarged oval roundabout extending towards the North A47 South Brink Road and included a new bridge alongside the existing bridge over the River Nene to accommodate additional east bound lanes on the A47 Fen Road. Three or two lane approaches have been designed across all arms.

13.2.17 The A47 Fen Road approach arm widens from single lane to 2 no. 5.0m lanes on a new bridge and meets the roundabout with 2 no. 4.4m lanes in east bound direction. The exit on this arm comprises of 2 no. 4.95m lanes merging to one lane at the scheme extent. The westbound carriageway is accommodated on the width of the existing bridge.

13.2.18 The A47 South Brink Road approach arm widens from single lane to 2 no. 4.3m lanes in the south bound direction at the proposed roundabout. The exit on this arm comprises of 3 no. 3.1m lanes merging to one lane at the scheme extent to the North.

13.2.19 The A141 March Road approach arm widens from single lane to 4.0m x 2No. lanes in the north bound direction at the proposed roundabout. The exit on this arm comprises of 2 no. 3.78m lanes merging to one lane at the scheme extent to the South.

13.2.20 The circulatory carriageway of the proposed roundabout has a consistent width of 10.00m comprised of 3 no. lanes.

13.2.21 This option would require land take and the relocation of non-motorised user paths with potentially the introduction of a signalised NMU pathway over the A141 March Road (see section 13.4 for further information).

13.2.22 This option represented the most future proof of the options taken for further assessment, as it aligned with the A47 Alliance's desire to dual carriageway the entire A47 route in the future. It also created another crossing point of the River Nene which would give greater network resilience and would mean in the event of an incident on the network, the lengthy diversions currently required would no longer be required.

13.3 Departures from Standard

13.3.1 This section identifies the Departures from Standards (DfS) for the sifted options, completed by AECOM during PCF Stage 1 and were detailed in the PCF Stage 1 Product, Departures from Standards Checklist, document reference A47IMPS1-AME-GJ-ZZ-DO-J0035. This was submitted to Highways England at the end of PCF Stage 1 but the departures were not formally applied for. This would be completed in future PCF stages.

Option 1

13.3.2 Three departures from standards were identified for this option. These were:

13.3.3 The minimum Stopping Sight Distance (SSD) achieved on A141 March Road on the approach to the roundabout did not meet the required minimum required by TD 9/93. It was necessary to remove the existing obstructions that restrict the visibility to the give way line at the roundabout to achieve the required sight distance. However, removing these obstructions will incur additional land take. Therefore, it is assumed a departure would be required.

13.3.4 TD16/07 section 7.8 states that the width of the circulatory carriageway must be between 1.0 and 1.2 times the maximum entry width. The entry width provided in the design on the A47 South Brink in the north approach fell just outside of the entry path requirements. A potential mitigation to reduce the impact of the departure was to decrease the diameter of the central island to increase the circulatory carriageway to meet the requirements. Vehicle tracking would confirm the widths required to avoid any clashes. The need for a departure in the future would depend on the outcome of further design and the above design investigations.

13.3.5 The existing A47 Fen Road contains a vertical crest curve which incorporates a substandard crest curve. As a result of the below desirable minimum vertical crest curve, the desirable minimum SSD as per TD 9/93 was not met in the vertical plane. Avoiding the departure at this location would require increasing the crest value to a minimum K value of 30. This was not however considered feasible as it would result in significant modifications to the existing bridge structure; tie in to the exiting alignment at the western end extending the project extents. Potential mitigations to reduce the impact of the departure were to provide skid resistance surface or tactile speed control strips.

Option 2

13.3.6 The departure described in section 13.3.5 above is applicable to this Option.

13.3.7 A Departure would be needed in order to reduce the minimum width of verge from 0.6m to 0.5m on the A47 Fen Road to accommodate the proposed widened alignment within the existing deck width (by narrowing the verges). Alternatively, road alignment could be refined in order to allow for verges compliant with this standard.

Option 8

13.3.8 TD16/07 section 7.8 states that the width of the circulatory carriageway must be between 1.0 and 1.2 times the maximum entry width. The entry width provided in the design on the A47 Fen Road in the west approach fell just outside of the entry path requirements. A potential mitigation to reduce the impact of the departure is to reduce the entry width to comply with the requirements. The feasibility of this proposal will be investigated in future stages therefore, the departure will depend on the outcome of the above assessments.

13.3.9 A Departure would be required for the proposed new bridge to replicate the construction of the existing Guyhirn Bridge. DMRB BD57/01 – Design for durability, Cl.2.9 states that ‘Abutment galleries shall be provided bellow all deck expansion and rotational joints’. Departure from this standard would result in significant aesthetic gain and allow both bridges to be inspected and maintained jointly. Note that inspections to expansion joints and bearings of the existing Guyhirn Bridge were carried out on foot in June 2016 with regular inspection equipment.

13.4 NMU Provision

13.4.1 At present a NMU survey has not been completed due to the small numbers of pedestrians that appear to use the area and junction as pedestrian routes.

13.4.2 A Road Safety Audit was also not conducted during PCF Stage 1 as it was not the appropriate stage to do so.

13.4.3 Both a RSA and NMU audit will be conducted at later PCF stages to inform and develop the designs.

13.4.4 On all proposed options (1, 2 and 8), the 2.0m wide footpath on the southern side of the A47 Fen Road will be retained. However due to the introduction of the additional lane on the opposite side, the existing 2.0m wide NMU pathway has been terminated. A possible design solution that may be considered in future stages, to ensure that connectivity is maintained, is to provide a crossing to the west of the roundabout on A47 Fen Road where the existing footpath terminates. This crossing will direct the eastbound NMUs to the southern footpath (or vice versa).

13.4.5 The off road NMU pathway that provided access from the A47 South Brink Road to the local access March Road is severed due to the enlarged roundabout. A new signalised NMU crossing may be proposed on A47 March Road to direct NMUs from the western side of A47 March Road to the eastern side (or vice versa). A new link would be required to tie into the existing local access March Road with the signalised NMU pathways.

13.5 Side Roads, Access and Accommodation Works

13.5.1 The full extent of accommodation works, side roads and access can only be determined once a detailed construction methodology is known and after detailed consultation with land owners and occupiers as to how the surrounding land and properties are accessed and used. This element of the design had not been developed as the information was not available at the end of PCF Stage 1 and so would be completed in future PCF Stages.

13.6 Drainage and Flooding

Option 1

13.6.1 This option will not alter the locations of the road drainage outfalls. It is assumed that the proposed drainage system will be a combination of gullies and carrier drains and will join into the existing pipe to the outfall; provided that it has adequate capacity.

13.6.2 It is estimated that there will be an increase in impermeable area (on plan) of 5,100m^2; approximately 750m^2 to the southern outfall and 4,400m^2 to the northern outfall. If the entire area of redundant road is removed and replaced with soft landscape then the net increase in impermeable area is estimated to be 2,150m$^{2.}$

13.6.3 The additional length of new road drainage is estimated to be 550m.

13.6.4 The proposed enlarged roundabout may create extra loading on the IDB outlet culvert but the surge chamber is unlikely to be needed to be moved which will be investigated in future PCF stages.

13.6.5 This option involves building in the floodplain of the River Nene and therefore may need compensatory storage to be provided which will be investigated further at a later stage.

Option 2

13.6.6 This option will not alter the locations of the road drainage outfalls. It is assumed that the proposed drainage system will be a combination of gullies and carrier drains and will join into the existing pipe to the outfall; provided that it has adequate capacity.

13.6.7 It is estimated that there will be an increase in impermeable area (on plan) of 2,850m^2; approximately 550m^2 to the southern outfall and 2,300m^2 to the northern outfall. If the entire area of redundant road is removed and replaced with soft landscaped then the net increase in impermeable area is estimated to be 1,800m^2.

13.6.8 The additional length of new road drainage is estimated to be 300m.

13.6.9 The proposed enlarged roundabout may create extra loading on the IDB outlet culvert and the surge chamber is likely to need to be moved which will be investigated further in future PCF stages.

Option 8

13.6.10 Option 8 will not affect the outfalls on the right bank of the river Nene but may affect the outfall on the left bank due to the construction of the new bridge. It is assumed that the proposed drainage system will be a combination of gullies and carrier drains and will join into the existing pipe to the outfall; provided that it has adequate capacity. It is assumed that the new road bridge drainage will flow west away from the junction and discharge into the River Nene via the outfall on the east bank.

13.6.11 It is estimated that there will be an increase in impermeable area (on plan) of 2,800m^2; approximately 750m^2 to the River Nene east bank outfall and 2,050m^2 to the northern outfall on the River Nene west bank. If the entire area of redundant road is removed and replaced with soft landscaped then the net increase in impermeable area is estimated to be 1,650m^2.

13.6.12 The additional length of new road drainage is estimated to be 400m.

13.6.13 The new bridge should not affect the flow in the River Nene but modelling will have to be carried out to confirm this in subsequent stages.

13.6.14 The proposed oval roundabout may create extra loading on the IDB outlet culvert and the surge chamber may have to be moved which will be investigated further in future PCF stages.

13.6.15 This option involves building in the floodplain of the River Nene and therefore may need compensatory storage to be provided which will be investigated further at a later stage. This needs further investigation and consultation with the EA and IDB which had not been carried out at this point.

13.7 Geotechnical Considerations

13.7.1 The junction lies within the alluvium deposits which extend from the original ground surface to a depth of approximately 9.0m to 10.0m below the original ground level. The thickness of the existing embankment fill varies between 5.0m and 5.7m.

13.7.2 Ground investigation data is available from the construction of the existing roundabout in the 1990s and settlement monitoring records are included in the geotechnical feedback reports. However, the alluvial deposits have been modified by previous engineering works and therefore their properties and engineering behaviour may vary significantly from that determined during earlier ground investigations.

13.7.3 Based on BH 1, BH 2/2A and BH 3 (Embankment Construction: Report on Site Investigation, HAGDMS Ref. No. 8269) a peat horizon (probably of Nordelph formation) of varying thickness (0.5m to 1.0m) is present approximately 8.0m below the surface of the embankment. Variability in the lateral extent of the peat may be problematic due to its compressibility leading to significant differential settlement.

13.7.4 At the area of the new bridge (option 8), the Oxford Clay formation is expected to be encountered at 15.50m below ground level and 17.00m below ground level on the west and east sides of River Nene respectively.

13.7.5 For the engineering assessment the following ground model has been assumed for the Guyhirn junction.

Table 13-1: Ground Model

Strata	Typical thickness (m)	Typical description	Comments
Recent Made Ground/ Top soil/ Fill	5.0-5.7m (based on)1990 report	Embankment fill	Clay fill with basal drainage blanket
Terrington Beds	2.5 – 3.0m	Cohesive material. Soft to firm, sandy clayey SILT, occasionally with organic matter.	Organic debris and/ or peat layers and lenses might occur within the formation
Nordelph Peat/ Upper Peat	1.5 – 2.0m	Soft and very soft Peat.	Discontinuous layer
Barroway Drove Beds	7.0m	Cohesive material. Soft to firm, sandy clayey SILT to silty CLAY, occasionally with gravels towards the base and with lenses and/or horizons of peat.	Silt roddens might be encountered within this formation.
Terrace Gravels	1.0 – 3.0m	Silty CLAY with chalk fragments and gravels.	No certain thickness Discontinuous layer At the bottom of the drift sequence
Boulder Clay	0.0 – 6.0m	Stiff to very stiff silty CLAY with some gravel.	Possible River Terrace (Note 1)
Oxford Clay	Not proved	Firm to very stiff fissured laminated silty CLAY.	Weathered mudstone. Pyrite might be present

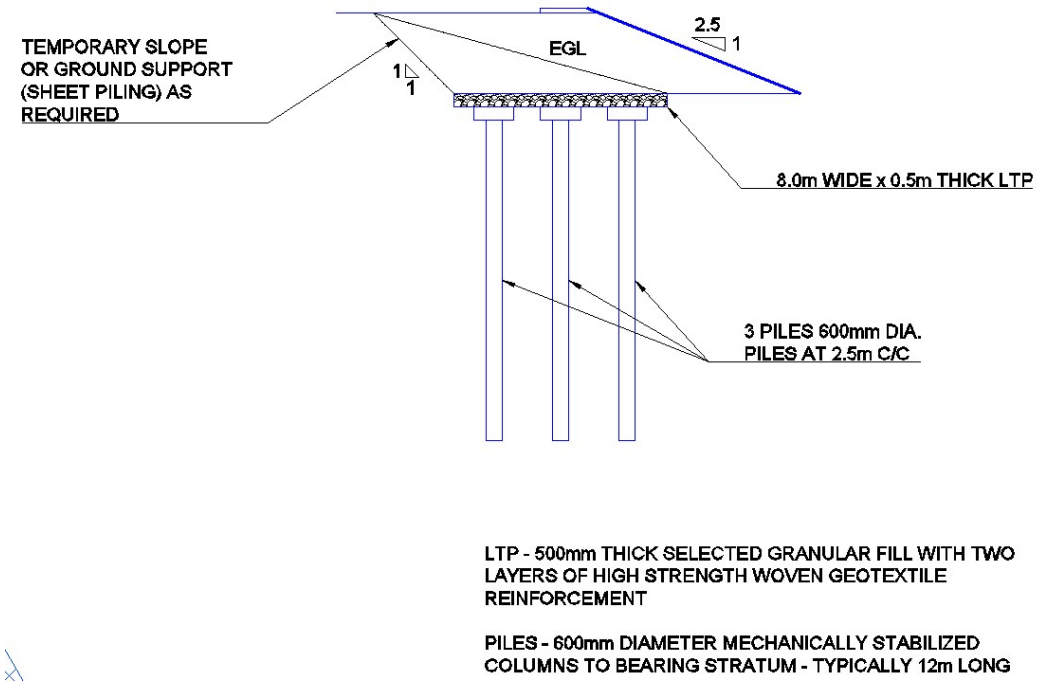
Note 1 - Older Reports Embankment Construction: Report on Site Investigation Ref No. 8269 & Geotechnical Feedback Report Ref No. 8271) describe this formation as Boulder Clay. The more up to date Geotechnical report (Ref. No. 19205) does not mention this formation and describes it as Terrace Gravels and probably as part of the upper unit of Oxford Clay.

13.7.6 Groundwater levels are shown at around 4.0m OD i.e. close to existing ground level but are assumed to be affected by pumping from the adjacent fen.

13.7.7 Each of the options will require widened embankments. The widened embankments will induce large settlements due to consolidation of the soft alluvial deposits and peat, potentially causing disruption to the existing infrastructure, including the existing road pavement, river bridge, buried services and culvert that crosses under the A47 immediately north of the roundabout. Geotechnical solutions including preloading, surcharging and the use of lightweight fills may be considered to manage settlements. However, to allow construction with minimal impact on the existing infrastructure, a piled load transfer platform is considered as the preferred solution for this scheme. Once detailed data on ground conditions is available the use of other techniques to reduce settlements should be further evaluated.

13.7.8 An indicative section through the proposed load transfer platform for Guyhirn junction is shown in Figure 13-1 below.

Figure 13-1: Typical section through load transfer platform



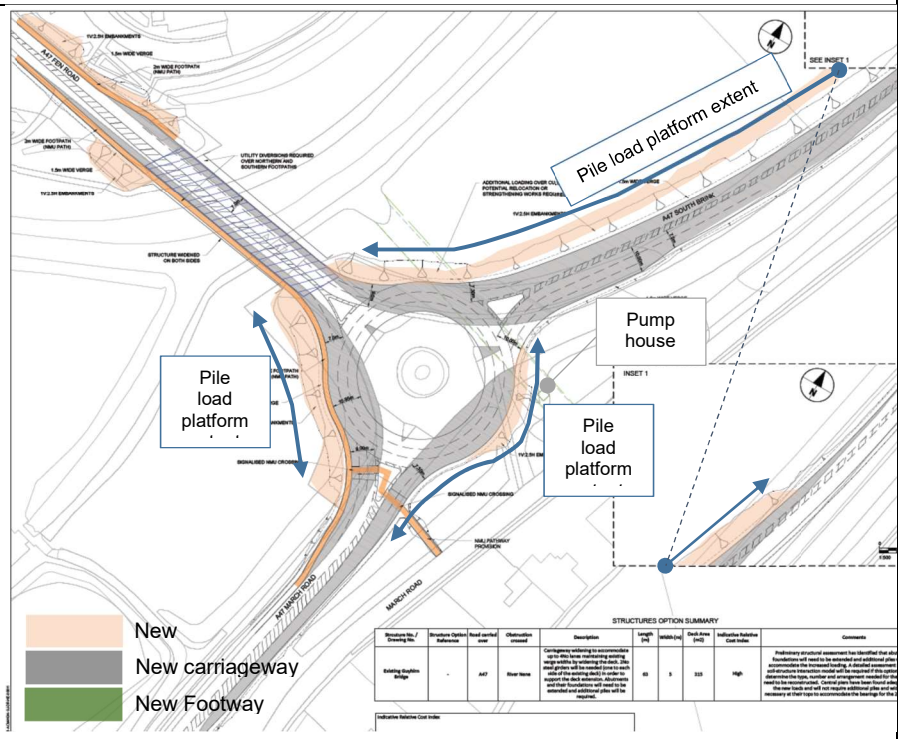
13.7.9 The side slopes for the widened embankment are proposed at 1(v) to 2.5(h) to allow flexibility in selection of fill material. The outline design comprises a 500mm thick geogrid reinforced load transfer platform supported on 600mm diameter piles at 2.5m centres. The piles will be founded in the Oxford Clay below 10m depth and could be formed as controlled modulus columns or Continuous Flight Auger piles. The load transfer platform is typically 8m in width requiring up to 3 rows of piles. The temporary excavated slope within the existing embankment is presumed to be constructed at 1(v) to 1(h) although additional temporary slope support may be required in areas of limited width.

13.7.10 One area of particular concern is the culvert that crosses the site leading to the Waldersey Pump House. Additional fill in this area may lead to significant settlement of the structure. If the depth of fill required in this area is small and the culvert is reasonably robust, the use of a lightweight fill could be considered. However, if significant loading is anticipated a piled slab would be required over the culvert.

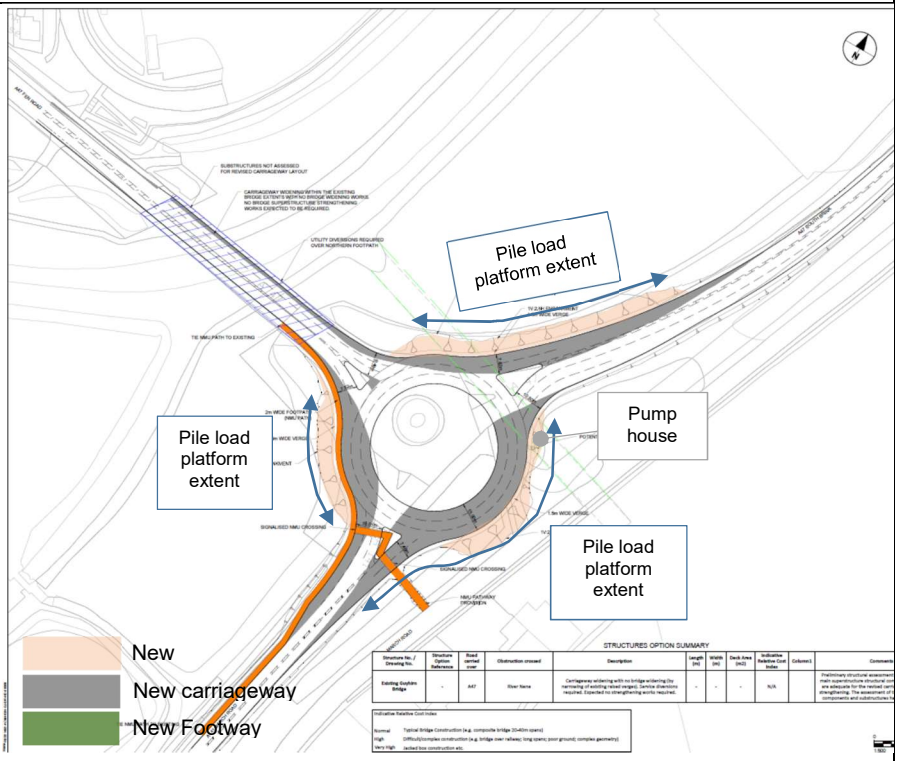
13.7.11 The geotechnical impacts for each option are reviewed in Table 13-2 below.

Table 13-2: Geotechnical Impacts

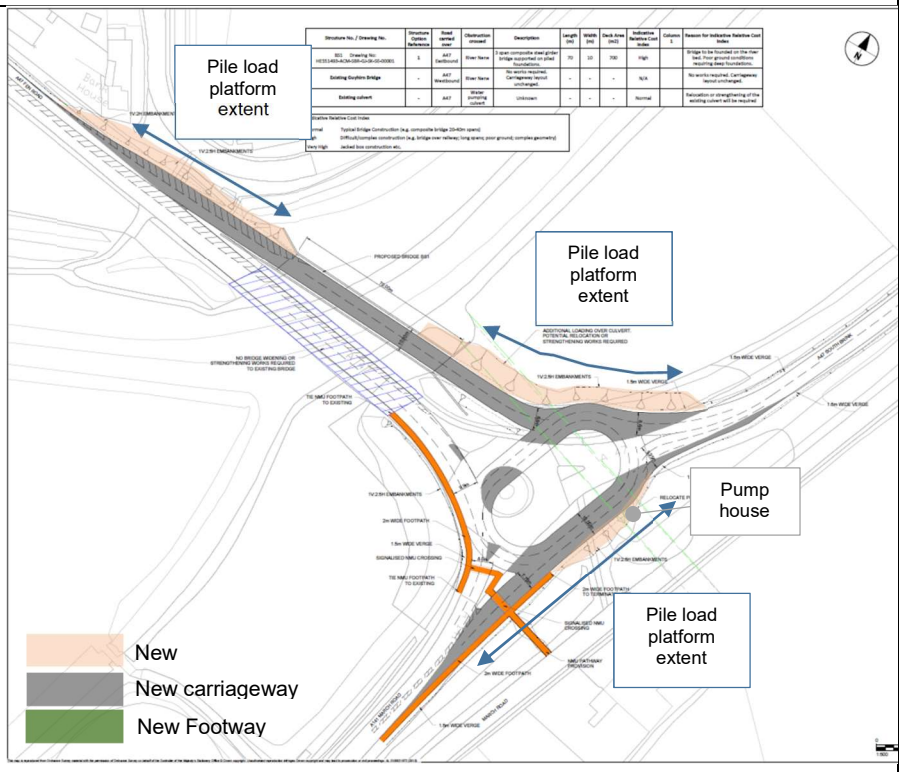
OPTIONS	PLAN VIEW

Option 1 - New Enlarged Roundabout concentric with the existing roundabout
 	
• New carriageway area: 6179m^2
• Use of existing bridge
• Widening embankments at:
  ○ Northwest side of the roundabout and along the north side of "A47 South Bank", for a length of L≈250m
  ○ East side of the roundabout
  ○ South-southwest side of the roundabout
• Pump house probably unaffected
• Localised widening of the existing bridge. Bridge strengthening may be required
 	
Due to the magnitude of anticipated settlements (around 1.0m) piled load transfer platforms are proposed for the widened embankments as
	

illustrated in the drawing on the right. Detailed design of the pile arrangement around the culvert will be required.	

Option 2 - New Enlarged Roundabout nonconcentric to the east of the existing roundabout
 	
• New carriageway area: 2634m^2
• Use of existing bridge
• Widening embankments at:
  ○ Northwest side of the roundabout and along the north side of "A47 South Bank", for L≈105m
  ○ East side of the roundabout
  ○ South-southwest side of the roundabout
• Pump house is potentially affected and it might need to be relocated
 	
Due to the magnitude of anticipated settlements (around 1.0m) piled load transfer platforms are proposed for the widened embankments as illustrated in the drawing on the right. Detailed design of the pile arrangement
	

around the culvert will be required.	

Option 8 - New Oval Roundabout, located over existing with a new bridge over the River Nene
 	
• New carriageway area: 3156m^2
• Constructing new bridge
  Bridge pile foundations will have to be established within the Oxford Clay formation.
• Widening embankments at:
  ○ East side of the roundabout
• Constructing new embankments
  ○ Northwest side of the roundabout and along the north side of "A47 Fen Road" towards the new proposed bridge, for L≈95m
  ○ Along "A47 Fen Road" after the new bridge towards
	

Thorney for L≈90m • Pump house will need to be relocated • Pile foundations of new bridge should be founded in the Oxford Clay. Due to the magnitude of anticipated settlements (around 1.0m) piled load transfer platforms are proposed for the widened embankments as illustrated in the drawing on the right. Detailed design of the pile arrangement around the culvert will be required..	

13.8 Structures

Option 1

13.8.1 The Option 1 proposal is to accommodate 3 lanes of traffic by widening the existing carriageway to both deck edges and maintaining the existing verge widths, leading to an overall increase in structure width of 5 metres. As described in section 13.4, the northern footway of the A47 Fen Road bridge will be terminated to allow for the widening of the carriageway.

13.8.2 Based on the outcome of the assessment carried out in July 2016 (Refer to Report HE551493-ACM-SBR-GJ-RP-SE-00003 in Appendix 13), the addition of two additional steel girders would be required to widen the superstructure to both sides of the existing deck.

13.8.3 The substructure would require extensive works. The abutments would need to be extended to accommodate the bearings for the two additional steel girders and significant extension would be required in order to adequate the foundations to the new loading scenario arising from the proposed widened structure. Extension of both abutments would be required. Sheet piling would be required in order to ensure the stability of the extended substructure around the base of the abutment, which may complicate access for construction.

13.8.4 Complex soil-structure interaction modelling and analysis would be necessary at detailed design stage to assess the existing piles and to design the additional piles required for widening. Detailed consideration of the joint between the new and existing structures would need to be given to mitigate any undesirable effects such as differential settlement.

13.8.5 Piers would require local extension to their bearing plinth to accommodate the bearings for the two additional steel girders to rest on. Work in the river would be necessary with the subsequent Health & Safety issues, requiring the use of suspended temporary works, pontoons, and provision for safety such as safety boats.

13.8.6 Wingwalls would need to be demolished and re-constructed resting on geotechnical loading transfer platforms due to the poor ground conditions present in the area. Refer to Section 13.6 Engineering Assessment - Geotechnical Considerations.

13.8.7 Allowance should be made at detailed design stage for a temporary works design with a strong focus on traffic management to prevent the bridge from total closure during widening works. Consideration should be given to the different construction stages and traffic phasing potentially leading to instability of the deck. Symmetrical widening results in works requiring two separate phases of works with some elements which cannot be completed simultaneously, extending the works programme.

13.8.8 Due to the nature of the proposed option, it is likely that significant temporary traffic management would be required and careful phasing of the works to ensure that disruption for road users is kept to a minimum. Buildability considerations are considered in section 13.11.

13.8.9 Relocation of service utilities to the new verges within the widened deck would be required. Requirements for the apparatus diversion should be discussed with the affected service providers.

13.8.10 The existing culvert located north of Guyhirn bridge is likely to have increased loading and so further investigation is recommended should this option be promoted.

13.8.11 For more details refer to Drawings No HE551493-ACM-SBR-GJ-DR-SE-0001 & HE551493-ACM-SBR-GJ-DR-SE-0002 in Appendix 14 and 15.

Option 2

13.8.12 Option 2 proposal is to accommodate 3 lanes of traffic within the width of the existing Guyhirn Bridge by widening the carriageway and widening the existing verges and retaining the existing deck edges.

13.8.13 Unlike Option 1, this option does not require widening of the existing structure. However a departure from the standard DMRB TD27/05 would need to be proposed in order to reduce the minimum width of verge from 0.6m to 0.5m (see section 13.3.6). This proposal would be justified on the fact that bridge widening could be avoided and the project is located in a rural area. Mitigation measures should be implemented, including the provision of suitable pedestrian routes through the wider verge involving the design of pedestrian crossings.

13.8.14 According to the outcome of the initial assessment carried out by AECOM in July 2016 (Refer to Report HE551493-ACM-SBR-GJ-TN-SE-00003 in Appendix 1), the existing superstructure is adequate to accommodate the proposed carriageway layout, subject to validating the assumptions made in this assessment through visual inspection. Therefore no structural works are anticipated as part of Option 2.

13.8.15 The existing substructure is expected to be adequate to cope with the increased loading arising from the new alignment, although this would need to be confirmed through visual inspection and assessment should Option 2 be progressed beyond PCF Stage 1.

13.8.16 Due to the nature of the proposed option, it is likely that significant temporary traffic management would be required and careful phasing of the works to ensure that disruption for road users is kept to a minimum. Buildability considerations are considered in section 13.11.

13.8.17 Service utilities would need to be fitted within the reduced verges. Consideration should be given to any abandoned apparatus that could be removed. Should all the apparatus not fit within the reduced verges then long and difficult diversions may be necessary. Requirements for the apparatus diversions should be discussed with the affected service providers.

13.8.18 The existing culvert located north of Guyhirn bridge is likely to have increased loading and so further investigation is recommended should this option be promoted.

13.8.19 For more details refer to Drawings No HE551493-ACM-SBR-GJ-DR-SE-0003 & HE551493-ACM-SBR-GJ-DR-SE-0004 in Appendix 16 & 17.

Option 8

13.8.20 Option 8 involves the construction of a new bridge to the north of the existing Guyhirn bridge to accommodate the A47 eastbound traffic feeding in to a proposed oval roundabout.

13.8.21 The proposed structure is a three span continuous structure consisting of plate girder steel 'I' beams, haunched at the piers, acting compositely with an in situ concrete slab replicating the outline of the existing Guyhirn Bridge. Its overall length would be in the order of 70 metres with a deck width of approximately 10m, enough to accommodate a two lane single carriageway and two 0.6m raised verges in compliance with DMRB TD27/05.

13.8.22 The articulation arrangements would be as per existing Guyhirn Bridge. The abutments and intermediate supports would be in situ reinforced concrete.

13.8.23 A departure from the standard DMRB BD57/01 would need to be proposed to avoid the use of gallery abutments, providing full height reinforced concrete abutment instead. This proposal would be justified on the proposed bridge being designed to replicate the existing Guyhirn Bridge, including its substructure and articulation arrangements, allowing for both bridges being inspected and maintained jointly. Specific mitigation measures should be implemented aimed to ease access for operation and maintenance and to improve durability.

13.8.24 The structure would be supported on piled foundations which will require earthworks and enabling works, such as the construction of cofferdams in the river bed, sheet piling in the river banks and significant excavation for construction of piling mats.

13.8.25 Wingwalls would be of reinforced concrete and rest on geotechnical loading transfer platforms due to the poor ground conditions present in the area. Refer to Section 13.6 Engineering Assessment - Geotechnical Considerations.

13.8.26 The existing Guyhirn Bridge would accommodate only two lanes for the A47 westbound traffic. Since the existing carriageway layout extent is greater than that proposed, the structure is anticipated to have sufficient capacity to sustain the design loading, hence no need for strengthening or widening works is expected.

13.8.27 Due to the nature of the proposed option, it is likely that significant temporary traffic management would be required and careful phasing of the works to ensure that disruption for road users is kept to a minimum. The new bridge is likely to be able to be constructed 'offline' keeping disruption to a minimum, although careful planning is required for the tie in of the new bridge to the A47 Fen Road and A47 South Brink road. Buildability considerations are considered in section 13.11.

13.8.28 No provision for service ducts has been made as these are expected to remain within the verges of the existing Guyhirn Bridge.

13.8.29 The existing culvert would be impacted and therefore relocation or strengthening would be needed if Option 8 is promoted.

13.8.30 For more details refer to drawing HE551493-ACM-SBR-GJ-DR-SE-00005 in Appendix 18.

13.9 Public Utilities

13.9.1 C2 enquiries have been submitted and C3 estimates have been obtained for the area around Guyhirn junction. Further statutory undertakers requests will be made in future stages to check for detailed positions of utilities and to provide cost certainty. Proposed changes to accommodate the options will need to be considered during the construction stages. General

descriptions of each option are described below. The location of the identified utilities can be seen on in Appendix 19 and further information can also be found in the PCF Stage 1 Product Statutory Undertakers Estimate, document reference number A47IMPS1-AME-GJ-ZZ-DO-J0037.

Option 1

13.9.2 Services for Anglian Water, BT, UKPN and Virgin Media are affected by this option. Consulting statutory undertakers, C3 estimates showed an approximate cost of £140,000.00 excl.VAT required for upgrades or changes to suit this option.

Option 2

13.9.3 Similar to Option 1, the services for Anglian Water, BT, UKPN and Virgin Media are affected by this option. Consulting statutory undertakers, C3 estimates showed an approximate cost of £140,000.00 excl.VAT required for upgrades or changes to suit this option.

Option 8

13.9.4 Services for Anglian Water, BT, UKPN and Virgin Media are affected by this option. Consulting statutory undertakers, C3 estimates showed an approximate cost of £212,000.00 excl.VAT required for upgrades or changes to suit this option.

13.10 Topography, Land Use, Property and Industry

13.10.1 There should be minimal change in elevation of the road for all of the potential options considered to date.

13.10.2 Changes in topography will be limited to embankment widening to accommodate a larger roundabout and widened approaches. The scheme will need to maintain a buffer between any relocated or widened carriageway and the existing vegetation between the A47/A141 and the local access March Road to the east, which acts as a local access road to a group of residents.

13.10.3 The nearest properties are located on local access March Road to the east of the Scheme and are within 100m of the junction. These properties will remain and none of the proposed options require any land or property acquisition. Mitigation measures to minimise disruption during construction and during operation are to be defined in later PCF stages.

13.10.4 As described in section 13.6, the existing IDB surge chamber is likely to need to be relocated with all the proposed options. This will be investigated further in future PCF stages.

13.10.5 The land use of the area will remain as primarily agricultural with all the proposed options.

13.10.6 The requirement for any land acquisition for the potential options is detailed below:

Option 1

13.10.7 New carriageway area increases by approximately 6,200m^2. Additional 1.5m verges and NMU paths increase the total footprint area of the option. Only one landowner is affected with a total required land take area of approximately 2,000m^2. The bulk of the land take is in the north west corner of the junction.

Option 2

13.10.8 New carriageway area increases by approximately 6,200 m^2. Additional 1.5m verges and NMU paths increase the total footprint area of the option. Only one landowner is affected with a total required land take area of approximately 500m^2. Due to the relocation of the roundabout, the bulk of the land take is in the east edge of the junction.

Option 8

13.10.9 New carriageway area increases by approximately 3,200m^2. Additional 1.5m verges and NMU paths increase the total footprint area of the option. Two landowners are affected with a total required land take area of approximately 1,500m^2. The bulk of the land take is in the north west corner of the junction and in the region of the new bridge.

13.11 Buildability

13.11.1 Each of the options selected for further evaluation have potential issues regarding buildability and temporary works associated with the construction sequence. Highways England has procured the advice of a Collaborative Delivery Framework (CDF) Lot 3b Framework contractor to provide buildability advice for each of the options.

13.11.2 Dialogue was at an early stage with the contractor during PCF Stage 1 and no specific information had been obtained on the Scheme at this stage. This is updated further in Chapter 23 of this report.

13.11.3 Each option will also have individual challenges in regards to the geotechnical and structural considerations. These are discussed in more detail in sections 13.6 & 13.7 above.

13.11.4 As discussed in Chapter 6, the constraints of the site at Guyhirn junction mean that significant diversion routes would need to be implemented in the event the A47 is required to be closed.

13.11.5 A key consideration in terms of buildability are the lengthy diversion routes required to accommodate closures of the existing road. Further consideration of the use of temporary structures and temporary local diversions will need to be considered during later PCF stages in order to minimise the need for closures.

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 existing operating regime is maintained by all of the options. However, there are specific intricacies for each option discussed below.

Option 1

14.1.2 The roundabout will remain but will be increased in size symmetrically over the location of the existing roundabout. Each approach will be increased to 3 lanes of traffic on each arm. Each movement will be indicated with road signs and road markings, although the detail of these is not yet developed. Lane 1 (nearside) on each arm/approach will encourage users to turn left only. Lane 2 approach (centre) on each arm will be a straight ahead or left turn. Lane 3 (outside) on each arm will be a straight ahead or right turn lane. Due to the increased size of the roundabout, it will be possible for users to turn right or perform U turns from any of the arms approaching the roundabout as there will be space for 3 lanes of traffic to circumnavigate the roundabout.

Option 2

14.1.3 This option is similar to Option 1 above except the enlarged roundabout is moved further east to mitigate the need to increase the bridge size. Therefore, the operating regime described in 14.1.2 above is also applicable to Option 2.

Option 8

14.1.4 This option changes the operating regime of the site due to the significant change in roundabout form and geometry and the construction of a of new bridge. The roundabout will become 'oval' or 'elliptical' in shape and will move further east than its current location. The new bridge on the A47 Fen Road will carry traffic travelling eastbound on the A47 only and will carry a new one way, 2 lane carriageway. This will flare from the existing A47 Fen Road prior to the River Nene.

14.1.5 Traffic travelling from the A141 March Road will have a new 2 lane approach to the roundabout. Any traffic wishing to travel west on the A47 Fen Road will do so over the existing bridge which will carry a one way, 2 lane carriageway again only a one way (westbound). Users will also be able to use the roundabout to continue straight on, northbound on to the A47 South Brink from either lane of the A141 March Road. The approach from the A47 South Brink will be a 3 lane approach allowing users to travel straight ahead southbound, or to turn right onto the A47 Fen Road.

14.1.6 As with the other 2 options described above, the roundabout will include a 3 lane circulatory carriageway and each exit will have an initial 2 lane arrangement before merging into the existing single lane carriageway.

14.2 Technology Assessment

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

14.2.2 The technology equipment will be affected by all the 3 options and will be replaced as required and as appropriate to the design of the preferred option once chosen.

14.2.3 The isolated road traffic loops on each of the approaches will be re sited as necessary in the new arrangements.

14.2.4 The junction and all 3 approaches are currently lit, with the A47 Fen Road being lit for a significant distance west of the junction, whereas the A47 South Brink and A141 March Road are only lit on the immediate approaches. It is likely that the new scheme will follow a similar lighting strategy, although street lighting provision will be reviewed in future PCF Stages and appropriate street lighting will be provided as required.

14.2.5 At present there are no plans to increase the level of technology at the junction but this will be explored further in later stages.

14.3 Maintenance Assessment

1.1.1 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-GJ-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, taking into account the collision data described in Chapter 3.4. It is also discussed 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 known. These surveys will be conducted during later PCF stages to inform and develop the designs.

15.2.2 As described in Section 3.4, the accident rate at this junction is low, with only seven reported incidents in the last 5 years, with no serious incidents recorded; all incidents were rear end shunts. The impact of the design on accident figures is discussed further in PCF Stage 2 section, Chapter 29.

15.2.3 It is anticipated that improvements to the junction will reduce the length of queuing at the junction, but not eliminate queuing. It is therefore not anticipated that the accident rate will reduce significantly.

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.

Options 1 & 2

15.2.5 The enlargement of the roundabout is assumed to increase the risk of collisions for those using the roundabout due to increased traffic on the circulatory carriageway and increased circulatory speed. The design has been developed to current standards but the operational aspects of the new design need to be further considered in future PCF Stages to determine the effect on incidents at the junction.

15.2.6 The increased number of lanes on all approaches to the roundabout is likely to reduce the risk of collisions for motor vehicles using the junction due to the increased capacity of the junction and segregation of movements. However, the increased capacity could potentially increase risk for some users, particularly cyclists who may have to cross more lanes of traffic. This will be investigated further as the scheme progresses.

15.2.7 Driver stress is likely to be reduced as queuing traffic on the approaches to the roundabout is reduced by the increase in number of lanes on all approaches and increased capacity of the roundabout.

15.2.8 Recognised NMU routes will be severed although the suggested introduction of a signalised crossing over the A141 March Road will improve the crossing facility on this arm. The severed routes will require further consideration once more data is available regarding NMU movements at the junction.

15.2.9 The new layout includes new 2 lane merges for all exits of the junction and so there is a potential risk of more collisions from this new arrangement. The detailed review of the exit widths and merge tapers have not been performed at this stage but an assessment against the relevant standards will be undertaken during later PCF stages.

15.2.10 Careful consideration will be given to the road markings and signage to ensure users are guided safely around the new junction layout. A RSA will be completed in future PCF Stages which will provide an assessment of the current proposals.

15.2.11 The NMU survey that will be conducted in the future will inform the choices of road markings and signage to ensure users are guided safely around the new junction layout.

Option 8

15.2.12 This option will also have the issues described above in regards to increased risk of collisions due to the increased size and newly shaped roundabout and the exit merge on all arms.

15.2.13 Severance of the existing NMU routes described above also exists in this option. Careful consideration of the proposed NMU facilities is required once more information is known from the NMU surveys conducted in the future.

15.2.14 Driver stress is anticipated to be reduced due to reduction in queuing traffic due to the increase in numbers of lanes approaching the junction on all arms.

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

15.2.15 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. The Delivery Plan has received a number of updates since publication which is discussed further in Chapter 32. A commentary is provided below about how the options identified during PCF Stage 1 align with the measures originally detailed in the Delivery Plan.

Upgrades to junctions and removing some of the worst bottlenecks

15.2.16 All the options identified seek to upgrade the Guyhirn junction and address the capacity issues and bottlenecks at the site. The extent to which this would be achieved is set out in Chapter 12.

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

15.2.17 The RIS sets out its vision of the network toward 2040. The A47 Guyhirn is not identified in the "current, planned and potential Expressways" category.

15.2.18 Should the Expressway network be expanded to include the A47 Guyhirn junction 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." None of the proposed options for Guyhirn fit this criterion.

15.2.19 The existing roundabout at Guyhirn facilitates an almost 90 degree change in direction of the A47 at this point. It is highly likely therefore that if the A47 were to be upgraded to expressway standards (or indeed standard dual carriageway), the alignment would be significantly different to that of the current route. A number of route options would be feasible for the new alignment and each would be likely to impact on the Guyhirn roundabout in different ways and in differing degrees.

Upgrading central barriers

15.2.20 The existing highway layout does not include a central reserve barrier. Minimising vehicle conflicts and providing appropriate segregation will be a factor as the scheme develops although central barriers are not currently anticipated.

Providing safer verges with improved run off protection

15.2.21 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

15.2.22 Providing improved road signing and markings is a detailed consideration which will be incorporated during the subsequent PCF stages.

Upgrading lay-bys

15.2.23 There are no existing lay-bys at Guyhirn junction. Consideration will be given at a later stage whether there would be a benefit in including any in the scheme.

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

15.2.24 The current Scheme scope does not necessitate the introduction of technology to prevent, detect and monitor incidents.

15.2.25 There is an existing CCTV camera at the site but, at the current time, we are not aware of who owns and operates it or for what purpose.

Using designated safety funding to deliver targeted safety improvements.

15.2.26 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 in PCF Stage 2 and detailed in the Value Management Workshop Report (PCF Stage 2) and the measures identified will be developed in future 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 and 8 will be taken forward for further assessment. The following sections provide an initial environmental assessment of these three 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.

16.1.3 Further information can be found in the PCF Stage 1 Environmental Assessment Report, document reference A47IMPS1-AME-GJ-ZZ-DO-J0024.

16.2 Option 1

16.2.1 Option 1 is presented and described in Chapter 9.

Air Quality

16.2.2 With Option 1, the enlarged roundabout moves the road edge approximately 15m closer to the residential receptors on local access March Road, approximately 13m closer to the properties on High Road and approximately 17m closer to the designated nature conservation sites. This reduces the distance between the pollutant source and the receptors and may adversely affect local air quality. However, the traffic flow should improve with Option 1 reducing stationary or low-speed traffic and the amount of time that engines are operating at sub-optimal levels. The necessity for heavy braking and acceleration will be reduced, and may lead to improvements in local air quality. Modelling will be required to confirm whether or not the closest two properties to the roundabout will experience a deterioration in air quality that is perceptible.

16.2.3 A reduction in queueing traffic may allow vehicles to travel at greater speeds, leading to greater greenhouse gas emissions. Changes in composition can affect ambient air quality due to an increase in diesel powered HGV and LGV traffic that could result in an increase of Particulate Matter and NO_2 levels.

16.2.4 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. Construction dust can also affect ecosystems through deposition that acts as a physical barrier to photosynthesising plants, and through the effects of its chemical constituents on sensitive ecological receptors.

16.2.5 At this stage, impacts on air quality from Option 1 are considered to be **neutral**.

Mitigation

16.2.6 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.

16.2.7 Normal mitigation measures will be required during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

16.2.8 There are no identified historic environment features within the footprint of Option 1. The closest cultural heritage receptors are approximately 200m from the existing roundabout and are archaeological features related to the water environment – Morton's Leam and Pea Kirk Drain – which could be affected by the bridge widening required for Option 1.

16.2.9 Construction activities could disturb or destroy previously unrecorded archaeological features or artefacts particularly as the preservation afforded by the waterlogged conditions within the study area, means that there is high potential for further unrecorded subsurface archaeological remains to survive. Investigations in the area have previously revealed Roman, Medieval and Post-medieval artefacts.

16.2.10 At this stage, impacts on cultural heritage from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.11 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 are not limited to, geophysical survey, field walking, evaluation excavation and landscape screening.

Landscape and Visual

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

16.2.13 Option 1 will require land take to accommodate the enlarged roundabout and three lane approaches, resulting in a loss of landscape features including vegetation and roadside woodland which will change the local landcover. Residential properties located on local access March Road will experience adverse visual impacts during both construction and operation due to the proximity of the enlarged roundabout and the loss of the screening woodland/vegetation.

16.2.14 At this stage, impacts on landscape and visual receptors from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.15 Mitigation should seek to integrate the junction improvements into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of woodland to limit views of this from local access March Road and to integrate the scheme into the landscape. However, it may take over 15 years to mature sufficiently to provide the same level of screening.

Nature Conservation and Biodiversity

16.2.16 Option 1 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats and species. The option has the potential to affect all of these sensitive receptors by disruption through noise (e.g. construction noise in particular for night works), air quality, loss of habitat, habitat fragmentation or by severance of migration routes. There may also be direct impacts to the Nene washes complex and the species that they support from the hydrological impacts of the bridge widening activities on the River Nene Bridge and construction of the enlarged roundabout.

16.2.17 Option 1 will result in direct loss and severance of habitats (some of which are priority habitats) including broadleaved woodland plantation, scrub, semi-natural mixed woodland, marginal and inundation vegetation, reedbed and lowland fen. The direct impact of habitat loss and severance at various locations for the installation of new highways infrastructure has the

potential to adversely affect various species including bats, badger, reptile, water vole, wintering birds, wetland birds, aquatic and terrestrial invertebrates, spined loach and botanical species.

16.2.18 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.

16.2.19 At this stage, impacts on nature conservation and biodiversity from Option 1 are considered to be **moderate to major adverse**.

Mitigation

16.2.20 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).

16.2.21 Additional mitigation measures to also consider during the scheme design, construction and operation, include: Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and Highways England BAPs; Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary); biodiversity no net loss assessment; enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and on-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

16.2.22 Detailed early engagement with Natural England in light of the potential impacts on the SAC/SPA/Ramsar.

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

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

Noise and Vibration

16.2.25 Noise Important Area 11363 is located at A141 March Road south of Guyhirn junction and Option 1 does not change the carriageway alignment through the Noise Important Area. Noise Important Area 11362 is located at an area surrounding Bank Side Farm at the junction of the A47 Fen Road and the B1187 Gull Road and again Option 1 does not change the carriageway alignment through the Noise Important Area. At this stage no traffic data is available to determine the overall effect of the option on these Noise Important Areas, though a minor adverse effect on both areas is possible during construction.

16.2.26 The enlarged roundabout of Option 1 and the three lane approaches moves traffic approximately 15m closer to the residential properties located along the northern extent of local access March Road and will require the removal of areas of woodland between local access March Road and the existing A47/A141 roundabout. The woodland acts as a screening barrier and the properties on local access March Road will experience an increase in noise levels from its removal.

16.2.27 Option 1 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats

and species. These sensitive ecological receptors are likely to be affected by any increase in noise levels, in particular during construction.

16.2.28 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.

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

Mitigation

16.2.30 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby 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 new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.
- Consultation with Highways England operational teams to understand what plans they may have within the Noise Important Areas and to agree where the scheme can deliver mitigation.

Road Drainage and Water Environment

16.2.31 Option 1 has the potential to significantly affect the water environment due to the proximity to the River Nene, Morton's Leam and the associated floodplain. The widening of the River Nene Bridge may involve in-river works which could lead to habitat loss, disturbance of species or water pollution events.

16.2.32 Groundwater in the study area belongs largely to secondary shallow superficial aquifers, closest to the existing Guyhirn junction to the north-west and south. These groundwater bodies are of low productivity, sitting within coastal and fluvial alluvium formations. Effects on groundwater quality are unknown at this stage, but are likely to be adverse through the potential for pollutant pathways from excavation required for any cuttings or drainage features.

16.2.33 This option includes areas of the design located within an area classified as Flood Zone 2 and the existing A47 forms part of the tidal defences. In addition, the option is in close proximity to Whittlesey (Nene) Washes which is a reservoir designated under the Reservoir's Act (1975). Any increase in impermeable area and construction works within areas at risk of flooding have the potential to result in adverse effects on flood risk and flooding potential. A standalone Flood Risk Assessment (FRA) would be required due to the potential effect of the proposed scheme upon areas at risk of flooding.

16.2.34 At this stage, impacts on road drainage and the water environment from Option 1 are considered to be **moderate to major adverse**.

Mitigation

16.2.35 The junction would require a Highways Agency Water Risk Assessment Tool (HAWRAT) to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.

16.2.36 Mitigation requirements would be those needed to reduce impacts identified in DMRB HD45/09 assessments to an acceptable level and may require attenuation measures to be included within the drainage design which may require land take.

16.2.37 The proposed scheme includes construction within areas classified as Flood Zone 2 and may include modifications to the existing tidal defences formed by the A47. The standalone FRA would outline the mitigation requirements to be included within the future design. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and IDB.

16.2.38 Widening of the bridge over the River Nene would need to be designed so as to minimise impact upon the watercourse.

16.2.39 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

16.2.40 Option 1 will sever the existing NMU pathway which links A141 March Road to A47 Fen Road and beyond which connects the PRoW at A141 March Road to the roundabout. Footpaths around Guyhirn roundabout and along the A47/A141 will be affected during construction.

16.2.41 Option 1 requires a large amount of land take from the woodland area next to local access March Road, which is likely used as a community space. However, no private, commercial or development land is likely to be required.

16.2.42 The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.

16.2.43 Users of the A47/A141 are likely to 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, particularly during peak hours. However, these impacts will be temporary.

16.2.44 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. However, these impacts will be temporary and Option 1 will lead to a reduction in driver stress due to a decrease in journey times and reduced congestion.

16.2.45 Users of the road network are likely to experience route uncertainty because of temporary lane or road closures and diversion routes. Lane restrictions in certain areas during construction could increase route uncertainty, particularly during peak hours and a temporary minor adverse effect will be experienced by travellers attributed to increased route uncertainty. When operational, Option 1 will improve route uncertainty.

16.2.46 At this stage, impacts on people and communities from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.47 As stated in Section 13.4, a NMU survey has not been undertaken at this time and will be conducted at later PCF stages. The results of these surveys will be used to inform the designs as they develop ensuring the impact of severance is mitigated taking into consideration the needs of all NMUs and vulnerable users.

16.2.48 Severance of the NMU footway can be mitigated through the introduction of a new pathway to the north of the existing one. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility within the vicinity of the junction.

16.2.49 Mitigation measures should also include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement Highways England 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

16.2.50 Option 1 does not affect any areas designated for their geological interest and no land take is required from agricultural land. However, 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 including for Waste Acceptance Criteria.

16.2.51 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.

16.2.52 At this stage, impacts on geology, soils and materials from Option 1 are considered to be **minor adverse**.

Mitigation

16.2.53 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.

16.2.54 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.

16.2.55 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 presented and described in Chapter 9.

Air Quality

16.3.2 With Option 2 the road edge moves approximately 27m closer to the residential receptors on local access March Road and approximately 12m closer to the designated nature conservation sites. This reduces the distance between the pollutant source and the receptors and may adversely affect local air quality. However, the traffic flow should improve with Option 2 reducing stationary or low-speed traffic and the amount of time that engines are operating at sub-optimal levels. The necessity for heavy braking and acceleration will be reduced, and may lead to improvements in local air quality. Modelling will be required to confirm whether or not the closest two properties to the roundabout will experience a deterioration in air quality that is perceptible.

16.3.3 A reduction in queueing traffic may allow vehicles to travel at greater speeds, leading to greater greenhouse gas emissions. Changes in composition can affect ambient air quality due to an increase in diesel powered HGV and LGV traffic that could result in an increase of PM and NO2 levels.

16.3.4 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. Construction dust can also affect ecosystems through deposition that acts as a barrier physical to photosynthesising plants, and through the effects of its chemical constituents on sensitive ecological receptors.

16.3.5 At this stage, impacts on air quality from Option 2 are considered to be neutral.

Mitigation

16.3.6 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.

16.3.7 Normal mitigation measures will be required during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

16.3.8 There are no identified historic environment features within the footprint of Option 2. The closest cultural heritage receptors are approximately 200m from the existing roundabout and are archaeological features related to the water environment – Morton's Leam and Pea Kirk Drain – which are unlikely to be affected by Option 2.

16.3.9 Construction activities could disturb or destroy previously unrecorded archaeological features or artefacts particularly as the preservation afforded by the waterlogged conditions within the study area, means that there is high potential for further unrecorded subsurface archaeological remains to survive. Investigations in the area have previously revealed Roman, Medieval and Post-medieval artefacts.

16.3.10 At this stage, impacts on cultural heritage from Option 2 are considered to be **neutral**.

Mitigation

16.3.11 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 are not limited to, geophysical survey, field walking, evaluation excavation and landscape screening.

Landscape and Visual

16.3.12 Option 2 is unlikely to affect the regional or local landscape character, with the pattern, scale and appearance and tranquillity of the landscape remaining unaffected.

16.3.13 Option 2 will require greater land take than Option 1 to accommodate the horizontal shift in alignment of the enlarged roundabout and three lane approaches, resulting in a considerable loss of landscape features including vegetation and roadside woodland which will change the local landcover. Residential properties located on local access March Road will experience adverse visual impacts during both construction and operation due to the proximity of the enlarged roundabout and the loss of the screening woodland/vegetation. Landscape and visual impacts are likely to be greater than Option 1 due to the greater amount of land take required, however this will be considered in detail during the next stage of the assessment.

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

Mitigation

16.3.15 Mitigation should seek to integrate the junction improvements into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of woodland to limit views of this from local access March Road and to integrate the scheme into the landscape. However, it may take over 15 years to mature sufficiently to provide the same level of screening.

Nature Conservation and Biodiversity

16.3.16 Option 2 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats and species. The option has the potential to affect all of these sensitive receptors by disruption through noise (e.g. construction noise in particular for night works), air quality, loss of habitat, habitat fragmentation or by severance of migration routes.

16.3.17 Option 2 will result in direct loss and severance of habitats (some of which are priority habitats) including broadleaved woodland plantation, scrub, semi-natural mixed woodland, marginal and inundation vegetation, reedbed and lowland fen. The direct impact of habitat loss and severance at various locations for the installation of new highways infrastructure has the potential to adversely affect various species including bats, badger, reptile, water vole, wintering birds, wetland birds, aquatic and terrestrial invertebrates, spined loach and botanical species.

16.3.18 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.

16.3.19 At this stage, impacts on nature conservation and biodiversity from Option 2 are considered to be **moderate adverse**.

Mitigation

16.3.20 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).

16.3.21 Additional mitigation measures to also consider during the scheme design, construction and operation, include: Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAPs; Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary); biodiversity no net loss assessment; enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and on-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

16.3.22 Detailed early engagement with Natural England in light of the potential impacts on the SAC/SPA/Ramsar.

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

16.3.24 Further baseline surveys are required at PCF Stage 2 to inform mitigation proposals. Consultation will also be required with ecological stakeholders on the mitigation proposed.

Noise and Vibration

16.3.25 Noise Important Area 11363 is located at A141 March Road south of Guyhirn junction and Option 2 does not change the carriageway alignment through the Noise Important Area. Noise Important Area 11362 is located at an area surrounding Bank Side Farm at the junction of the A47 Fen Road and the B1187 Gull Road and again Option 2 does not change the carriageway alignment through the Noise Important Area. At this stage no traffic data is available to determine the overall effect of the option on these Noise Important Areas, though a minor adverse effect on both areas is possible during construction.

16.3.26 Option 2 moves traffic approximately 27m closer to the residential properties located along the northern extent of local access March Road and will require the removal of large areas of woodland between local access March Road and the existing A47/A141 roundabout. The woodland acts as a screening barrier and the properties on local access March Road will experience an increase in noise levels from its removal.

16.3.27 Option 2 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats and species. These sensitive ecological receptors are likely to be affected by any increase in noise levels, in particular during construction.

16.3.28 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.

16.3.29 At this stage, impacts on noise and vibration from Option 2 are considered to be **moderate adverse**.

Mitigation

16.3.30 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby 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 new/realigned sections of road into the surrounding area. This can also provide visual mitigation;

- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.
- Consultation with Highways England operational teams to understand what plans they may have within the Noise Important Areas and to agree where the scheme can deliver mitigation.

Road Drainage and Water Environment

16.3.31 Option 2 has the potential to affect the water environment due to the proximity to the River Nene, Morton's Leam and the associated floodplain. Potential impacts would be to surface water quality and runoff volume during construction and operation with potential impacts to groundwater quality during construction. There is potential for groundwater to be impacted during operation if the drainage strategy includes infiltration features.

16.3.32 This option includes areas of the design located within an area classified as Flood Zone 2 and the existing A47 forms part of the tidal defences. In addition, the option is in close proximity to Whittlesey (Nene) Washes which is a reservoir designated under the Reservoir's Act (1975). Any increase in impermeable area and construction works within areas at risk of flooding have the potential to result in adverse effects on flood risk and flooding potential. A standalone Flood Risk Assessment would be required due to the potential effect of the proposed scheme upon areas at risk of flooding. Land drainage may also be affected if the pump house and existing culvert needs to be relocated.

16.3.33 At this stage, impacts on road drainage and the water environment from Option 2 are considered to be **moderate adverse**.

Mitigation

16.3.34 The junction would require a HAWRAT to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.

16.3.35 Mitigation requirements would be those needed to reduce impacts identified in DMRB HD45/09 assessments to an acceptable level and may require attenuation measures to be included within the drainage design which may require land take.

16.3.36 The proposed scheme includes construction within areas classified as Flood Zone 2 and may include modifications to the existing tidal defences formed by the A47. The standalone FRA would outline the mitigation requirements to be included within the future design. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and IDB.

16.3.37 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

16.3.38 Option 2 will sever the existing NMU pathway which links A141 March Road to A47 Fen Road and beyond which connects the PRoW at A141 March Road to the roundabout. Footpaths around Guyhirn roundabout and along the A47/A141 will be affected during construction.

16.3.39 Option 2 requires a large amount of land take from the woodland area next to local access March Road, which is likely used as a community space. However, no private, commercial or development land is likely to be required.

16.3.40 The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.

16.3.41 Users of the A47/A141 are likely to 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, particularly during peak hours. However, these impacts will be temporary.

16.3.42 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. However, these impacts will be temporary and Option 2 will lead to a reduction in driver stress due to a decrease in journey times and reduced congestion.

16.3.43 Users of the road network are likely to experience route uncertainty because of temporary lane or road closures and diversion routes. Lane restrictions in certain areas during construction could increase route uncertainty, particularly during peak hours and a temporary minor adverse effect will be experienced by travellers attributed to increased route uncertainty. When operational, Option 2 will improve route uncertainty.

16.3.44 At this stage, impacts on people and communities from Option 2 are considered to be **minor adverse**.

Mitigation

16.3.45 As stated in Section 13.4, a NMU survey has not been undertaken at this time and will be conducted at later PCF stages. The results of these surveys will be used to inform the designs as they develop ensuring the impact of severance is mitigated taking into consideration the needs of all NMUs and vulnerable users.

16.3.46 Severance of the NMU footway can be mitigated through the introduction of a new pathway to the north of the existing one. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility within the vicinity of the junction.

16.3.47 Mitigation measures should include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement with Highways England 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

16.3.48 Option 2 does not affect any areas designated for their geological interest and no land take is required from agricultural land. However, 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 including for Waste Acceptance Criteria.

16.3.49 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.

16.3.50 At this stage, impacts on geology, soils and materials from Option 2 are considered to be **minor adverse**.

Mitigation

16.3.51 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.

16.3.52 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.

16.3.53 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 Option 8

16.4.1 Option 8 is presented and described in Chapter 9.

Air Quality

16.4.2 With Option 8 the road edge moves approximately 13m closer to the residential receptors on local access March Road and approximately 16m closer to the properties on High Road with the distance between the road edge and the designated nature conservation sites unaffected. The new crossing of the River Nene will move the road edge of the eastbound carriageway up to 20m closer to properties on High Road and B1187 Gull Road. This reduces the distance between the pollutant source and the receptors and may adversely affect local air quality. However it is likely that the new slip road and larger roundabout will reduce queueing traffic which may result in small improvements to local air quality.

16.4.3 A reduction in queueing traffic may allow vehicles to travel at greater speeds, leading to greater greenhouse gas emissions. Changes in composition can affect ambient air quality due to an increase in diesel powered HGV and LGV traffic that could result in an increase of Particulate Matter and NO_2 levels.

16.4.4 All human receptors within the study area are exposed to the risk of health impacts from the inhalation of construction dust. Construction dust can also affect ecosystems through deposition that acts as a barrier physical to photosynthesising plants, and through the effects of its chemical constituents on sensitive ecological receptors.

16.4.5 At this stage, impacts on air quality from Option 8 are considered to be **neutral**.

Mitigation

16.4.6 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.

16.4.7 Normal mitigation measures will be required during the construction phase to minimise adverse impacts from dust emissions and vehicle emissions on nearby sensitive receptors.

Cultural Heritage

16.4.8 There are no identified historic environment features within the footprint of Option 8. It is possible that the new crossing of the River Nene may affect the setting of two Grade II listed buildings - the Church of St Mary Magdalene, High Road and the war memorial situated within the church grounds. However, both listed buildings are around 500m from the scheme.

16.4.9 Construction activities could disturb or destroy previously unrecorded archaeological features or artefacts particularly as the preservation afforded by the waterlogged conditions within the study area, means that there is high potential for further unrecorded subsurface archaeological remains to survive. Investigations in the area have previously revealed Roman, Medieval and Post-medieval artefacts.

16.4.10 At this stage, impacts on cultural heritage from Option 8 are considered to be **neutral**.

Mitigation

16.4.11 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 are not limited to, geophysical survey, field walking, evaluation excavation and landscape screening.

Landscape and Visual

16.4.12 Option 8 will not affect the regional landscape character. However, impacts are likely on a local scale. The elliptical roundabout and slip road will require land take to the north east, north west and south of the existing junction. There will be a subsequent loss of landcover, specifically grassland, woodland and vegetation. The addition of a new slip road and bridge over the River Nene will alter the pattern and appearance of the local landscape. The enlarged elliptical roundabout will further alter the scale of the landscape.

16.4.13 The new river crossing of Option 8 will be highly visually intrusive and have adverse visual impacts for the residential properties located on local access March Road and High Road, particularly during construction and from the more permanent loss of screening vegetation.

16.4.14 At this stage, impacts on landscape and visual receptors from Option 8 are considered to be **minor to moderate adverse**.

Mitigation

16.4.15 Mitigation should seek to integrate the junction improvements into the landscape as far as possible. Potential mitigation could consist of screen planting or reinstatement of woodland to limit views of this from local access March Road and to integrate the scheme into the landscape. However it may take over 15 years to mature sufficiently to provide the same level of screening.

Nature Conservation and Biodiversity

16.4.16 Option 8 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats and species. The option has the potential to affect all of these sensitive receptors by disruption through noise (e.g. construction noise in particular for night works), air quality, loss of habitat, habitat fragmentation or by severance of migration routes. There may also be direct impacts to

the Nene washes complex and the species that they support from the hydrological impacts of the new crossing of the River Nene and construction of the elliptical roundabout.

16.4.17 Option 8 will result in direct loss and severance of habitats (some of which are priority habitats) including broadleaved woodland plantation, scrub, semi-natural mixed woodland, marginal and inundation vegetation, reedbed and lowland fen. The direct impact of habitat loss and severance at various locations for the installation of new highways infrastructure has the potential to adversely affect various species including bats, badger, reptile, water vole, wintering birds, wetland birds, aquatic and terrestrial invertebrates, spined loach and botanical species.

16.4.18 Indirect impacts of noise, watercourse pollution / sediment dust, lighting, increased human disturbance, potential for invasive non-native species from works at various locations and operational traffic also have potential to adversely affect various species. Some of the resulting effects may be temporary or permanent, and of varying magnitude, which may in turn be significant or not significant.

16.4.19 At this stage, impacts on nature conservation and biodiversity from Option 8 are considered to be **moderate to major adverse**.

Mitigation

16.4.20 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).

16.4.21 Additional mitigation measures to also consider during the scheme design, construction and operation, include: Retention of habitats and on-site soft landscaping which would also benefit flora and fauna species and meet the objectives of local and HE BAPs; Off-site mitigation and enhancement areas (where this cannot be met within the proposed scheme boundary); biodiversity no net loss assessment; enhancing the wildlife corridor and ecosystem function of the proposed scheme e.g. through appropriate habitat creation, wildlife tunnels, underpasses and culvert/bridge design; Mammal fencing to minimise operational effects on fauna e.g. badger and otter (where applicable); and on-going monitoring surveys with a feedback mechanism in place to ensure results are fed into the detailed design.

16.4.22 Detailed early engagement with Natural England in light of the potential impacts on the SAC/SPA/Ramsar.

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

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

Noise and Vibration

16.4.25 Noise Important Area 11363 is located at A141 March Road south of Guyhirn junction and Option 8 does not change the carriageway alignment through the Noise Important Area. Noise Important Area 11362 is located at an area surrounding Bank Side Farm at the junction of the A47 Fen Road and the B1187 Gull Road and again Option 8 does not change the carriageway alignment through the Noise Important Area. At this stage no traffic data is available to determine the overall effect of the option on these Noise Important Areas, though a minor adverse effect on both areas is possible during construction.

16.4.26 Option 8 moves traffic approximately 13m closer to the residential properties located along the northern extent of local access March Road and approximately 16m closer to the properties on

High Road. It will require the removal of large areas of woodland between local access March Road and the existing A47/A141 roundabout. The woodland acts as a screening barrier and the properties on local access March Road will experience an increase in noise levels from its removal. The elevated position of the new crossing of the River Nene may lead to an increase in the noise levels for the residential and commercial properties on High Road, which are currently screened by a flood defence embankment.

16.4.27 Option 8 improvements are adjacent to the Nene Washes SAC, SPA, SSSI and RSPB reserve and within the Guyhirn Reedbed CWS which support a range of protected and notable habitats and species. These sensitive ecological receptors are likely to be affected by any increase in noise levels, in particular during construction.

16.4.28 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.

16.4.29 At this stage, impacts on noise and vibration from Option 8 are considered to **be moderate adverse**.

Mitigation

16.4.30 Mitigation measures that could be considered to reduce the impact of traffic noise on local receptors, if required, include:

- Maximising the distance between new/realigned sections of road and nearby receptors;
- Minimising changes in traffic on existing roads due to the scheme;
- Earth bunds/noise barriers to screen nearby 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 new/realigned sections of road into the surrounding area. This can also provide visual mitigation;
- Low noise surfacing, if traffic speeds are sufficient for a low noise surface to be effective. Current guidance in the DMRB advises that a noise benefit from a low noise surface should only be assumed at speeds of 75 km/hr or more; and
- Noise insulation of individual properties to protect the internal noise environment.
- Consultation with Highways England operational teams to understand what plans they may have within the Noise Important Areas and to agree where the scheme can deliver mitigation.

Road Drainage and Water Environment

16.4.31 Option 8 has the potential to significantly affect the water environment due to the proximity to the River Nene, Morton's Leam and the associated floodplain. The creation of the new bridge over the River Nene will likely involve in-river works which may adversely impact the water environment through habitat loss, disturbance of species or water pollution events. The construction of the new slip road will likely disturb the existing culvert to the north east of the existing roundabout.

16.4.32 Groundwater in the study area belongs largely to secondary shallow superficial aquifers, closest to the existing Guyhirn junction to the north-west and south. These groundwater bodies are of low productivity, sitting within coastal and fluvial alluvium formations. Effects on groundwater quality are unknown at this stage, but are likely to be adverse through the potential for pollutant pathways from excavation required for any cuttings or drainage features.

16.4.33 This option includes areas of the design located within an area classified as Flood Zone 2 and the existing A47 forms part of the tidal defences. In addition, the option is in close proximity to Whittlesey (Nene) Washes which is a reservoir designated under the Reservoir's Act (1975). Any increase in impermeable area and construction works within areas at risk of flooding have the potential to result in adverse effects on flood risk and flooding potential. A standalone Flood Risk Assessment would be required due to the potential effect of the proposed scheme upon areas at risk of flooding.

16.4.34 At this stage, impacts on road drainage and the water environment from Option 8 are considered to be **moderate to major adverse**.

Mitigation

16.4.35 The junction would require a HAWRAT to quantitatively assess potential impacts to the water environment from the junction. A HAWRAT assessment would indicate if spillage containment is required to satisfy the spillage risk assessment and whether attenuation of pollution is required for routine runoff.

16.4.36 Mitigation requirements would be those needed to reduce impacts identified in DMRB HD45/09 assessments to an acceptable level and may require attenuation measures to be included within the drainage design which may require land take.

16.4.37 The proposed scheme includes construction within areas classified as Flood Zone 3. The standalone FRA would outline the mitigation requirements to be included within the future design. Mitigation requirements would need to take into account sustainable drainage principles and the advice of the EA and IDB.

16.4.38 The new crossing River Nene should be designed so as to minimise impact upon the watercourse and riparian zone.

16.4.39 The procedures for managing the water resources implications during scheme construction would be defined in the CEMP, and would therefore comply with current planning policies / regulations for the protection of water resources. This document would be compiled, reviewed and revised when the project progresses to the construction stage.

People and Communities

16.4.40 Option 8 will sever the existing NMU pathway which links A141 March Road to A47 Fen Road and beyond which connects the PRoW at A141 March Road to the roundabout. Footpaths around Guyhirn roundabout and along the A47/A141 will be affected during construction.

16.4.41 Option 8 requires a large amount of land take from the woodland area next to local access March Road, which is likely used as a community space. However, no private, commercial or development land is likely to be required.

16.4.42 The option will have a beneficial impact on journey ambience. Driver views from the road will be adversely affected during construction and in the short term, however views will improve as roadside mitigation planting matures.

16.4.43 Users of the A47/A141 are likely to 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, particularly during peak hours. However, these impacts will be temporary.

16.4.44 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. However, these impacts will be temporary and Option 8 will lead to a reduction in driver stress due to a decrease in journey times and reduced congestion.

16.4.45 Users of the road network are likely to experience route uncertainty because of temporary lane or road closures and diversion routes. Lane restrictions in certain areas during construction could increase route uncertainty, particularly during peak hours and a temporary minor adverse effect will be experienced by travellers attributed to increased route uncertainty. When operational, Option 2 will improve route uncertainty.

16.4.46 At this stage, impacts on people and communities from Option 8 are considered to be **minor adverse**.

Mitigation

16.4.47 As stated in Section 13.4, a NMU survey has not been undertaken at this time and will be conducted at later PCF stages. The results of these surveys will be used to inform the designs as they develop ensuring the impact of severance is mitigated taking into consideration the needs of all NMUs and vulnerable users.

16.4.48 Severance of the NMU footway can be mitigated through the introduction of a new pathway to the north of the existing one. There is also potential to introduce new cycleways and further pedestrian footpaths to improve accessibility within the vicinity of the junction.

16.4.49 Mitigation measures should include; the contractor undertaking the construction of the proposed scheme planning road junction closures and restrictions in agreement 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

16.4.50 Option 8 does not affect any areas designated for their geological interest and no land take is required from agricultural land. However, 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 including for Waste Acceptance Criteria.

16.4.51 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.

16.4.52 At this stage, impacts on geology, soils and materials from Option 8 are considered to be **minor adverse**.

Mitigation

16.4.53 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.

16.4.54 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.

16.4.55 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.

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 undertaken for each of the options as recommended by the sifting review meeting. The estimates were produced to demonstrate the affordability of the project. The Options Estimates were used in the decision-making process by Highways England 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 2) by the Highways England Commercial team.

17.1.3 The options estimate taken forward was on the option considered to be the most viable option, which was Option 2, given it enabled greater traffic flow.

17.2 Options Estimate

17.2.1 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.

17.2.2 The Options Estimate includes 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 Options 2.

Table 17-1 – Guyhirn Cost Estimates

Option	Range Min (£M)	Range Most Likely (£M)	Range Max (£M)
1	**	**	**
2	£16.7m	£20.6	£29.5m
8	**	**	**

**Option price not available at this point in PCF Stage 1.

17.4.2 The Range Estimates for the Proposed Scheme at PCF Stage 0, derived from the Order of Magnitude Estimate, are as detailed below 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)	6.3	7.8	10.1

17.4.3 The outturn range estimate prepared for the 2014 route Feasibility Study (published in February 2015) reported a range estimate of £11M to £17M.

17.5 Cost Estimate Analysis

17.5.1 A comparison of the Order of Magnitude and the Options Estimate was not possible at the end of PCF Stage 1 due to the availability of only one Options Estimate from Highways England Commercial team.

17.5.2 The cost estimate received for Option 2 was used in the economics assessment described in Chapter 18.

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 Further detail on the economics appraisal is contained within the PCF Stage 1 Economics Appraisal Report, document reference A47 IMPS1-AME-GJ-ZZ-DO-J-0039.

18.2 Methodology

18.2.1 Benefits have been estimated over a 60-year appraisal period, standard for a transport scheme as per WebTAG Unit A1.1 “Cost-Benefit Analysis”. All values have been converted to the WebTAG standard of 2010 costs and values, to allow direct comparability between effects occurring in different years.

18.2.2 The economic assessment was performed by firstly observing the traffic impacts of the scheme through comparison of the Do-Minimum and Do-Something model outputs. These impacts were then assigned a value using the WebTAG Data Book estimates on the economic value of time for vehicle operators, vehicle operating costs (VOCs) and other wider macroeconomic factors.

18.2.3 These monetisation calculations were performed using the Transport Users Benefit Appraisal (TUBA) software package. For each assessment scenario 12 traffic models were run (Do-Minimum and Do-Something networks in two forecast years and three time periods) and for each model, user class and origin-destination pair the total vehicle demand, distance travelled per vehicle and travel time through the network was extracted from the models.

18.2.4 The scheme benefits are explicitly calculated for the fully modelled forecast years only and assumptions are made to estimate benefits for the remainder of the appraisal period:

- Benefits occurring between two modelled forecast years are interpolated from the impact change between them, initially in a linear fashion before the effects of inflation and discounting are applied;
- No growth in the magnitude of impacts is assumed after the final forecast year and therefore further benefits are reduced over time due to the effects of inflation and discounting.

18.2.5 Two different versions of TUBA have been used in the PCF Stage 1 assessment, versions 1.9.7 and 1.9.8. Version 1.9.7 incorporates baseline economic information from the WebTAG Data Book version 1.5, current as of July 2016, whereas version 1.9.8 uses the Data Book version 1.6 published in November 2016; as such it was being used as a sensitivity test only. The primary difference between the versions is the modification of values of time in version 1.9.8 which are variable dependent on the overall distance travelled.

18.2.6 In order to accommodate the variable values of time in version 1.9.8 a reference distance matrix has been defined which specifies a total journey distance for each O-D pair, not just the distance travelled within the model extents. A location was selected which represented the most likely trip origin or destination for travel through each zone connector, and the distance between the location and zone was added to the modelled distance to create a reference distance.

18.2.7 Travel-to-work data for Peterborough was used in the selection of most likely origins/destinations as a substitute for roadside interview data. In the absence of an obvious trip attractor/producer for journeys from zone 3, the next junction on the B1167 was chosen.

18.2.8 TUBA defines economic benefits for each vehicle (which is multiplied by vehicle occupancy to deliver benefits per person) but SATURN matrices are defined in PCUs. To prevent over-reporting of benefits each user class matrix has therefore been factored by the inverse of its PCU value to convert it from PCUs to vehicles.

18.2.9 Construction costs for Option 2 were inflated to outturn costs using Highways England's construction-specific inflation projection and then rebased to 2010 values and prices using the GDP deflator series in the WebTAG Data Book.

18.3 Journey Time Benefits

18.3.1 The scheme benefits calculated by TUBA are segregated by time period as shown in Table 18-1.

Table 18-1: Scheme benefits by time period

Design option	Time period	Journey time benefits	Vehicle operating cost benefits		Change in indirect tax revenues
			Fuel	Non-fuel	
Option 1	AM peak	14,241	319	140	65
	PM peak	9,380	196	19	25
	Inter-peak	16,520	85	-95	622
Option 2	AM peak	14,151	311	131	69
	PM peak	9,287	185	9	30
	Inter-peak	16,201	42	-133	642
Option 8	AM peak	12877	317	144	24
	PM peak	9299	210	37	11
	Inter-peak	16644	148	-29	564

18.3.2 Table 18-2 shows the scheme benefits split between the journey purposes.

Table 18-2: Scheme benefits by trip type

Design option	Journey purpose	Journey time benefits	Vehicle operating cost benefits		Change in indirect tax revenues
			Fuel	Non-fuel	
Option 1	Business	22,737	209	805	520
	Commuting	5,625	171	-215	24
	Other	11,779	220	-526	168
Option 2	Business	22,451	174	769	536
	Commuting	5,573	163	-221	27
	Other	11,615	200	-541	178
Option 8	Business	21,939	259	812	449
	Commuting	5,342	174	-186	11
	Other	11,538	243	-473	139

18.3.3 Business users perceive the greatest economic benefits from the scheme in each of the design options. 57% of benefits fall on business users, commuting users accrue 14% of benefits and other users 29%. These proportions remain constant across all three design options.

18.3.4 Non-fuel vehicle operating cost benefits positive for business users and negative for consumers (commuters and other users). Indirect tax revenues are also most pronounced for business users.

18.4 Annualisation

18.4.1 The SATURN models represent one-hour periods of a typical weekday, however the traffic impacts of the scheme are spread throughout the day and occur in each such weekday over a year. Therefore, the benefits must be annualised by calculating a factor representing by the number of occasions per year with similar traffic flow behaviour.

18.4.2 The three peak hour models each represent one hour in a typical weekday, namely the AM peak hour (07:30 to 08:30), the interpeak hour (14:00 to 15:00) and PM peak hour (16:45 to 17:45). For the purposes of economic assessment, the impacts measured in the three peak hours must be scaled so they are representative of those occurring throughout each typical weekday in a full year, using a process of annualisation.

18.4.3 The full periods represented by each model are defined in TUBA:

- The AM peak model represents the full period 07:00 to 10:00;
- The interpeak model represents the full period 10:00 to 16:00;
- The PM peak model represents the full period 16:00 to 19:00.

18.4.4 Annualisation was performed by calculating scaling factors that represented the number of hours in each day in which flows, and therefore impacts, were comparable to those in the peak hour models. To calculate these factors, the ATC data from the A47 Fen Road, A47 South Brink and A141 March Road counters were examined and the combined bidirectional flow for all three counters within the modelled hour was calculated. Data is reported from the ATC counters at 15 minute intervals:

- 07:30 to 08:30 total traffic flow: 5,255 vehicles per hour or 1,314 vehicles per 15 minutes;
- 14:00 to 15:00 total traffic flow: 3,899 vehicles per hour or 975 vehicles per 15 minutes;
- 16:45 to 17:45 total traffic flow: 5,402 vehicles per hour or 1,351 vehicles per 15 minutes.

18.4.5 The flows throughout the day were then examined and, for each time period (AM peak, interpeak and PM peak) the number of 15-minute periods with total traffic flows similar (within 10%) to those in the measured peak hour were calculated:

- Five 15-minute periods had similar flows to those represented by the AM peak model;
- 28 15-minute periods had similar flows to those represented by the interpeak model;
- Seven 15-minute periods had similar flows to those represented by the PM peak model.

18.4.6 Annualisation factors were then calculated by multiplying the number of 15-minute periods per day by 253, the number of weekdays in a typical year:

- For the AM peak period, the annualisation factor is (5 × 253) = 316;
- For the interpeak period, the annualisation factor is (28 × 253) = 1,771;
- For the PM peak period; the annualisation factor is (7 × 253) = 443.

18.4.7 Weekday off-peak and weekends was not modelled in SATURN and therefore these periods were excluded from Annualisation.

18.5 Accidents - Application of COBALT

18.5.1 The Cost and Benefit to Accidents - Light Touch (COBALT) software was not used in the economic assessment of the scheme at PCF Stage 1 as the program does not have sufficient resolution to determine accident rate differences between the base and design options given that the scheme construction is limited to a single roundabout only. A qualitative assessment

of potential accident benefits and disbenefits has been included within the Appraisal Summary Tables (ASTs) based upon the configuration of the roundabout design options and the change in the number of vehicles using the roundabout between the Do-Minimum and Do-Something scenarios.

18.5.2 This was approached differently for PCF Stage 2 which is explained in Chapter 29.

18.6 Delays during construction

18.6.1 The impact of delay due to Traffic Management measures during construction was not assessed at PCF Stage 1 as no information on construction methodology or scheduling was available at this point from which to model temporary traffic management impacts.

18.6.2 This is updated for PCF Stage 2 in Chapter 29.

18.7 Economic Summary Tables

18.7.1 The Transport Economic Efficiency (TEE) tables output by TUBA for each option are shown in Table 18-1. Economic benefits are expressed in thousands of pounds and rebased to 2010 values.

Table 18-1: TEE tables for Do-Something options (£1,000s)

Trip Type	Benefit	TUBA v1.9.7			TUBA v1.9.8		
		Option 1	Option 2	Option 8	Option 1	Option 2	Option 8
Commuter	Travel Time	5,625	5,573	5,342	8,240	8,162	7,842
	Vehicle operating costs	-44	-58	-13	-50	-64	-19
	Net commuter benefits	5,581	5,515	5,329	8,190	8,098	7,823
Other	Travel Time	11,780	11,615	11,538	10,232	10,089	10,014
	Vehicle operating costs	-306	-341	-230	-315	-351	-236
	Net other user benefits	11,473	11,275	11,308	9,917	9,738	9,778
Business	Travel Time	22,737	22,451	21,939	15,199	15,010	14,639
	Vehicle operating costs	1,014	943	1,071	968	900	1,023
	Net business benefits	23,751	23,395	23,010	16,167	15,910	15,662
Present Value of TEE benefits		40,805	40,185	39,647	34,274	33,746	33,263

18.7.2 In TUBA version 1.9.7 all three Do-Something options have TEE benefits exceeding £39 million. The option with the highest benefits is Option 1 with a TEE and PVB exceeding that of Option 2 by approximately £620,000.

18.7.3 The additional benefits in Option 1 relative to Option 2 are a result of the positioning of the roundabout resulting in small journey time benefits. Fine geometric changes between Options 1 and 2 are not well represented in a strategic modelling package such as SATURN, so care should be taken with such fine resolution of benefits and at this preliminary stage these benefits are effectively identical.

18.7.4 Option 8 performs slightly less well, with benefits approximately £1.16 million lower than those seen in Option 1. This is primarily due to the congestion experienced in the 2036 AM peak period although overall it remains a very well performing scheme.

18.7.5 The updated and distance-banded values of time represented in TUBA version 1.9.8 result in commuter travel time benefits increasing by around 47%, business travel time benefits

decrease by around 32% and other user travel time benefits decrease by around 16%. Non-travel time benefits remain unaffected. The overall effect is a drop in benefits when using TUBA version 1.9.8 as most of the modelled journeys are short (less than 50km) resulting in proportionally less travel time benefit. The relative performance of the three Do-Something options remains broadly similar to that seen in version 1.9.7.

18.7.6 These figures represent only costs and benefits which are regularly monetised in transport appraisals; non-monetised costs and benefits have not been considered in the TUBA assessment. Given the environmental sensitivity of the scheme these are likely to form a significant part of the overall appraisal and option selection, and therefore care should be taken when considering these outputs in isolation.

Public Accounts (PA) Tables

18.7.7 Table 18-2 presents costs to Public Accounts as output by TUBA. Costs presented have been converted from factor prices to market prices, and discounted against a 2010 base year using the standard DfT discount rate.

Table 18-2: Public Accounts tables for Do-Something options (£1,000s)

Trip Type	Benefit	TUBA v1.9.7			TUBA v1.9.8		
		Option 1	Option 2	Option 8	Option 1	Option 2	Option 8
Central Government Funding: Transport	Revenue	-	-	-	-	-	-
	Operating costs	-	-	-	-	-	-
	Investment costs	NA	14,541	NA	NA	14,541	NA
	Developer and other contributions	-	-	-	-	-	-
	Grant/subsidy payments	-	-	-	-	-	-
	Net impact	NA	14,541	NA	NA	14,541	NA
Central Government Funding: Non Transport	Indirect Tax Revenues*	712	741	599	712	741	599
Totals	Broad Transport Budget	NA	14,541	NA	NA	14,541	NA
	Wider Public Finances*	712	741	599	712	741	599

*Indirect tax revenues presented as cost

Analysis of Monetised Costs and Benefits (AMCB) tables

18.7.8 The Analysis of Monetised Costs and Benefits (AMCB) tables are shown in Table 18-3. This provides an economic summary for all of the options. Negative numbers represent increased costs rather than benefits.

Table 18-3: AMCB tables for Do-Something options (£1,000s)

Category	TUBA v1.9.7			TUBA v1.9.8		
	Option 1	Option 2	Option 8	Option 1	Option 2	Option 8
Greenhouse gas emissions	-368	-382	-310	-368	-382	-310
Commuter travel time benefits	5,581	5,515	5,329	8,190	8,098	7,823
Business travel time benefits	23,751	23,395	23,010	16,167	15,910	15,662
Other user travel time benefits	11,473	11,275	11,308	9,917	9,738	9,778
Indirect taxation revenues	712	741	599	712	741	599
Present Value of Benefit (PVB)	41,149	40,544	39,936	34,618	34,105	33,552
Net Present Value (NPV)		26,003			19,564	
Benefit to Cost Ratio (BCR)		2.788			2.345	

18.8 Value for Money

18.8.1 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 in Table 18-4.

Table 18-4: 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

18.8.2 During PCF Stage 1 a single cost estimate was provided by Highways England, based upon the design for Option 2. And so NPVs and BCRs were developed for this option only.

18.8.3 The BCR for design option 2 when assessed in TUBA version 1.9.7 is 2.788. This represents a high value for money, with significant benefits over and above the estimated costs. The overall effect on results by using TUBA version 1.9.8 instead of version 1.9.7 is a drop in BCR as most of the modelled journeys are short (less than 50km) resulting in proportionally less travel time benefit. The BCR for design option 2 is 2.345, which represents high value for money. The relative benefits of the three Do-Something options remains broadly similar as seen in version 1.9.7.

18.8.4 Option 1 has a greater PVB than Option 2, which in turn slightly outperforms Option 8 although the difference in PVB is less than 3% between all three options. Without detailed PVCs to compare to the PVBs, it was not possible to deliver reliable BCRs or VfM categories for these options.

18.9 Non-Monetised Benefits

18.9.1 The qualitative element of the economic assessment outlines the potential use benefit of impacts which have not been monetised at this stage. It is recognised that there is the potential for benefits to be derived from the scheme, including:

- Benefits in journey time savings will improve resilience and reliability which directly affect journey quality, predominantly associated with traveller stress;
- The increase in reliability results in fuel efficiencies for all users and;
- The improvements in journey times may benefit the users of facilities located nearby the scheme.

19 Assessment Summary of Sifted Options

19.1 Introduction

19.1.1 At the end of PCF Stage 1, as instructed by Highways England, the reporting process was drawn to an early conclusion in order to facilitate governance and decision making process. Therefore, an assessment summary and comparison of the options was deferred and agreed to be undertaken early in PCF Stage 2. It was intended that these would be fully produced once this information was available as an addendum to this report, but events in PCF Stage 2 superseded this approach (see Chapters 20 & 21).

19.2 Appraisal Summary Table (ASTs)

19.2.1 At the end of PCF Stage 1 only one AST was produced for Option 2, this can be found in Appendix 20.

19.2.2 As stated above the option comparisons were not completed. As a result AST's for Option 1 and 8 were not produced.

19.3 Engagement with Public Bodies

19.3.1 A summary of completed stakeholder engagement during PCF Stage 1 that included Highways England is detailed below.

19.3.2 For details of stakeholder engagements completed during PCF Stage 2, please refer to Chapter 32.

Fenland District Council (FDC) and Cambridgeshire County Council (CCC)

19.3.3 A few meetings were held with FDC and CCC during PCF Stage 1, where discussions took place around the A47 Guyhirn junction, the programme, progress and details of the options, including meetings with Technical Officers.

- 23 October 2015 – Initial discussions regarding PCF Stage 1
- 07 March 2016 – A47 Programme Progress
- 11 August 2016 – Technical Officers Meeting to discuss options
- 13 September 2016 - Meeting with Councillors to discuss A47 Programme progress

Peterborough City Council (PCC)

19.3.4 A meeting was held with PCC Councillors on 13 September 2016 where discussions regarding the key option constraints were discussed for A47 Wansford to Sutton dualling and Guyhirn Schemes.

Environmental Bodies

19.3.5 An initial meeting with local Environment Agency and Internal Drainage Board (North Level District, Middle Level District and Waldersey District) stakeholders that cover the Guyhirn area was held on 25 August 2016 where discussions were held regarding the options being considered at Guyhirn and information was gathered regarding the pumping station and surge chamber close to the Guyhirn junction.

19.3.6 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)

19.3.7 Meetings were held with PINS to discuss the relevant planning conditions that need to be taken into consideration for all the A47 Schemes including Guyhirn as per the below.

- 20 April 2016
- 21 June 2016
- 13 July 2016

A47 Alliance

19.3.8 Meetings were held with the A47 Alliance on 26 January 2016 and 12 July 2016 when discussions regarding the A47 Programme and schemes contained in this including Guyhirn, were completed.

Members of Parliament

19.3.9 There were a number of meetings with Members of Parliament where details of the A47 Schemes have been discussed as per the below.

- 19 January 2016
- 07 July 2016

20 PCF Stage 1 Conclusions and Transition to PCF Stage 2

20.1 Stage 1 Conclusions

20.1.1 The PCF Stage 1 work confirmed the transport problem as being Guyhirn junction is predicted to be over capacity by 2021 on the A47 approaches. By 2036 the problem will be further exacerbated by the potential future developments in the area which are noted within the Fenland 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 The three sifted options, Options 1, 2 and 8, all resolve the transport problem in so much that they will increase the junction capacity at Guyhirn and should allow for a safer, swifter movement of traffic through the junction.

20.1.4 Indications from the limited economics information available at the end of PCF Stage 1 were positive in that a high BCR (2.79 for Option 2) value was expected. A comparison with other options' BCR's was not possible at the end of PCF Stage 1 due to the lack of available commercial information from Highways England for the remaining sifted options (Options 1 & 8).

20.1.5 Equally, there were a number of areas identified for improvement that would need further investigation as the Scheme progressed to PCF Stage 2, they included: ensure these are covered off in later sections

- The designs taken forward to PCF Stage 2 would need to be developed 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 (during PCF Stage 3 if required) giving greater understanding of the impacts on the sensitive designated sites in the area.
- Greater understanding of the impacts on the existing surge chamber and culvert in the area, in particular the potential requirement to move the surge chamber depending on option chosen.
- An appropriate level of flood risk assessment to assist and determine the preferred route.
- 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 the junction.
- Buildability of the options and understanding the arrangements in regards to Traffic Management required during construction to minimise disruption.
- Affordability and Value Management – A Value Management exercise (see Chapter 22) would be carried out with the buildability contractors early in PCF Stage 2 and the outputs detailed in the Value Management Workshop Report, document reference A47IMPS2-AMY-GJ-ZZ-DO-J0041. Further value management interventions will be carried out as the Scheme progresses to refine the Scheme costs.

20.2 Transition to PCF Stage 2

20.2.1 As explained in 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 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).

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 12, 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 three 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 which was reported to the SGAR by the production of a Technical Note, this was on the understanding that detailed estimates for the three options 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 agreement from the Investment Decision Committee (IDC), held in December 2016.

20.2.6 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 for sign off prior to public consultation launch.

20.2.7 A process of value management and an affordability review was therefore undertaken. This allowed a review of the construction cost estimates provided by HE 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.

20.2.8 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-GJ-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-GJ-ZZ-DO-J0041.

21.2 PCF Stage 1 Cost Estimates

21.2.1 During PCF Stage 1, on the basis that all three options would be estimated in further detail in PCF Stage 2, it was decided to undertake a single estimate for the scheme based on one of the route options which could be used to assess the overall viability of the scheme in terms of cost.

21.2.2 More detailed cost estimate information was supplied early in PCF Stage 2. The initial available cost estimate information at the end of PCF Stage 1 indicated that the options were not economically viable. A summary of the cost estimates provided is detailed in Table 21-1 below.

Table 21-1: Guyhirn Cost Estimates

Option	Range Min (£M)	Range Most Likely (£M)	Range Max (£M)
1	£31.1	£48.2	£70.1
2	£16.7	£20.6	£29.5
8	£25.0	£35.8	£55.3

21.2.3 The PCF Stage 1 range estimate undertaken for Option 2 gave a most likely outturn cost of £20.6m which was in excess of the Feasibility Study range estimate of £11M - £17M.

21.2.4 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-GJ-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 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.

21.3.4 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

21.3.5 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.
- 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.

21.3.6 The updated design as a result of the VM exercise can be seen in Appendix 21 and the revised Bill of Quantities (BoQ) as a result of the VM exercise submitted to Highways England for commercial estimating can be seen in Appendix 22.

21.3.7 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.

21.3.8 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)
£20.6	£12.0	£8.6 (+/- 25%)

21.3.9 Cost Planning advised the project teams, in advance of issuing the figures, that the figures provided were highly indicative and carried a low level of assurance. The information provided did not represent a standard Commercial Services Division output and should not be treated as such.

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 high 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.

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 Chapters 10 and 11 of this report. The changes made at Value Management Deep Dive review have not changed the option alignment.

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 PCF Stage 2 Assessment

21.5.1 The information detailed in the VM exercise above was presented to senior Highways England members at the Project Review meeting held on 14th February 2017.

21.5.2 The high costs described above were primarily as a result of the significant constraints present at the site (the River Nene bridge, ground conditions and the sensitive designated environmental areas at the site) limiting options and inflating design option costs.

21.5.3 The VM exercise identified significant savings on the construction costs for Option 2 and this was compared to the sifted options in PCF Stage 1 to confirm the suitability of the revised option. This is summarised in Table 21-4 below.

Table 21-4: Early PCF Stage 2 Sifting

Option	Option taken forward to Public Consultation	Comment
Option 1	No	• High environmental impact on designated sites due to bridge widening • High cost due to bridge widening • Extended construction duration and disruption
Option 2 (amended)	Yes	• Least environmental impact on designated sites • Most affordable and viable option • Solves the transport problem
Option 8	No	• Significant environmental impacts due to new bridge • High cost due to new bridge construction • Long construction duration

21.5.4 The high costs of the proposed options and the results of the VM exercise described above meant that the options that were identified as not being economically viable would not be pursued any further. This was confirmed at the Project Review meeting and meant that Options 1 and 8 were not progressed.

21.5.5 At the Project Review meeting, it was confirmed that the amended Option 2 should therefore be focussed upon and progressed throughout PCF Stage 2 and that this option should be

presented to the public at the non-statutory public consultation in March and April 2017 to gauge public opinion.

22 Option Renumbering for Consultation

22.1 Option Numbers for Assessment and Consultation

22.1.1 As there was only one option viable to take forward to public consultation (Option 2), we renamed that option, Option 1 to avoid the potential for option numbering to cause confusion. This option will be only be referred to as Option 1 for the remainder of this report.

22.1.2 The non-statutory public consultation period for the single option taken forward was Consultation period 13th March to 21st April 2017, with the consultation events held between 16th and 18th March 2017.

23 Engineering Overview of Remaining Option

23.1 Introduction

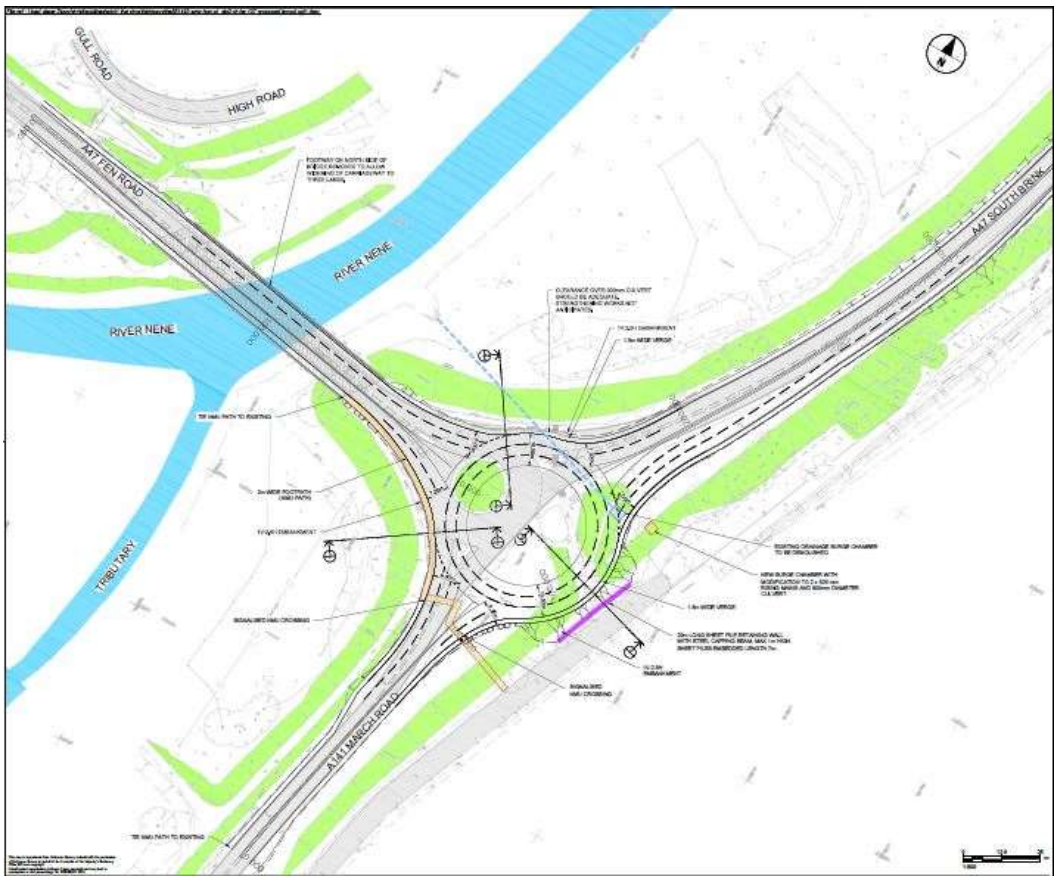
23.1.1 The following sections describe the engineering features and assessment of the amended design of the remaining option from the VM exercise described in Chapter 21 and updates the information described in Chapter 13.

23.2 Highways and Alignment

23.2.1 Option 1 layout was developed from the work undertaken during PCF Stage 1 as part of the ongoing solution development. The amendments described during the VM exercise (Chapter 21) above (and shown in Appendix 21) were taken forward for further assessment.

23.2.2 The final proposed layout (updated from the Value Management exercise) is shown on drawing HE551493-AMY-HGN-GJ_STG2-DR-HE-107 and cross sections shown on drawing HE551493-AMY-HGN-GJ_STG2-DR-HE-108 in Appendix 23 & 24 and in Figure 23-1 below.

Figure 23-1: Option 1 Layout



23.2.3 The roundabout has been designed nonconcentric to the existing with an overall shift of the horizontal alignment to the east to allow the carriageway over the River Nene bridge to be widened without the need to undertake structural modifications to widen the bridge.

23.2.4 The A47 Fen Road eastbound approach widens from a single 3m lane to two 3.35m lanes across the existing bridge and then widens to three 3.0m lanes in eastbound direction on the immediate approach to the proposed roundabout. The westbound exit from the roundabout

comprises two 3.6m lanes that merge to a 3.35m single lane in advance of the existing bridge. The widened carriageway is accommodated on the existing bridge.

23.2.5 The A47 South Brink Road approach arm from the north widens from a single lane to two 3.0m lanes in the southbound direction and then widens to three 3.0m lanes in advance of the proposed roundabout. The northbound exit from the roundabout on this arm comprises two 3.65m lanes merging to one lane at the scheme extent to the north.

23.2.6 The A141 March Road approach arm widens from single lane to three 3.0m lanes in the northbound direction at the proposed roundabout. The southbound exit on this arm comprises two 4.1m lanes merging to one lane at the scheme extent to the south.

23.2.7 The circulatory carriageway of the proposed roundabout has a consistent width of 10.5m comprising three lanes.

23.2.8 Option 1 requires land take and the relocation of NMU paths with the introduction of a signalised NMU crossing over the A141 March Road. The NMU footpath on the north side of the A47 Fen Road River Nene bridge will be removed to allow the carriageway to be widened as described, leaving NMU's to utilise the footpath on the south side of the A47 Fen Road River Nene bridge that will be retained.

23.3 Departures from Standard

23.3.1 The minimum Stopping Sight Distance (SSD) achieved on A47 Fen Road on the eastbound approach to the roundabout does not meet the required minimum SSD for a 70kph design speed, as per TD9/93, due to the existing substandard vertical alignment over the bridge. The crest curve has a radius that is less than 2000m; to provide a compliant SSD the crest curve would have to be a minimum 3000m radius.

23.3.2 The provision of a 3000m radius crest curve is not considered feasible as it would require as a minimum the complete reconstruction of the bridge deck to achieve the new road levels and may even require the reconstruction of the whole bridge. This would also result in extension of the project extents at the western end to tie into the existing road levels. The new roundabout would also have to be constructed approximately 1.2 metres higher than the existing roundabout. The potential mitigation to reduce the impact of the departure would probably be to provide adequate warning signage, high friction surfacing on the approach to the roundabout and possibly the introduction of rumble strips.

23.3.3 At the time of writing, no departures have been applied for but this information is contained in the PCF Stage 2 product, Departures from Standards Checklist, document reference number A47IMPS2-AMY-GJ-ZZ-DO-J0050. This will be updated and progressed early in PCF Stage 3.

23.4 NMU Provision

23.4.1 Please refer to Chapter 13.4 that gives details of the NMU provision for the Option. This has not changed from the information provided for PCF Stage 1.

23.4.2 An NMU context report (document reference A47 IMPS2-AMY-GJ-ZZ-DO-J-0059) has been prepared during PCF Stage 2 in accordance with HD 42/05 and HD 42/17 and will inform the preparation for a future NMU Audit in later PCF Stages.

23.5 Drainage and Flooding

23.5.1 Option 1 shall not alter the locations of the road drainage outfalls. It is assumed that the proposed drainage will be by gullies and carrier pipe and will join into the existing carrier pipe to the outfall; provided the carrier pipe has adequate capacity.

23.5.2 It is estimated that there will be an increase in impermeable area (on plan) of 2,000m^2; approximately 400m^2 to the southern outfall and 1,600m^2 to the northern outfall. If the entire redundant road is soft landscaped (200m^2) then the net increase in impermeable area is 1,800m^2. It is anticipated that the new drainage will incorporate over-sized pipes to store the increase in run-off due to the proposed works and that flow control devices will be incorporated (orifice plates or hydro-brakes) to ensure the outfall flows do not exceed the current flows.

23.5.3 The additional length of new road drainage is estimated to be 300m.

23.5.4 It is not anticipated that the proposed enlarged roundabout shall create significant extra loading on the IDB outlet culvert (that runs below the A47 South Brink), but this shall be verified at later stages of the design. Record drawings show that there is an existing outfall bay and headwall at the downstream end of the culvert with a single non-return flap valve and a 1.5m diameter inspection chamber on the culvert at the toe of the embankment on the west side of the A47. The proposed works shall not impact on these assets.

23.5.5 The existing IDB surge chamber on the east side of the A47 lies within the footprint of the proposed road works, therefore a new surge chamber shall be required, located in the embankment to the south-east of the existing chamber.

23.5.6 At this stage it is anticipated that all alterations to IDB assets shall be completed in advance of the proposed road works and shall be sequenced such that any isolation or temporary reduction in pumping capacity of the Ring's End pumping station (PS), due to the construction of the alterations, is kept to a minimum. All alterations including the sequencing and any isolation or temporary reduction in pumping capacity shall be approved by the IDB. The IDB has indicated that there is another pumping station south of Ring's End PS that drains an adjacent catchment. As a temporary measure, when Ring's End PS is at a reduced capacity during alteration work, it may be possible to connect the catchments to reduce the demand on the Ring's End PS. This will be determined in future stages.

23.5.7 It is anticipated that the new surge chamber shall be constructed off-line from the existing mains and culvert to maximise the time that the existing arrangement is operable during construction of the new facilities. The sequence of proposed alterations to the IDB assets is currently proposed as follows:

- With Ring's End PS fully operable:
  - in verge on east side of junction excavate and expose culvert
- With Ring's End PS isolated for a limited period (to be agreed with IDB):
  - remove section of existing culvert and insert oblique angle junction fitting (900mm diameter concrete) with temporary stopper in branch section
- With Ring's End PS fully operable:
  - construct new surge chamber off-line
  - without making connection to new junction fitting on culvert construct outlet (900mm diameter concrete pipe) from the new surge chamber
  - without making connections to the existing rising mains construct new dual PE rising mains (630mm outside diameter) from Ring's End pumping station to the new surge chamber
- With Ring's End PS isolated for a limited period (to be agreed with IDB):
  - remove temporary stopper in branch section of junction fitting and make connection
- With pump nr.1 at Ring's End pumping station isolated for a limited period (to be agreed with IDB):

- make rising main connection to pump nr.1
- bring pump nr.1 back into operation

- With pump nr.2 at Ring's End pumping station isolated for a limited period (to be agreed with IDB):
  - make rising main connection to pump nr.2
  - bring pump nr.2 back into operation

- With Ring's End PS fully operable:
  - demolish and remove original surge chamber and redundant lengths of rising main and culvert

Flood Risk Assessment

23.5.8 Investigations were undertaken regarding the need for a Flood Risk Assessment (FRA) due to the proximity of the River Nene, flood defences around the site and the proximity of the IDB surge chamber, pumping station and culvert.

23.5.9 As described above and in this section, the drainage proposals are not anticipated to have an adverse effect on the existing IDB assets beyond relocating the existing surge chamber.

23.5.10 Taking all this into consideration, given that the site lies within Flood Zone 1, there is no evidence of historic flooding and the flood levels from the River Nene for this location do not impact upon the roundabout, it is considered in accordance with National Planning Policy Framework (NPPF) that the site is suitable for the proposed development and will not increase flood risk elsewhere and therefore a full FRA was not required. This will need to be continually reviewed as the scheme progresses through later PCF Stages and as more information is known regarding the construction methodology.

23.5.11 This was the position declared to the EA in August 2017.

Geotechnical Considerations

23.5.12 The superficial geology underlying the junction comprises Flandrian Age alluvium deposits which extend from the original ground surface to a depth of approximately 10m to 12m below the original ground level. The thickness of the existing embankment fill varies but was recorded at up to 5.5m thick (Foundation & Exploration Services Ltd, 1990).

23.5.13 Ground investigation data is available from the construction of the existing roundabout in the 1990s and settlement monitoring records are included in the geotechnical feedback reports. However, the alluvial deposits have been modified by previous engineering works and therefore their properties and engineering behaviour, as provisionally indicated by the recent June 2017 investigation works, suggests that the ground is soft to very soft and likely highly compressible. This is due to the presence of peat and soft silt and clay layers beneath the embankment fill. Further detail regarding the Ground Investigation works conducted in June 2017 can be found in the Ground Investigation Report, document reference A47IMPS2-AMY-GJ-ZZ-DO-J0062, HAGDMS reference 29843.

23.5.14 Based on BH 1, BH 2/2A and BH 3 (Embankment Construction: Report on Site Investigation, HAGDMS Ref. No. 8269) a peat horizon (probably of the Nordelph Peat Member) of varying thickness (0.30m to 0.55m) is present approximately 8m below the surface of the embankment. Variability in the lateral extent of the peat may be problematic due to its compressibility leading to significant differential settlement.

23.5.15 Below the superficial alluvial deposits, the Oxford Clay Formation is expected to be encountered at between 11m and 16m below ground level on the west of the junction and 12m on the east side.

23.5.16 For the engineering assessment, the following ground model (see Table 23-1) has been assumed for the Guyhirn junction.

Table 23-1: Ground Model

Strata	Typical thickness (m)	Typical description	Comments
Made Ground/ Topsoil/Fill.	5.5m.	Embankment fill.	Silty clay fill with basal drainage blanket.
Terrington Beds.	2.3 – 3.0m.	Cohesive material. Soft to firm, sandy/clayey SILT, occasionally with organic matter.	Organic debris and/ or peat layers and lenses might occur within the formation.
Nordelph Peat	0.2 – 0.5m.	Soft to very soft PEAT.	Discontinuous layers.
Barroway Drove Beds.	Up to 11m.	Cohesive material. Very soft to stiff silty CLAY, occasionally with gravels towards the base and with lenses and/or horizons of peat.	Silt roddons might be encountered within this formation.
Boulder Clay (Glacial Till).	2.3 – 3.0m.	Stiff to very stiff silty CLAY with variable amounts of gravel.	Possible River Terrace (Note 1).
Oxford Clay.	Not proved.	Firm to very stiff fissured laminated silty CLAY.	Weathered mudstone. Pyrite might be present.

Note 1 - Older Reports Embankment Construction: Report on Site Investigation Ref No. 8269 & Geotechnical Feedback Report Ref No. 8271) describe this formation as Boulder Clay. The more up to date Geotechnical report (Ref. No. 19205) does not mention this formation and describes it as Terrace Gravels and probably as part of the upper unit of Oxford Clay.

23.5.17 Groundwater levels during the June 2017 investigation were recorded between 2.5m AOD to -6.5m AOD i.e. indicating that the level is variable though is likely to be at or near ground level due to the proximity of the river. The variability in the recorded depths is assumed to be caused by pumping from the adjacent fen.

23.5.18 Further information regarding ground conditions for the scheme can be found in the PCF Stage 2 Product, Preliminary Sources Study Report, document reference A47IMPS2-AME-GJ-ZZ-DO-J0049, HAGDMS Ref No. 29495.

23.5.19 The proposed design will require widened embankments. The widened embankments will induce large settlements due to consolidation of the soft alluvial deposits and peat, potentially causing disruption to the existing infrastructure, including the existing road pavement, river bridge, buried services and culvert that crosses under the A47 immediately north of the roundabout. Geotechnical solutions including preloading, surcharging and the use of lightweight fills may be considered to manage settlements. However, to allow construction with minimal impact on the existing infrastructure, a piled load transfer platform is considered as the preferred solution for this scheme. Once detailed data on ground conditions is available the use of other techniques to reduce settlements should be further evaluated at later stages of the design.

23.5.20 An indicative section through the proposed load transfer platform for Guyhirn junction is shown in Figure 23-2 below.

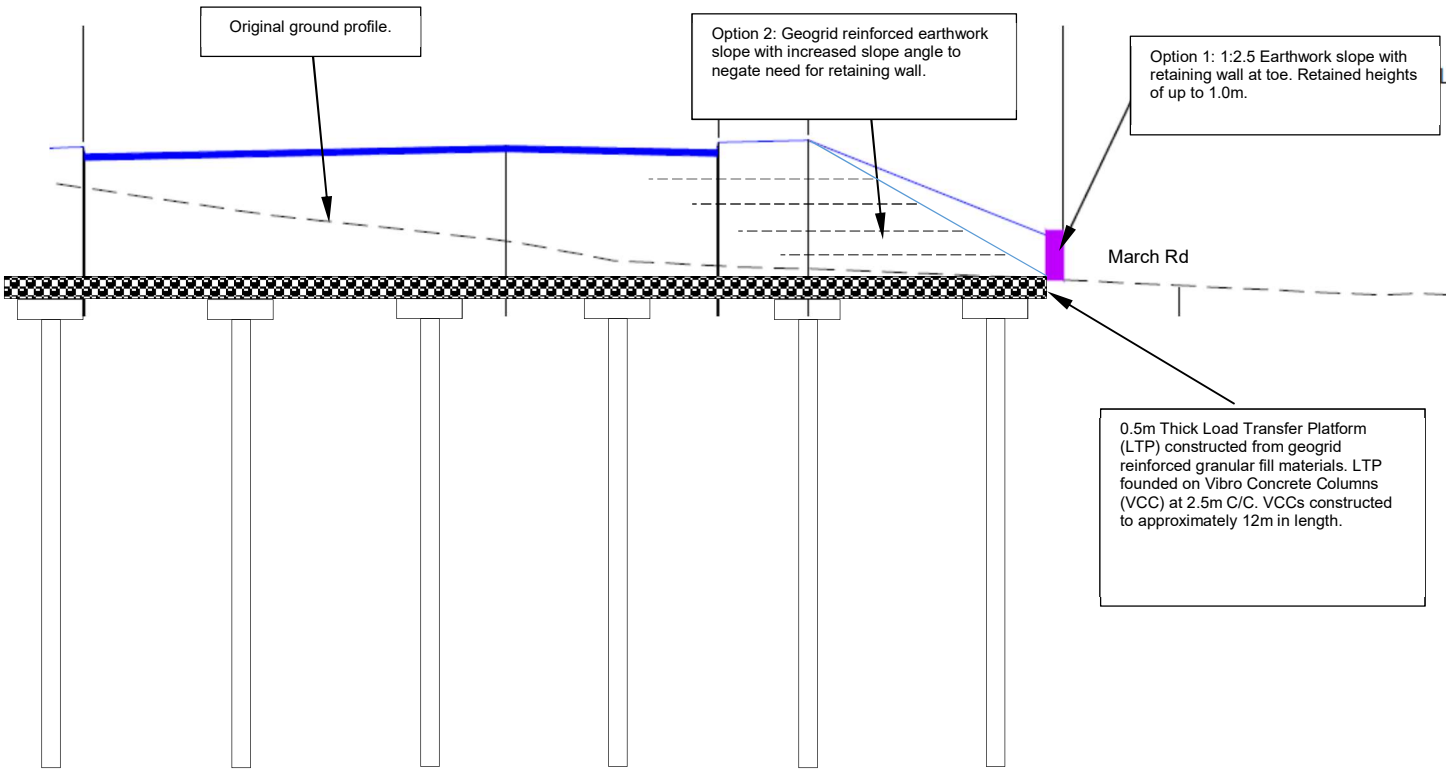
23.5.21 Current option geometry dictates the modification of existing earthworks to accommodate the new junction arrangement. Generally, these earthwork modifications are likely to be achieved through the addition of small volumes of fill material to existing embankment slopes and are unlikely to necessitate any further geotechnical solutions to be implemented. However, the geometry of Option 1 requires significant volumes of fill materials to be placed upon the shallow embankment slope to the east of the roundabout. This fill material will further surcharge the soft, compressible soils beneath the earthworks and measures will be required to limit settlements.

23.5.22 The outline design for this area comprises a 500mm thick geogrid reinforced load transfer platform supported on Vibro Concrete Columns (or similar piled/ground improvement solution) at 2.5m centres. The Vibro Concrete Columns (VCCs) will be founded in the Oxford Clay below 12m depth. The load transfer platform is typically 16m and 40m in length requiring approximately 119 No. VCCs.

23.5.23 The side slopes for the widened embankment are proposed at 1(v) to 2.5(h) to allow flexibility in selection of fill material. Currently, this proposed slope geometry would impact upon local access March Road to the east of the works and therefore measures will be required to modify the slope geometry along the eastern edge of the Load Transfer Platform. Two options considered viable solutions for this area; a sheet pile retaining wall with retained heights of approximately 1.0m, or the construction of a geogrid reinforced embankment slope allowing a steeper earthwork slope to be constructed. Both of these options are outlined in Figure 16-2.

23.5.24 One area of particular concern is the culvert that crosses the site leading to the Ring's End PS. Additional fill in this area may lead to significant settlement of the structure. If the depth of fill required in this area is small and the culvert is reasonably robust, the use of a lightweight fill could be considered. However, if significant loading is anticipated a piled slab would be required over the culvert.

Figure 23-2: Typical section through load transfer platform



23.6 Structures

23.6.1 Option 1 accommodates three lanes of traffic across the width of the existing River Nene Bridge by widening the carriageway and reducing the width of the existing northern verge to 0.6m and thus terminating the footway on the north side of the bridge.

23.6.2 See drawing HE551493-AMY-HGN-GJ-STG2-DR-HE-120 in Appendix 25 for initial details of the proposed carriageway modifications on the bridge.

23.6.3 Option 1 does not require any works to widen the existing structure.

23.6.4 A structural assessment of the bridge was carried out in PCF Stage 1 by AECOM in July 2016 (Refer to Report HE551493-ACM-SBR-GJ-TN-SE-00003 in Appendix 1). The report confirmed that the existing superstructure is adequate to accommodate the proposed carriageway layout, subject to validating the assumptions made in this assessment through visual inspection. Therefore, no structural works are anticipated.

23.6.5 Due to the nature of the proposed option, it is likely that significant temporary traffic management would be required and careful phasing of the works to ensure that disruption for road users during construction works is kept to a minimum.

23.6.6 Service utilities in the northern verge would need to be relocated. Consideration should be given to any abandoned apparatus that could be removed. Requirements for the apparatus diversions should be discussed with the affected service providers as the scheme progresses.

23.6.7 It is not anticipated that the proposed enlarged roundabout would result in significant extra loading on the IDB outlet culvert located to the north of River Nene Bridge, but this shall be verified at later stages of the design.

23.7 Public Utilities

23.7.1 C2 enquiries were submitted and details received, C3 estimates have been obtained for the diversion of utilities in the vicinity of Guyhirn junction. Further statutory undertakers requests will be made in future stages to check for detailed positions of utilities and to obtain more accurate estimates for utility diversions.

23.7.2 The services for Anglian Water, BT, UK Power Networks and Virgin Media are affected by the remaining option. Consulting statutory undertakers, C3 estimates showed an approximate cost of £201,500 (excluding VAT) to divert or upgrade the utilities to accommodate the preferred option.

23.7.3 Further detail regarding the location and impact on utilities identified can be found in the PCF Stage 2 product Statutory Undertakers Estimate, document reference A47IMPS2-AMY-GJ-ZZ-DO-J-0037.

23.8 Topography, Land Use, Property and Industry

23.8.1 There should be minimal change in elevation of the existing road. The existing roundabout approaches are built on embankments, which act as a flood defence.

23.8.2 Changes in topography will be limited to embankment widening to accommodate a larger roundabout and widened approaches. The scheme will need to maintain a buffer between any

relocated or widened carriageway and the existing vegetation between the A47/A141 and the local access March Road to the east, which acts as a local access road to a group of residents.

23.8.3 New carriageway area increases by approximately 2,000 m^2. Additional 1.5m verges and NMU paths increase the total footprint area of the preferred option. Only one landowner, the Environment Agency, is affected with a total required permanent land take area of approximately 650m^2. As a result of the relocation of the roundabout, the bulk of the land take is on the east side of the junction.

23.9 Buildability

23.9.1 Option 1 has potential issues regarding buildability and temporary works associated with the construction sequence. Highways England has procured the advice of a CDF Lot 3b Framework contractor to provide early contractor involvement (Taylor Woodrow).

23.9.2 The framework contractor has provided feedback on construction of the project and phasing of the works including suggested temporary traffic management measures to achieve this.

23.9.3 A construction methodology was developed for the current scheme design which accounts for the relatively isolated location of Guyhirn roundabout and therefore avoids closures as far as is practicable. A seven-phase construction plan is currently proposed with the duration, construction activities and associated temporary traffic management (TTM) associated with each phase shown in Table 23-2. The dates shown are indicative and have been used to determine construction phase durations. Actual dates of works will be confirmed after the award of the construction contract.

Table 23-2: Guyhirn scheme construction methodology

Phase	Start date	End date	Actions and TTM impacts
1	4/3/2020	31/3/2020	Construction of new roundabout: narrow lanes on the east and southwest of the existing roundabout and its approaches
2	1/4/2020	7/10/2020	Construction of new roundabout: narrow lanes on the east and northwest of the existing roundabout and its approaches
3	8/10/2020	16/11/2020	Removal of existing roundabout: traffic partially using new roundabout with circulatory carriageway reduced to two lanes
4	17/11/2020	25/11/2020	Construction of splitter islands: traffic partially using new roundabout with circulatory carriageway reduced to one lane
5A	26/11/2020	1/12/2020	Surfacing and lane marking; A141 arm closed and traffic diverted via A142/A10/A1122/A1101; A47 operates under convoy working
5B	2/12/2020	7/12/2020	Surfacing and lane marking; A141 arm closed and traffic diverted via A142/A10/A1122/A1101; A47 operates under convoy working
5C	8/12/2020	11/12/2020	Surfacing, lane marking and reinstatement of access points; A47 South Brink operates under convoy working

Key Points from Buildability Contractor

- 9 – 10 month construction programme (estimated)
- Further consideration required for NMU's particularly for crossing A47 Fen Road to the west of junction
- A detailed review of drainage proposals is required

- Acoustic fencing may be needed
- Full closure of A141 is currently required (2 weeks approx. – phases 5A & 5B)

Key Risks

- Utility diversions – must be done in parallel to main works and confirmation they can be accommodated in reduced pedestrian footway on north side of bridge
- Further information required for surge chamber for temporary measures / relocation
- Culvert and rising main – further information needed as possibly unsuitable
- Pollution control measures required
- Bridge structure can accommodate extra lane of traffic
- Access to bridge through SPA – needs further consideration / mitigation
- Consents required – EA / Marine / IDB etc.

Key Opportunities

- Possibility to retain the surge chamber
- Number of gullies could be reduced through re-alignment
- Environmental benefit from improvements to drainage strategy
- Opportunity to create environmental habitat from removed spoil adjacent to March Road
- Improve local access March Road after construction by removing old tarmac and improving redundant land
- Deposit spoil to other A47 schemes

23.9.4 The construction methodology, taking into consideration the identified risks and any new risks, will be further developed as the design develops in later PCF stages and will aid screening determination that is critical to confirm the planning route to be pursued.

23.10 Effective Construction Management – Construction (Design and Management) Regulations 2015 – PCF Stage 2

23.10.1 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-GJ-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.

23.10.2 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

23.11 Operational, Technology, Safety and Maintenance Assessment

23.11.1 The information contained in this section updates the information from Chapters 14 and 15 of this report.

Operational Assessment

23.11.2 The operational assessment described in section 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

23.11.3 The Technology described in section 14.2 of this report has not been developed any further at this time and is therefore still applicable to Option 1.

Maintenance Assessment

23.11.4 Maintenance considerations have been detailed in the PCF Stage 2 Maintenance and Repair Strategy Statement PCF Product, document reference A47IMPS2-AMY-GJ-ZZ-DO-J0030.

Safety Assessment

23.11.5 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.

23.11.6 As described in Section 3.4, the accident rate remains low at this junction, with only seven reported incidents in the 5 year period (2011 – 2016), with no serious incidents recorded.

23.11.7 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-GJ-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-GJ-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.

24.2 Public Information Process

24.2.1 Following the early PCF Stage 2 affordability review (see Chapter 21), only one option 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 sections 24.3 and 24.4 of this report was developed in conjunction with Highways England 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 26.

24.3.2 The brochure includes:

- Information on the scheme proposals
- A map showing constraints around the local area

24.3.3 Contact details to enable comments to be made to Highways England. These consisted of postal address, email and website address, and telephone number.

24.3.4 A separate questionnaire document for respondents to complete and return to the Highways England was prepared.

24.3.5 Questions were asked to gain information such as type and location of user, frequency and purpose of use and to obtain feedback on the proposal 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.

24.3.6 Brochures and questionnaires were also deposited at Wisbech Library and March Tesco (after the PIE).

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 27.

Advertising

24.3.9 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, held on the 13 and 14 March 2017 for Norwich and Peterborough, respectively;
- Advertisements in local newspapers; Norwich Evening News, Eastern Daily Press, Fenland Citizen and Cambridge & Wisbech Standard;
- Interviews on local television news and radio;
- Notices posted at strategic locations around the Guyhirn and Wisbech area before the Exhibition;
- Leaflet drops were undertaken in the Guyhirn and Wisbech area;
- Notices posted at the exhibition venue on the days of the exhibition;
- A 'static' advertisement was set up at Wisbech Library (refer to section 14.4.7 for further details).

24.4 Public Information Events (PIE)

24.4.1 The Public Information Events (PIEs) were held on 16, 17 and 18 March 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. Details of the venue locations can be found in the Public Consultation Leaflet in Appendix 28.

1.1.2 The PIEs presented the scheme proposals on display boards, with a combination of drawings and descriptive text. The display material was based on the brochures, presented to a smaller scale.

24.4.3 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 Highways England using the Freepost envelope provided or complete the questionnaire online at the website detailed in the brochure.

Display Material

- The display material contained information about the scheme and the issues surrounding it, including the following:
- Welcome board (including an introduction to the scheme);
- A47 Guyhirn Junction (including details of why the scheme is needed);
- Objectives of the scheme;
- Environmental constraints plan;
- Proposed option (with a diagrammatic layout drawing of the proposed option);
- What happens next? (with board details of the overall scheme programme);
- How to respond? (with details of the various methods for completing the questionnaire).

1.1.3 In addition, plans were available to view on tables, including option drawings and Ordnance Survey base mapping.

Additional material on display

24.4.4 An additional 'static' panel was set up at Wisbech Library during the course of the consultation period and March Tesco following the conclusion of the PIEs. The panel provided details of the proposed Public Information 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

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

24.4.6 Consultation will continue with affected parties as the design progresses.

24.5 Numbers of Visitors and Responses

24.5.1 The total number of visitors that attended the exhibition is detailed in Table 24-1 below.

Table 24-1: Public Information Exhibitions Details

Venue	Date	Opening Times	Number of Visitors
Wisbech St Mary Sports and Community Centre	Thurs 16 March 2017	3pm – 8pm	11
Guyhirn Village Hall	Fri 17 March 2017	10am – 5pm	55
Wisbech St Mary Sports and Community Centre	Sat 18 March 2017	10am – 2pm	11

24.5.2 The total number of respondents to the consultation was 70, which includes several responses submitted by organisations.

25 Assessment of Consultation Responses

25.1 Introduction

25.1.1 This section describes the feedback received from the Public Consultation at Guyhirn and Wisbech.

25.1.2 Further information and more detail can be found in the PCF Product Report on Public Consultation, document reference A47IMPS2-AMY-GJ-ZZ-DR-J-0007.

25.2 Key Response Statistics

1.1.4 70 responses were received from the questionnaires, online or via email and included a number of local organisations.

1.1.5 As a result, the findings set out in the report should be treated with caution and not interpreted as representative of the views of the wider population of Guyhirn, Wisbech and the surrounding area. Nevertheless, the responses that have been received highlight a wide range of issues detailed later in this report.

25.2.1 63 people answered the question regarding whether they thought improvements were needed at the A47 Guyhirn junction. 50 (79%) of those who answered agreed that improvements were needed.

25.2.2 Congestion is the most common reason that respondents give to support the need for improvements. Many respondents comment that traffic at peak times and during summer (due to holiday traffic) is particularly bad at this junction, causing serious delays. Some comment specifically that there is not enough capacity at this junction, especially given the increase in traffic volume. Several respondents say that the level of traffic is a safety hazard, with a few respondents specifying that there is currently no room to overtake others in the case of an accident, and that it is unsafe for cyclists.

25.2.3 Those that opposed the need for improvements at the junction (13) gave a number of reasons for their opposition;

- Money should be used on dualling the A47 instead
- Junction operates fine as it is
- Problems are actually elsewhere e.g. Elme Hall roundabout in Wisbech or the B1187 Gull Road junction to the west.
- Local disruption during construction

Feedback on the proposed option design

25.2.4 36 of 64 (56%) respondents were either strongly in favour or somewhat in favour of the scheme.

25.2.5 Some respondents express support for the proposed option as they believe that it will relieve congestion at the Guyhirn junction leading to quicker journey times. A small number comment that this is the cheapest solution. A few respondents comment that the proposal to expand the road approaching the roundabout to 3 lanes is necessary as, given the River Nene; there are no alternative options for accessing the roundabout.

25.2.6 A few respondents who support the proposed option believe that it should only be viewed as a medium-term solution and many say that it should only be considered if it is part of a larger dualling scheme for the A47.

25.2.7 16 respondents (25%) said they were against the proposals.

25.2.8 Reasons for opposition included concerns over local disruption during construction, the proposed solution does not solve the issues and is not future proof, concerns over more lanes encouraging poor driver behaviour and the problems are actually elsewhere.

25.2.9 A number of people gave alternative suggestions such as installing traffic lights at the B1187 Gull Road junction, dualling the entire route instead, bypassing the junction between Thorney and Wisbech or from March to Thorney.

Feedback on NMU's

25.2.10 One question asked respondents to consider the needs of NMU's. 41 of 61 (67%) who answered this question indicate that improvements to provisions for pedestrians, cyclists, equestrians and/or other users are needed, whereas 20 (33%) indicate that they are not required.

25.2.11 Several respondents comment that the A47 Guyhirn junction is dangerous for pedestrians and cyclists. Some respondents comment that the speed and volume of traffic will increase due to the proposed improvements to this junction, making it more difficult to join the A47 for cyclists and to cross for pedestrians. Some respondents comment that there is no suitable alternative route for pedestrians and cyclists other than crossing the roundabout; a few suggest that an underpass is required. Some respondents comment that villagers are required to cross the A47 in order to reach the only local shops, and a few specify crossing B1187 Gull Road in order to reach the local café and petrol station. These respondents request that these crossings are made safer with some respondents proposing a zebra crossing. Many also comment that improved provisions are needed for those walking or cycling between Guyhirn and Rings End (and further to March) to access local amenities.

25.2.12 Some respondents comment that a path is required for pedestrians, equestrians and cyclists for crossing the River Nene. Some suggest this should be included in the widening of the bridge while others suggest that a separate route should be considered. A few respondents express concern that the current footpath on the bridge will be removed as part of the proposal.

25.2.13 Many respondents comment on the current difficulty accessing buses at this junction, for example the X1, and call for this to be improved. Several respondents comment that provisions for non-motorised users at this junction need to be considered to allow for more sustainable transport methods.

25.3 Key Stakeholder Responses

Cambridgeshire County Council (CCC)

25.3.1 CCC are supportive of the scheme.

25.3.2 They state however that roundabouts with more approach lanes and more circulatory lanes tend to have worse safety records. It further notes that the additional capacity sought may be constrained by the merge back to one lane from two after the exits from the roundabout, where driver behaviour can mean that some drivers will be reluctant to use all of the capacity that is nominally provided.

25.3.3 The Council is supportive of improvements to the Guyhirn junction but believes that additional work is needed to provide more detail on safety and capacity, environmental and flooding impacts before it could consider formally endorsing an option.

25.3.4 They also generally seek more information and comment that not enough information was provided in the consultation material, particularly in regards to discarded options.

Fenland District Council (FDC)

25.3.5 FDC are supportive of the scheme.

25.3.6 They state that 'FDC supports the aim and objectives of this consultation and the delivery of schemes to improve the A47. We also support the objectives of this specific A47 scheme as set out in the consultation leaflet. Improvements to the Guyhirn roundabout will improve the local highway. As a location where two roads with high volumes of traffic meet, this is a strategic location on the network'.

25.3.7 FDC also request further information before they can fully endorse the scheme.

25.3.8 They also state that they are a partner of the A47 Alliance and share the aims of the A47 from Peterborough to Great Yarmouth becoming a dual carriageway.

Middle Level Commissioners – Waldersey Internal Drainage Board (IDB)

25.3.9 The Waldersey IDB made significant comment regarding the potential for affected organisations and raised a number of issues that need to be considered and addressed.

25.3.10 They state that previous engagement with the commissioners has been completed but detailed information regarding those discussions could not be found and so request further information.

25.3.11 Middle level commissioners are a statutory water level and flood risk management authority responsible for the maintenance of major watercourses within their catchment. They provide a planning consultancy service to the IDB's within and adjacent to their area. The commissioners and associated boards are Risk Management Authorities identified by DEFRA. Four water level and flood risk management authorities are involved at Guyhirn, these being:

- EA – scheme crosses and scheme adjacent to Nene River and close to Whittlesey washes. They require access to their system at all times. Planning Liaison team based at Bramption Office.
- North Level District IDB – Primarily west of site but require access to its systems. Access point for both EA and IDB is adjacent to bus stop to north of toll House at Rings End
- Waldersey IDB – District covers prime agriculture land and is at some risk of flooding but that is controlled by the IDB through operation of pumping stations and channel system.
- Cambridgeshire County Council Flood and Water Team – lead local flood authority.

25.3.12 A number of items that are of note that the commissioners raise are:

- The proposals are within the sub-catchment of Rings End pumping station and will directly affect the surcharge chamber located to the east of the roundabout
- IDB systems are protected under land drainage Act 1991 and associated Byelaws. The IDB systems are protected by a 9m wide maintenance and access strip and is subject to IDB byelaws. Works within the strip requires prior written consent. Proposal encroaches within the discharge pipeline and surcharge chamber. Works including haul roads, site offices, fencing, landscaping utilities etc. MUST be positioned outside the access strips.
- Surface water disposal and discharge consent – discharge to the system requires consent
- Related infrastructure – sewers – consultation with Anglian Water required
- Environmental Issues – Any works affecting its systems, requiring consent or that affect onsite open watercourses will require an ES and Risk Impact Assessment.
- Additional – IDB will require further discussion and provision of adequate supporting evidence such as Drainage Strategy/Flood Risk Assessment, layout plans, hydraulic

calculations, works schedule, method statements to prove no impact on local water systems prior to consent.

- Works within 9m of commissions' rivers or boards drains require prior written consent – contributions required by others is in addition. Consents likely to require Flood Risk Assessment and an ES MUST be provided to ensure no detrimental impacts on protected species/habitats. This requirement is in relation to the Byelaws and does not fulfil any DCO requirement.

25.4 Consultation Conclusions

25.4.1 The total number of respondents to this consultation was 70, which included responses from stakeholder organisations and members of the public. When being asked about the need for improvement to the A47 Guyhirn junction, 13 respondents disagree that improvements are needed while 50 are in agreement. The most common reason given my respondents for supporting the need for improvements is congestion caused by an increase of traffic over the years and a lack of capacity on this junction. Respondents comment that traffic on the junction is exacerbated by the lack of a right time from B1187 Gull Road. Those opposing the needs for improvements believe that Guyhirn junction currently works well, particularly when compared with other junctions. Respondents suggest that traffic issues are caused elsewhere, for example on the roads leading to the junction, which could be solved with dualling.

25.4.2 A total of 64 respondents comment on the proposed changes with 36 expressing support and 16 expressing opposition for the proposal. Respondents who support the proposed changes to Guyhirn junction believe that these changes will successfully improve congestion and journey times. Those who challenge the proposed changes express concern that it will lead to disruption during construction and cause 'rat runs' through villages. Others comment that the proposed changes would not address issues and could push them elsewhere. Respondents give suggestions to improve the proposal, particularly with regards to the entrance to the junction which respondents believe should be reconsiders. Those who provide alternative suggestions for improvements request that the A47 be dualled.

25.4.3 A total of 41 respondents express support for improving provision for pedestrians, cyclists and other users (NMUs) whilst 20 say improvements are not needed. Those who support provisions for NMUs comment that Guyhirn junction is currently dangerous for pedestrians and cyclists. Respondents suggest that crossing the A47 is required for residents to reach local shops and that this should be made safer. Respondents who oppose the need for provisions for NMUs comment that there is no current need case, as pedestrians and cycles do not use this junction.

25.4.4 Respondents who comment on the consultation process comment that information is missing, particularly with regards to how this proposal was chosen and why others were rejected. Respondents comment that more information should be provided with regards to environmental mitigation measures.

25.5 How Responses were taken forward

25.5.1 The responses and suggestions made by the public, summarised in this report and contained in the Report on Public Consultation, were used and considered as part of the PCF Stage 2 assessment work.

25.5.2 The feedback was also discussed at the Preferred Route Decision meeting held on 15 June 2017 that ultimately informed the Preferred Route Announcement in August 2017, see Chapter 20 for further information.

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. For PCF Stage 2, an estimate was undertaken for Option 1 which was taken forward for further assessment and consultation following the value management process described in Chapter 21. The estimate is produced to demonstrate the affordability of the project.

26.2 Options Estimate

26.2.1 Following the value management exercise undertaken early in PCF Stage 2, the revised design and BoQ for the remaining option, Option 1, was sent to Highways England commercial team for estimating in April 2017.

26.3 Review of the Estimate

26.3.1 The estimate was received from Highways England Commercial team on 13 June 2017.

26.4 Summary of Estimate

26.4.1 Table 26-1 below presents the range cost estimates for Option 1.

26.4.2 To allow for project uncertainty and risk in costs and timescales, a range of potential outturn costs were developed. Table 26-1 details the cost estimate received. The outturn costs in each scenario were estimated at:

- £8.26 million in the minimum cost scenario;
- £11.27 million in the most likely cost scenario;
- £17.21 million in the maximum cost scenario.

26.4.3 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.

26.4.4 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.

Table 26-1: Guyhirn Cost Estimates

Option	Range Min (£M)	Range Most Likely (£M)	Range Max (£M)
1	£8.3	£11.3	£17.2

26.4.5 The scheme construction costs for the updated design are included in Table 26-1. Costs have been separated into preparation, supervision, works and lands costs over the life of the scheme between the present and the scheme opening year of 2021. All sunk costs incurred in previous stages of the PCF have been excluded for the assessment as per WebTAG Unit A1.2 “Scheme Costs”.

26.4.6 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-GJ-ZZ-DO-J0041

26.5 Derivation of Costs for Economic Assessment

26.5.1 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 by HE 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 Guyhirn scheme at base year values and prices

Cost type	Total expenditure	Percentage of cost spent in			
		2017	2018	2019	2020
Preparation	£ 1,621,943	35.9%	25.1%	37.9%	1.2%
Supervision	£ 315,660	0.0%	0.0%	0.0%	100.0%
Works	£ 5,889,602	0.0%	0.0%	0.0%	100.0%
Land	£ 53,407	0.0%	0.0%	0.0%	100.0%
Total	£ 7,880,612	7.4%	5.2%	7.8%	79.7%

26.5.2 Further information on the economics assessment for the Option is contained in Chapter 29.

27 Preferred Route Decision

27.1.1 Highways England undertook a detailed programme review of PCF Stage 3 and determined that in order to meet the March 2020 proposed start on site date that PCF Stage 3 work would need to commence in September 2017. To facilitate a September 2017 start of PCF Stage 3, the preferred route would need to be announced in mid-August 2017. In order to give sufficient time for internal Highways England governance, preparation of PRA leaflets and DfT reviews, a preferred route decision (PRD) would be required by mid-June 2017.

27.1.2 The purpose of the PRD was to ensure all evidence available at the time was presented and discussed with all views aired and recorded, including expectations for Preferred Route Announcement.

27.1.3 The Preferred Route Decision (PRD) meeting was held on 15 June 2017 with representatives from Highways England and Amey to discuss the process to date including analysis of the option presented at the PIE's earlier in PCF Stage 2. The goal of the session was to make a recommendation as to whether the sifted and assessed option (Option 1) should progress as the Preferred Route and so ultimately be declared to the public as such at the Preferred Route Announcement, planned for 14 August 2017.

27.1.4 The agenda for the meeting included reviewing baseline information, the identified problem, the constraints of the site, the options considered during earlier stages, current status including PCF Products, the planning route, the public information events and outcomes, cost information, buildability and a review of the assessments including the process to get to the single sifted option (Option 1). The outcome of the PRD was an unqualified decision on the preferred route.

27.1.5 The historical, baseline, constraints and previous options including the process undertaken to get to the single option (Option 1) has been described in Chapters 1 – 13 of this report. The presentation used to illustrate and supplement the discussions can be found in Appendix 30.

27.1.6 The below sections describe the main items from the meeting agenda that were discussed and not outlined in other areas of this report, further detail can be found in the meeting minutes in Appendix 31.

27.2 PCF Products

27.2.1 Due to the timing of the PRD meeting being part way through PCF Stage 2, not all of the PCF Stage 2 information assessments and reporting were available to inform the meeting. A list of PCF Stage 2 Products and their status was tabled and discussed. The table shows the status of each of the products which are complete, or incomplete including limitations. Refer to Appendix 32 – 'Exceptions and Limitations Document -A3 - Rev A'.

27.2.2 Complete PCF products included:

- Appraisal Specification Report (ASR)
- Traffic Data Collection Report (TDCR)
- Local Model Validation Report (LMVR) (operational model [Paramics] produced subsequently)
- F10 Notification of Construction Project
- Preliminary Sources Study Report (PSSR)
- Public Consultation Leaflet
- Public Consultation Publicity Checklist
- Public Consultation Exhibition Checklist

27.2.3 The remaining products were DRAFT. Refer to Appendix 32 – 'Exceptions and Limitations Document -A3 - Rev A' for further detail.

27.2.4 Where assessments were incomplete at the time of PRD, they were supplemented with PCF Stage 1 assessment information and/or qualitative assessments. The limitations and risks of making an early decision based on the available information were highlighted to the PRD workshop to allow an informed decision to be made.

27.3 Previously Discounted Option

27.3.1 As described in Chapter 15, during the PIE's, a number of respondents raised concerns regarding the junction of the B1187 Gull Road / A47 Fen Road approximately 350m west of the main Guyhirn junction, but outside the extent of the scheme and proposed works.

27.3.2 The traffic movements at this junction and the interaction with the main Guyhirn junction described in this study, appeared to be an issue for local residents and so a discussion was held regarding the previously discounted option (Option 4) that had been developed further during PCF Stage 2 following comments obtained at the PIE. This option had performed well during PCF Stage 1 and so warranted a review. A technical paper was produced by Amey which formed the basis of discussions at the meeting, see Appendix 33.

27.3.3 Option 4 was revisited again following the VM exercise as a potential local option and discussions were held regarding a possible 'hybrid' option combining the enlarged roundabout with a remodeling and signalised B1187 Gull Road junction. It was noted that the likely costs of this option would be comparable to those that were progressed to PCF Stage 2 (options 1, 2 & 8).

27.3.4 Option 4 (see Figure 9-4) performed well against the traffic models and was comparable in regards to levels of engineering and impacts on the environment to the options progressed from PCF Stage 1 (Options 1, 2 & 8).

27.3.5 The issue with this option concerned the users from the B1187 Gull Road. This junction was remodeled a few years ago, to ban right turns for those exiting the B1187 Gull Road onto the A47 Fen Road heading west towards Peterborough due to accidents at this junction, therefore it was changed to a left in left out arrangement. This means that any traffic leaving Guyhirn village wishing to travel west on the A47 is forced to use the roundabout to perform a U-turn.

27.3.6 If Option 4 was implemented, this movement would not be possible due to the lack of suitable U-turn facility and so the scheme would need to be extended to include the B1187 Gull Rd junction to remodel this and include in the design.

27.3.7 Highways England raised concerns regarding extending the scheme extents and amending the design at this stage when there was little tangible evidence to support reconsidering a signals option. The main reason for it being discounted in PCF Stage 1 (not facilitating U-turns for traffic from Gull Road) was still valid. Therefore, Highways England were not in favour of pursuing this any further and so the option was not progressed.

27.3.8 A discussion was held regarding the existing safety issue (vehicles continue to perform the banned right turn maneuver) raised by the public at B1187 Gull Road and its impact on the scheme. It was deemed to be an operational issue that needed further investigation to provide the latest information which would be dealt with during future PCF stages.

27.4 Scheme Constraints

27.4.1 The scheme constraints have been discussed at length within this report, but discussions were held at the PRD meeting around the below items to ensure all were aware of the issues.

Environmental

27.4.2 The main constraints are the nearby designated environmental sites – within 100m of the site there is:

- Special Area of Conservation (SAC) – mainly for spine loach (fish)
- Special Protection Area (SPA) – overwintering birds in the area
- Site of Special Scientific Interest (SSSI)
- County Wildlife Site (CWS)
- Ramsar site
- RSPB Nature Reserve
- Residents on local access March Rd impacted by noise, air and visual impacts of scheme
- River Nene & Nene Washes 'complex'
- Morton's Leam
- 2x Noise Important Areas (one to the west and one to the south)

27.4.3 It was noted that the residents on local access March Road will likely receive an increase in noise of approx. 3 dB (at the time of the meeting) and visual and air impacts which could affect DCO screening (see below section 27.5).

Engineering

27.4.4 The main engineering constraints discussed were:

- Internal Drainage Board (IDB) Culvert under A47 South Brink
- IDB Surge Chamber to the east of junction
- IDB Pumping Station to the east of the junction
- Existing roundabout is raised on flood embankment
- A47 Fen Rd River Nene bridge structure
- NMU desire lines
- Existing statutory undertakers in the bridge
- Ground conditions – potential soft ground

Existing Properties, Land Owners & other items

27.4.5 Other items discussed were:

- Residents on local access March Road
- Affected land included Environment Agency, Secretary of State and Crown
- Earthworks would need to be carried out outside of overwintering birds season
- Surge chamber will need to be relocated. This also requires further discussion with EA and local managing agents the IDB / Middle Level Commissioners.

27.5 Statutory Process / Planning Considerations

27.5.1 Due to environmental constraints, the project was progressed through PCF Stage 2 as if it would require a DCO. Additional works were completed to see if the scheme could be screened out of the DCO process to potentially enable a non-statutory planning route to be followed, which would offer programme savings and an earlier start on site date.

27.5.2 The approach was described for determining the planning route for the scheme (as described below).

27.5.3 The key criteria for Guyhirn is determining whether there would be 'likely significant environmental effects' as a result of the Scheme. If there were 'likely significant effects', then an Environmental Impact Assessment (EIA) and Environmental Statement (ES) would be required which would mean the scheme would be required to complete the DCO process.

27.5.4 In order to determine whether the Scheme did have 'likely significant environmental effects', and to keep on programme for the desired start on site date of March 2020, additional work in PCF Stage 2 would be required.

27.5.5 The additional work would include developing the design to a more detailed level (preliminary design level) which would require intrusive surveys to be completed (ground investigation, topographical, pavement and drainage). This would inform the design which would enable a detailed construction methodology to be produced. This construction methodology would then inform the 'screening opinion' along with the results of more detailed environmental surveys.

27.5.6 The critical environmental reports to be produced would be the Habitat Regulations Assessment (HRA), Environmental Impact Assessment Screening & Scoping and a more detailed Environmental Assessment Report (based on the increased surveys). Once these were complete, the HRA would require review and approval from Natural England as to whether the Scheme did (or did not) cause 'likely significant environmental effects'. This would then enable Highways England to complete the screening opinion.

27.5.7 If the screening opinion is that there were no likely significant environmental effects, then the Scheme could follow an alternative planning route and be screened out of the DCO process, thus realizing programme savings which is estimated as approximately 1 year..

27.5.8 The meeting also noted the comments received from Middle Level Commissioners at the PIE's regarding the requirement for an environmental statement which could impact the DCO determination (see Chapter 25).

27.5.9 Further consideration would also need to be given to the noise impacts for the residents on local access March Road and whether the expected increase in noise levels as a result of the scheme would be deemed as a 'likely significant environmental effect'. This is further assessed is section 30.14.15.

27.6 NMU's

27.6.1 As described in Chapter 13, Option 1 includes the removal of the northern footway on the A47 Fen Road River Nene bridge.

27.6.2 This was discussed during the PRD meeting as NMU desire lines were raised by a number of people at the PIE's (refer to Chapter 25).

27.6.3 It was widely acknowledged that the current route for NMU's wishing to access Guyhirn village from Ring's End to the south of the junction, was not fit for purpose and potentially dangerous. However, it was also noted that the design currently does not cater for these users and how they will now access Guyhirn village as they will still need to cross the A47 Fen Road at some point.

27.6.4 A suggestion would be to improve the facilities by creating a footpath under the bridge by the river on the western side of the river as there is sufficient space to do so, or creating a NMU crossing facility of the A47 Fen Road (not currently included in the design and not yet considered). Further work is required as the scheme progresses (PCF Stage 3 & beyond) on connecting up PRoW's and NMU desire lines/provision.

27.7 Review of Assessments

27.7.1 A discussion on each of the elements to confirm that the scheme as presented should continue was held and the following was agreed at the meeting.

Alignment to strategic objectives

27.7.2 The high level strategic assessment of KPIs aligned to the Delivery Plan showed a positive overall performance. Particular concerns were raised in regard to the impact on the environment and NMU's.

AST Review

27.7.3 Overall the AST showed that the scheme had a positive scheme but the data required a review with new cost estimate information and particular focus on the social area which required more detailed assessment. Environmental impact would remain an issue until 'likely significant effects' could be ruled out (or not).

PIE Feedback

27.7.4 The general opinion from the public was that the scheme was wanted, needed and would be beneficial in that it would reduce congestion and improve journey times, but points to note for future stages were the interaction with B1187 Gull Road to the west, the provisions for NMU's, delays/disruption during construction and concerns from local councils regarding the potential for additional accidents as a result of the increased capacity on the roundabout.

Buildability

27.7.5 The information provided by the buildability contractor (Taylor Woodrow) confirmed that the programme aligned with HE requirements in terms of timing and durations (9-10 months) and did not identify any major issues. There were points to note regarding options for the surge chamber, drainage and access to the site, namely through the sensitive designated sites and further information required on the culvert, bridge, utilities and surge chamber flow rates.

27.8 Conclusion

27.8.1 On the basis that the information presented demonstrated that the scheme was viable and solved the transport problem, and met the RIS commitment, the consensus was that the Scheme (Option 1) should be promoted as the Preferred Route.

27.9 Interim SGAR 2

27.9.1 Following the PRD meeting an Interim Stage Gate Review was held to confirm the status of the scheme.

27.9.2 The Interim SGAR acknowledged the risk of making 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.

27.9.3 It was confirmed that the PCF Stage 2 Reporting should be concluded. Highways England confirmed that PCF Stage 2 environmental, transport and economic assessments should be completed and written up within transportation, economics and environmental reports and these to be 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 33 Appraisal Summary Table

27.9.4 The above completed assessments will then be used to confirm and validate the assessments prepared for PRD.

27.9.5 Highways England requested the PCF Stage 3 supplier to start developing the scheme based on the PRA.

28 PCF Stage 2 Traffic Analysis

28.1 Introduction

28.1.1 This section describes the traffic modelling and assessments carried out on Option 1 and updates the PCF Stage 1 traffic sections (Chapters 3 & 12).

28.2 Modelling Approach

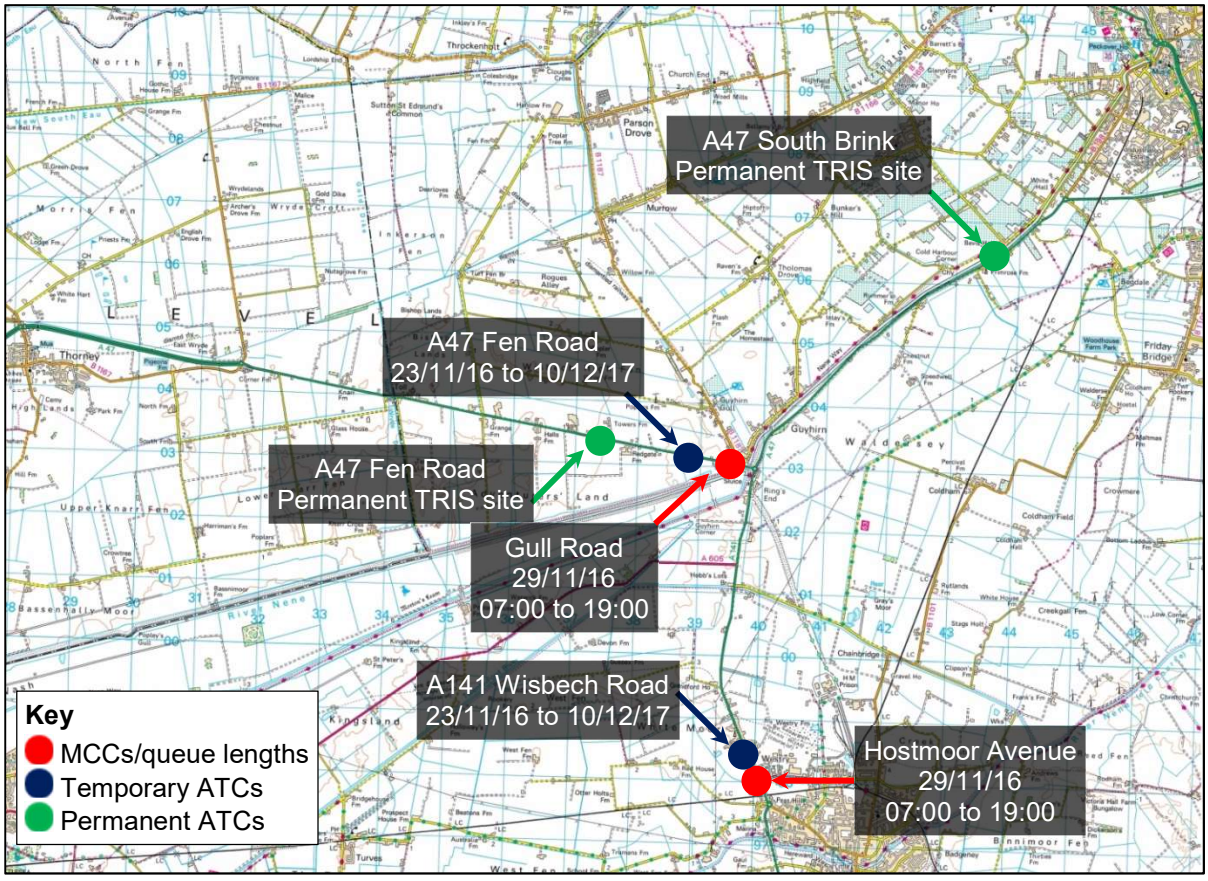
Model Scope

28.2.1 The model scope at PCF Stage 2 is identical to that at PCF Stage 1, covering the same sections of A47 and A141 and the same seven junctions and is described in Chapter 12.

Traffic Data Collection

28.2.2 In addition to the traffic data collection described in section 12.2.3 and shown in Figure 12-1, new MCCs were conducted at the B1187 Gull Road and Hostmoor Avenue priority junctions to improve the quality of modelling of those junctions, for which traffic volumes were inferred at PCF Stage 1. Two new ATCs were also performed on the A47 and A141 respectively to improve the quality of information available for model validation. The counts, locations and survey durations for each are shown in Figure 28-1.

Figure 28-1: MCC and ATC locations and durations for PCF Stage 2



28.2.3 Counts from different dates are not directly comparable due to traffic growth and the effects of seasonality, so all counts have therefore been normalised to a 2015 base. Normalisation factors

have been derived by comparing the Average Annual Weekday Traffic (AAWT) volumes for the appropriate months as measured by the A47 Fen Road TRIS site.

Model Validation

28.2.4 The model validation and matrix development methodology from PCF Stage 1, described in Chapter 12, has been retained.

28.2.5 Further information for PCF Stage 2 is contained in the PCF Product Local Model Validation Report, document reference number A47 IMPS2-AMY-GJ-ZZ-DO-J-0031

Traffic Forecasting

28.2.6 Reference forecasts for the scheme have been produced using the forecasting model developed for the PTM. Although the PTM was not suitable for evaluating the scheme independently, it was revalidated with an updated forecasting model and therefore provides detailed local forecasts. The Midlands Regional Transport Model (MRTM) is a SATURN regional model developed to support the Corridor Feasibility Study schemes; it was considered for use in forecasting but the forecast models were not available in time for use in this scheme.

28.2.7 The PTM was revalidated in February 2017 to a 2016 base year, using count data collected between June 2014 and November 2016. The forecasting model generates forecasts for any year covered by the Peterborough City Council (PCC) Local Plan (up to 2036) with trip generation based upon committed and allocated development as well as national traffic growth estimates.

28.2.8 A core forecasting scenario was selected with the assumed that three committed major mixed-use developments in Peterborough (Hampton, Paston Reserve and Stanground South) are constructed and that PCC constructs all committed housing specified in the Local Plan. These assumptions were input into the forecasting model to generate PTM forecasts for the desired years of 2021 (the Guyhirn scheme opening year) and 2036 (the furthest distant forecast year available).

28.2.9 High and low growth forecasting scenarios were also programmed to test the sensitivity of scheme performance to variations in the national rate of growth; these were developed by adding (in the high growth scenario) or subtracting (in the low growth scenario) a proportion of the base year demand from the core scenario using the formula:

$$u = p \times \sqrt{f - b}$$

- u is the uncertainty, the proportion of base year demand to be added to (in the high growth scenario) or subtracted from (in the low growth scenario) the core forecast demand;
- p is a factor representing the uncertainty in macroeconomic variables influencing travel demand, defined in WebTAG Unit M4 as 2.5% for national highway traffic;
- f is the forecast year being modelled (up to a maximum of 36 years after the base model);
- b is the model base year.

Elasticity of Demand

28.2.10 The elastic demand modelling methodology from PCF Stage 1, described in Chapter 12, has been retained.

28.3 Modelling Constraints

28.3.1 The modelling constraints are governed by the quality and quantity of traffic data available from which to construct the model.

28.3.2 Onward routing data is not defined by the MCCs so the MRTM base year model was investigated to determine if the routing it predicts could be incorporated into the Guyhirn model. However the turning proportions predicted by the MRTM showed poor agreement with the MCCs and were unlikely to induce correct traffic volumes on the downstream links and adversely affect the model calibration. Traffic routing has therefore been estimated using a proportional gravity model which is representative of local conditions as described in section 12.2.7.

28.3.3 Traffic forecasts have been limited to 2036 as this is the horizon of data available from the PTM forecasting model which draws from the PCC Local Plan. Therefore benefits to traffic are not estimated any further than 15 years in the future whereas the scheme appraisal period is 60 years. Therefore forecast impacts beyond this period are not included in the scheme assessment.

28.3.4 The elasticity of demand has been estimated using local observations, and assumes minimal traffic rerouting; however these are assumptions and do not draw upon local data. The potential for rerouting could only be explored in a wider area model.

28.4 Modelling Outputs

Link Flows

28.4.1 The percentage flow increases on each junction-to-junction link from the Do-Minimum to the Do-Something models is shown in Figures 28-2 and 28-3. Each link which demonstrates at least 1% flow increase in any of the modelled time periods in the corresponding forecast year is shown.

Figure 28-2: Percentage flow increase on junction-to-junction links 2021

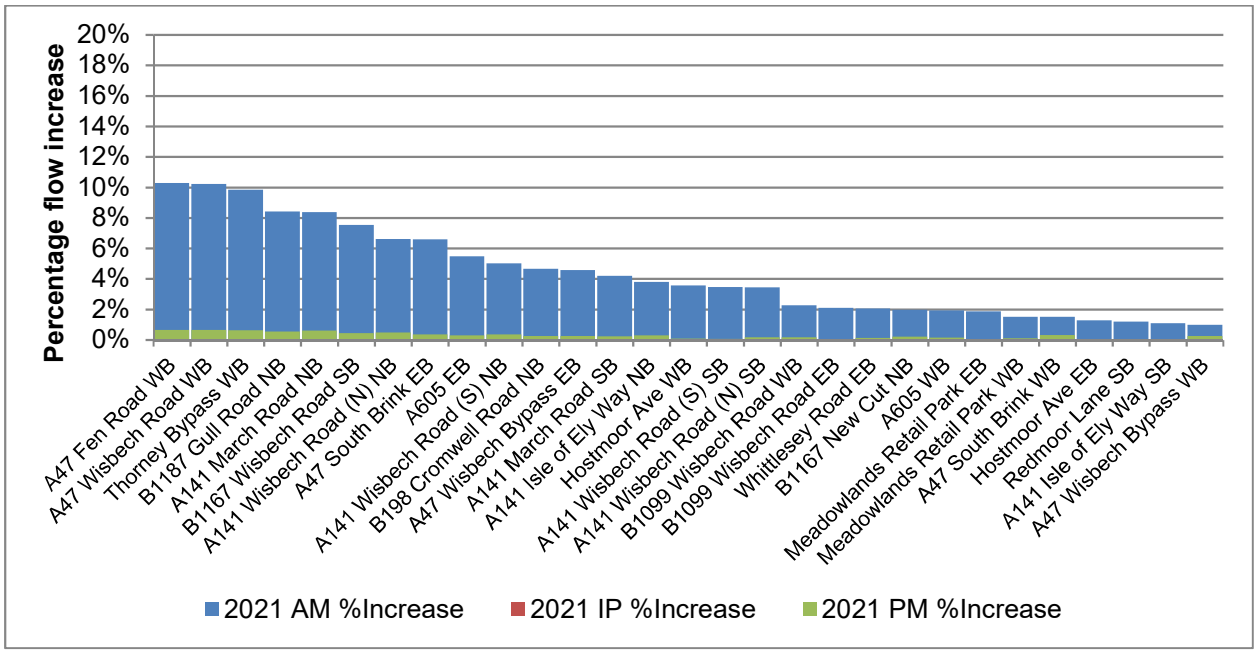
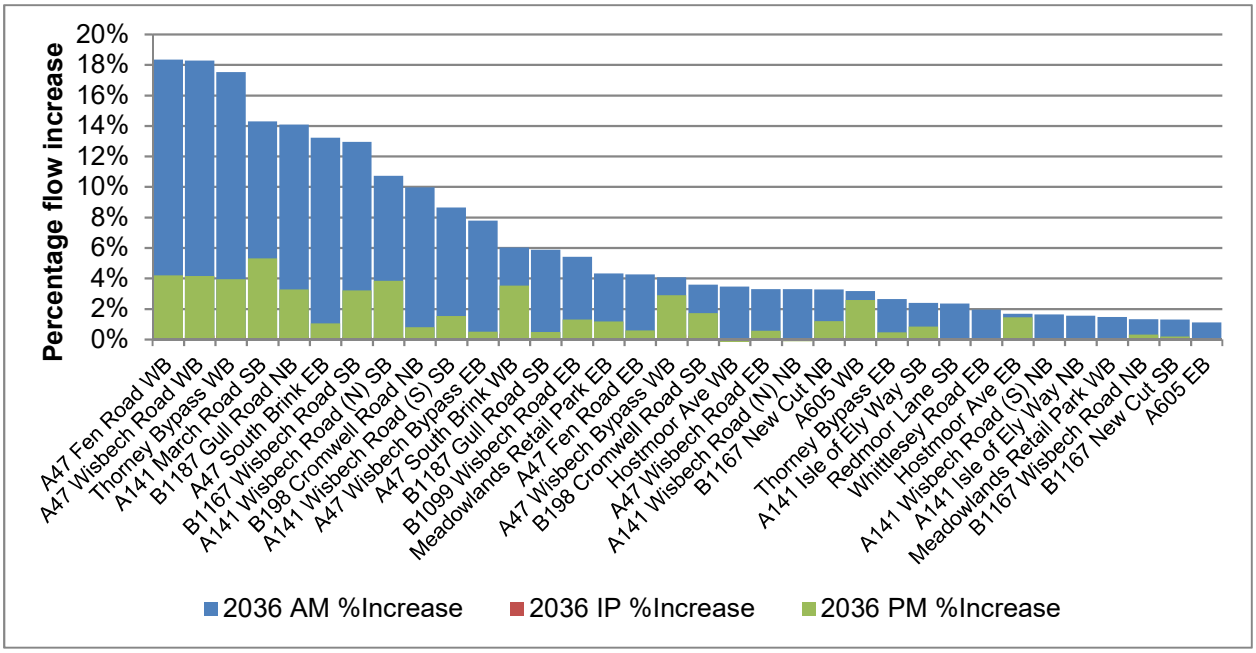


Figure 28-3: Percentage flow increase on junction-to-junction links 2036



28.4.2 In both forecast years the links with the greatest flow increases are those proceeding away from Guyhirn Roundabout westbound on the A47. This suggests that the throughput at Guyhirn has been significantly improved, particularly on this arm. This is consistent with the increased capacity of the Do-Something design and is also the rationale for increased flows northbound on Gull Road. There are also increases in the number of vehicles approaching Guyhirn from the A141 arm, due to VDM increasing vehicle demand owing to reduced delays at Guyhirn.

28.4.3 In the 2021 forecast models, almost all vehicle flow increases are observed in the AM peak, the time period when the junction is most congested in the Do-Minimum model. It is also predicted by the PTM modelling suite that overall traffic growth will be greater in the AM peak than in any other time period. No link flow increases by more than 0.7% in any other time period.

28.4.4 The magnitude of flow increase at 2036 AM peak forecast traffic levels is greater than in 2021 with links heading westbound away from Guyhirn on the A47 experiencing flow increases of up to 18.3%. Both directions of A141 also experience additional benefits as the congestion and delay are more acute in the Do-Minimum model.

28.4.5 Unlike at 2021 traffic levels, the increase in 2036 PM peak traffic is significant. The benefits are distributed differently to the AM peak with more benefits for traffic travelling via Hobbs Lots Bridge Junction, which has exceeded its capacity in the Do-Minimum model.

Journey Times

28.4.6 The change in journey times brought about by the reduction in delay and increase in throughput through the network are shown in Figures 28-4 & 28-5. The journey times are measured for all principal routes through the model, terminating on A47 west and east, the A141 south and A605 west.

Figure 28-4: Journey time changes for routes via Guyhirn 2021

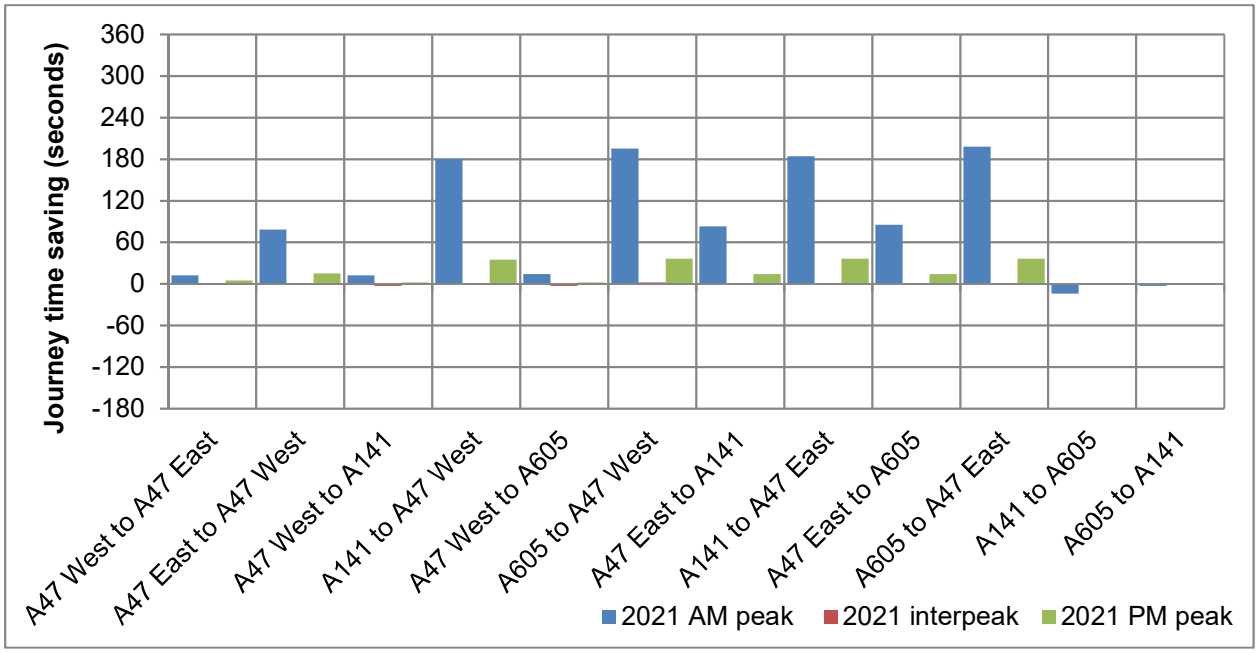
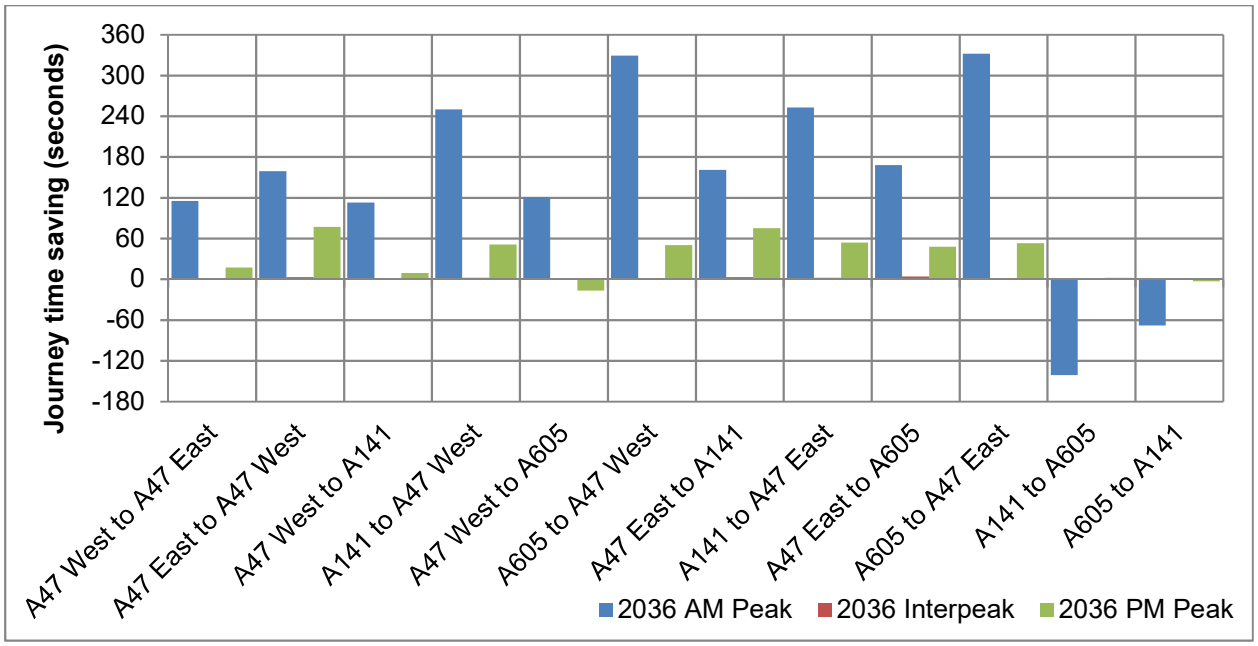


Figure 28-5: Journey time changes for routes via Guyhirn 2036



28.4.7 In the 2021 AM peak hour, there are very significant benefits to vehicles approaching Guyhirn from the A141 or A605, with journeys to all destinations experiencing a reduction in delay of 3 minutes. Traffic from Wisbech experiences a journey time improvement of between 78 and 85 seconds. There are few underlying delays for journeys approaching Guyhirn from the west, so benefits for traffic from Thorney and Guyhirn are much smaller at 15 seconds or less. The journeys which do not pass through Guyhirn (between the A141 and A605) do not experience benefits.

28.4.8 In the 2036 AM peak forecast models, journey time benefits occur in the same pattern as with the 2021 forecasts, although the benefits are increased by between 1 and 2 minutes depending on origin and destination, as the Do-Minimum model becomes increasingly congested. The

disbenefits to traffic via Hobbs Lots Bridge have however increased due to the added throughput at Guyhirn, with additional delays of up to 2 minutes 21 seconds.

28.4.9 As there are no significant underlying delays in the interpeak hour, there are few benefits to traffic in the Do-Something model; instead the increased roundabout circulatory diameter results in small journey time increases in most cases. This is true at both 2021 and 2036 traffic levels

28.4.10 Benefits in the 2021 PM peak are spread amongst the origin-destination pairs in a manner similar to that observed in the AM peak although the magnitude is much smaller; the largest journey time savings are for journeys approaching Guyhirn from the A141 or A605 of 36 seconds.

28.4.11 There is some variation in journey time behaviour in the 2036 PM peak. Journeys to and from the south using the A141 or A605 show benefits of around one minute, and the greatest benefits are for journeys from Wisbech on the A47 which show benefits of up to 77 seconds. Journeys to Guyhirn from the west experience much smaller benefits, with fewer underlying delays in the Do-Minimum model.

Data for Environmental Assessment

Link Flows

28.4.12 Link flow information is contained is section 28.4.1 to 28.4.5 above.

Vehicle Speeds

28.4.13 Vehicle speeds, for noise impact assessments, are estimated from a weighted average of AM peak, interpeak, PM peak and overnight link speeds (the latter of which was not measured and is therefore assumed to be the free-flow speed).

28.4.14 Link speeds in all forecast models are based upon the speed-flow curves assigned to each link. In most cases, where there link flows are not a significant proportion of the link capacity, most traffic moves at free-flow speeds. The assignment of link categories is described in the Local Model Validation Report for the scheme.

28.4.15 The single carriageway section of A47 (east of Thorney) has restricted link speeds due to capacity, with 24-hour average speeds of around 74kph in the base year falling to 72-73kph by 2036 as link volumes increase. The A141 has varying levels of capacity restraint, with the 50mph (80kph) speed limit section from Ring's End to Westry showing speeds of 76kph north of the A605 and 67kph south of there in the base year, falling by around 1kph each by 2036 traffic levels.

28.4.16 Almost all remaining links in the network operate at effectively free-flow speed at all times. Note however that these are mid-link speeds and not representative of junction delay.

Queue Lengths

28.4.17 Queue lengths in metres (as converted from PCUs at 5.75 metres per PCU) are measured directly from the model. The longest queues measured in the base model are listed in Table 28-1, along with the increases in queue lengths in the two forecast Do-Minimum models. For comparison, the queue length growth in the Do-Something models are shown in Table 28-2.

Table 28-1: Average queue lengths observed in Guyhirn base and Do-Minimum models

Junction	Arm	Period	Length (m)		
			2015	2021	2036
Guyhirn	A47 South Brink	AM Peak	63	166	334
Guyhirn	A141 March Road	AM Peak	56	300	601
Hostmoor Avenue	Hostmoor Avenue	PM Peak	28	55	104
Guyhirn	A47 Fen Road	AM Peak	27	29	246
Guyhirn	A141 March Road	PM Peak	26	59	86
Hobbs Lots Bridge	A141 Wisbech Road	PM Peak	24	21	53
Peas Hill	B1099 Wisbech Road	PM Peak	23	34	83
Hobbs Lots Bridge	A141 Wisbech Road	AM Peak	20	19	53
Peas Hill	B1099 Wisbech Road	AM Peak	20	21	69
Peas Hill	A141 Isle of Ely Way	PM Peak	20	29	87

28.4.18 The longest modelled queue lengths are observed at Guyhirn Roundabout and these grow exponentially in the forecast years, with the A47 South Brink queue growing from 63m average in 2015 to over 300m and the A141 March Road arm from 56m to over 600m. The A47 Fen Road arm queue does not grow significantly between 2015 and 2021 but exceeds capacity thereafter with queues averaging nearly 250m in the 2036 AM peak.

28.4.19 The only other queue which exceeds 100m average in 2036 is the entry from Hostmoor Avenue to the high-flow A141 Wisbech Road in the PM peak period.

Table 28-2: Average queue lengths observed in Guyhirn base and Do-Something models

Junction	Arm	Period	Length (m)		
			2015	2021	2036
Guyhirn	A47 South Brink	AM Peak	63	1	2
Guyhirn	A141 March Road	AM Peak	56	3	3
Hostmoor Avenue	Hostmoor Avenue	PM Peak	28	57	114
Guyhirn	A47 Fen Road	AM Peak	27	3	4
Guyhirn	A141 March Road	PM Peak	26	2	2
Hobbs Lots Bridge	A141 Wisbech Road	PM Peak	24	22	53
Peas Hill	B1099 Wisbech Road	PM Peak	23	35	88
Hobbs Lots Bridge	A141 Wisbech Road	AM Peak	20	22	186
Peas Hill	B1099 Wisbech Road	AM Peak	20	43	139
Peas Hill	A141 Isle of Ely Way	PM Peak	20	31	85

28.4.20 In the Do-Something models the queues on Guyhirn Roundabout are effectively eliminated in the forecast years due to increased capacity. However, this has a knock-on effect on the rest of the network as additional throughput at Guyhirn, combined with the reduction in trip suppression in the variable demand model, results in extra downstream traffic on the A141 resulting in significant queue length increases at Hobbs Lots Bridge and Peas Hill Roundabout relative to the Do-Something models, particularly in the AM peak. However, the amount of queueing in the network is significantly reduced.

Vehicle Class Splits

28.4.21 Vehicle class splits were averaged for the 18-hour period 06:00 to 22:00. Class splits for the non-modelled off-peak period (before 07:00 and after 19:00) are assumed to be identical to the interpeak splits with local classified traffic count data backing up this assumption. The vehicle class splits, averaged across routes and urban areas, is shown in Table 28-3.

Table 28-3: Average vehicle class splits on major links and in local urban areas, base model

Class	Link average			Local urban area average			
	A47	A141	A605	Thorney	Guyhirn	Wisbech	March
Car	68.4%	72.6%	69.3%	66.7%	78.4%	79.8%	80.5%
LGV	17.2%	16.1%	22.1%	20.3%	15.5%	15.2%	14.7%
OGV1	4.1%	3.1%	2.9%	1.8%	1.9%	1.9%	1.4%
OGV2	9.1%	7.0%	4.7%	5.6%	2.0%	2.4%	2.1%
PSV	1.3%	1.3%	1.0%	5.5%	2.2%	0.8%	1.2%

28.4.22 The only significant change between the base model and any of the forecast models is that the percentage of cars drops on the A605 in the forecast years, to a minimum of 64.5% in the 2036 models, with the percentage of OGVs increasing by the same margin. This is due the A605 being increasingly used as a strategic route between Peterborough and the A47 east.

29 PCF Stage 2 Economic Assessment

29.1 Introduction

29.1.1 This section describes the economic assessment carried out on Option 1 during PCF Stage 2 and updates the information from PCF Stage 1 contained in Chapter 18.

29.1.2 Further information on the economic assessment and appraisal is contained in the PCF Stage 2 Economic Assessment Report, document reference A47 IMPS2-AMY-GJ-ZZ-DO-J-0039.

29.2 Previous Work

29.2.1 The economic assessment of the scheme at the end of PCF Stage 1 considered the traffic modelling outputs only and did not take account of accident savings, construction delays, operational/maintenance costs or monetisation of air quality and noise effects. Therefore, the economic assessments were developed further in PCF Stage 2 as described below.

29.3 Methodology

29.3.1 The methodology described in section 18.2 for PCF Stage 1 has been used during PCF Stage 2 to complete the economics assessment. Further methodology information is contained in the PCF Stage 2 Economic Assessment Report, document reference A47 IMPS2-AMY-GJ-ZZ-DO-J-0039.

29.4 Journey Time Benefits

29.4.1 The journey time benefits calculated by the TUBA assessment are shown in Table 29-1 and further broken down by time period and by trip purpose.

Table 29-1: Journey time benefits by time period and trip purpose

Category	Journey time benefits
AM peak period	£23.369m
PM peak period	£6.297m
Interpeak period	£0.463m
Business trips	£17.706m
Commuting trips	£5.711m
Non-commuting consumers	£6.712m
Total journey time benefits	£30.129m

29.4.2 Over 75% of journey time benefits accrue in the AM peak, due to the greater congestion in the Do-Minimum model and the greater forecast growth rate compared to the other periods. Approximately 20% of journey time benefits occur in the PM peak. With little underlying delay in the interpeak Do-Minimum model, only 1.5% of journey time benefits occur in this period.

29.4.3 Business users account for 59% of all journey time benefits, commuters accrue 19% of benefits and other users 22%.

29.5 Annualisation

29.5.1 Annualisation for PCF Stage 1 is described in section 18.3 of this report, the below updates this work for PCF Stage 2.

29.5.2 Local count data for the full year 2016 was used in annualisation, obtained from HE Web Traffic Information System (TRIS) ATCs on the A47 South Brink approximately 5km north-east of Guyhirn. The AAWT for 2016 is shown in Table 29-2 for the modelled peak hours.

Table 29-2: 2016 AAWT on A47 east of Guyhirn Roundabout

Peak hour	Peak hour AAWT	
	Eastbound	Westbound
AM (07:30 - 08:30)	906.2	958.9
IP (14:00 - 15:00)	830.2	810.6
PM (16:30 - 17:30)	1011.7	994.8

29.5.3 Annualisation was performed by counting the number of hours in 2016 where flows and therefore presumed traffic conditions were similar to the averages in Table , defined as any interval in the appropriate peak period where traffic flows were at least 90% of the annual average. Only 217 of the 253 weekdays in 2016 contained reliable TRIS counts due to traffic incidents or missing data, so a factor of 253/217 was applied to the results. The resultant annualisation factors, averaging eastbound and westbound totals, are shown in Table 29-3.

Table 29-3: Annualisation factors for each time period

Peak period	Duration of at least 90% of annual average peak flow				Annualisation factor
	Per 217 weekdays		Per 253 weekdays		
	Eastbound	Westbound	Eastbound	Westbound	
AM	404 hrs 45 min	337 hrs 45 min	471 hrs 53 min	393 hrs 46 min	433
IP	1085 hrs 30 min	1199 hrs 45 min	1265 hrs 34 min	1398 hrs 47 min	1332
PM	352 hrs 15 min	445 hrs 45 min	410 hrs 41 min	519 hrs 41 min	465

29.6 Non-Modelled Periods

29.6.1 The off-peak weekday period (19:00 to 07:00) and weekends are not modelled. No scheme benefits are therefore derived for these times; this results in a conservative estimate of benefits.

29.7 Impact on Accidents

29.7.1 As described in Chapter 18, the accident benefits were not assessed in COBALT at PCF Stage 1 as COBALT was not detailed enough to resolve differences in accident rates between the existing roundabout and the Do-Something designs, so no accident benefits would be resolved. At PCF Stage 2, in order to improve and develop the PCF Stage 1 modelling, a COBALT assessment was carried out using variable demand modelling.

29.7.2 The impacts of a change in the rate of accidents were appraised by comparing the existing accident rates with those predicted for the scheme design.

29.7.3 COBALT uses Annual Average Daily Traffic (AADT) link and junction flows to predict the change in accident and casualty rates given the characteristics of the scheme design, which are then compared against the observed accident data for the most recent five years. The

AADTs are calculated from the modelled hourly flow outputs using scaling factors which represent the proportion of full day flows which occur in the modelled peaks. Data from the A47 South Brink TRIS counters have been used in their calculation.

29.7.4 The economic impact of accidents as predicted by COBALT is shown in Table 29-4.

Table 29-4: Impacts due to change in accident rates

Location	Do-Minimum accidents		Do-Something accidents		Additional accidents	
	Accidents	Impact	Accidents	Impact	Accidents	Impact
A47 South Brink link	8.6	-£0.496m	8.9	-£0.510m	0.3	-£0.014m
A141 March Road link	8.6	-£0.495m	8.8	-£0.508m	0.2	-£0.013m
A47 Fen Road link	22.0	-£1.270m	22.7	-£1.308m	0.7	-£0.038m
Guyhirn Roundabout	111.6	-£4.291m	113.4	-£4.361m	1.8	-£0.070m
All accidents	150.9	-£6.552m	153.8	-£6.686m	2.9	-£0.134m

29.7.5 The scheme results in greater flows on the roundabout approaches due to fewer delayed or abandoned trips as represented with VDM, and improved junction throughput resulting in greater exit flows. As a result of the Scheme the increase in traffic flow is predicted to result in a total of one additional link accident and two additional accidents at Guyhirn roundabout itself. There is very little variation in the overall rate of accidents per vehicle. The net disbenefit to the scheme over the full appraisal period is £134,000.

29.8 Impacts on Maintenance and Construction

29.8.1 A construction methodology was developed for the scheme which accounts for the relatively isolated location of Guyhirn Roundabout and therefore avoids closures as far as is practicable. A seven-phase construction plan has been proposed by Taylor Woodrow with the duration, construction activities and TTM associated with each phase shown in Table 23-2.

29.8.2 The works area is subject to a reduced speed limit which increases vehicle travel times and each TTM layout impacts on vehicle routing and/or junction capacity. The economic impacts of these effects were assessed using models which simulate the TTM within the existing network.

29.8.3 The modelling methodology for construction impacts varies dependent on the phase:

- For phases 1 to 4 the Guyhirn SATURN models were modified to reflect the TTM impacts of each phase. The TTM models were run with the forecast 2021 Do-Minimum demands as a proxy for the construction year demands;
- Phase 5A and 5B require the A141 south of Guyhirn to be closed and traffic diverted; no alternative routes are covered within the Guyhirn model so the MRTM was used to predict wider area routing with the A141 is closed. The TTM for Phase 5 is in place overnight only so the TTM models therefore used a demand matrix representing an average off-peak hour scaled from the MRTM interpeak demands.

29.8.4 The impacts from the TTM models were similarly annualised to represent the full duration of each TTM phase as per Table 23-2. The calculated annualisation factors are shown in Table 29-5:

- TTM phases 1 to 4 are in place continuously so their annualisation factors were calculated as a percentage of the full year factors from Table 29-3 given their duration in typical weekdays (i.e. excluding bank holidays);
- The TTM for Phase 5 is in place overnight only. The matrices used in the models represent an average hour in this period therefore these models are annualised by multiplying the duration in weeknights by the number of hours' work per weeknight

Table 29-5: TUBA annualisation factors for TTM models

TTM phase	Duration	Annualisation factor			
		AM peak	Interpeak	PM peak	Off-peak
Phase 1	20 weekdays	34	105	37	-
Phase 2	131 weekdays	224	690	241	-
Phase 3	28 weekdays	48	147	51	-
Phase 4	7 weekdays	12	37	13	-
Phase 5A	4 weeknights	-	-	-	40
Phase 5B	4 weeknights	-	-	-	40
Phase 5C	4 weeknights	-	-	-	40

29.8.5 The economic impact of the TTM regime required to construct the scheme is shown in Table 29-6.

Table 29-6: Impacts due to temporary traffic management

TTM phase	Economic impacts					
	Greenhouse gas emissions	Travel time changes			Change in taxation	Overall impacts
		Commuter	Other	Business		
Phase 1	-£0.001m	-£0.020m	-£0.033m	-£0.074m	£0.004m	-£0.124m
Phase 2	-£0.004m	-£0.116m	-£0.201m	-£0.441m	£0.017m	-£0.745m
Phase 3	<£0.001m	£0.002m	-£0.008m	-£0.009m	£0.001m	-£0.014m
Phase 4	-£0.001m	-£0.020m	-£0.034m	-£0.072m	£0.005m	-£0.122m
Phase 5A	-£0.001m	-£0.012m	-£0.019m	-£0.017m	£0.005m	-£0.044m
Phase 5B	-£0.001m	-£0.013m	-£0.020m	-£0.017m	£0.005m	-£0.046m
Phase 5C	<£0.001m	-£0.001m	-£0.001m	-£0.003m	<£0.001m	-£0.005m
All phases	-£0.008m	-£0.181m	-£0.319m	-£0.638m	£0.037m	-£1.100m

29.8.6 Disruption due to TTM during construction has an economic disbenefit of £1.1 million. TTM Phase 2 is the most disruptive overall with disbenefits of £745,000, although it is also the phase of longest duration. The most disruptive phase relative to its duration is Phase 4 which generates £122,000 of disbenefits in seven weekdays or £17,429 per day.

29.9 Wider Impacts

29.9.1 Three types of Wider Impacts are assessed in an economic appraisal as per WebTAG Unit A2.1 "Wider Impacts":

- Agglomeration impacts: the increase in concentration of economic activity over an area allowing access to bigger product, input and labour markets;
- Output change due to imperfect competition: reduced transport cost permits firms to increase output of transport-dependent goods and services;

- Tax revenues due to labour market impacts: reduced transport cost allowing workers to travel further to find work and companies relocating to capture larger travel-to-work areas.

29.9.2 It is not expected that a single junction improvement scheme will have an effect on the concentration of economic activity, therefore it is not appropriate to assess agglomeration impacts. For similar reasons, it is not appropriate to assess labour market impacts as it is not expected that the scheme will increase the travel-to-work area for the major commuter destination of Peterborough.

29.9.3 Therefore, the only wider impact assessed is output change due to imperfect competition. The WebTAG compliant approach to monetising output change is to apply an uplift of 10% to the scheme's business user benefits. Business user benefits total of £18.743 million, the output change due to imperfect competition results in an additional scheme benefit of £1.874 million.

29.10 Economic Summary Tables

29.10.1 The economic assessment is summarised using the Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) tables:

- The TEE is shown in Table 29-7 and summarises the scheme benefits for road users;
- The PA is shown in Table 29-8 and summarises the effect on public finances in the form of costs to government and changes in tax intake;
- The AMCB is shown in Table 29-9 and summarises all quantitative effects in calculates the Present Value of Benefits (PVB), Present Value of Costs (PVC), Net Present Value (NPV) and Benefit to Cost Ratio (BCR) of the scheme.

Table 29-7: TEE table

User type	Benefit type	Benefits by journey type			
		Road Personal	Road Freight	Bus Personal	Total
Commuting	Journey time	£5.711m	-	-	£5.711m
	VOCs	-£0.168m	-	£0.018m	-£0.150m
Other	Journey time	£6.712m	-	-	£6.712m
	VOCs	-£0.385m	-	£0.029m	-£0.356m
Business	Journey time	£8.792m	£8.914m	-	£17.706m
	VOCs	£0.221m	£0.811m	£0.005m	£1.037m
Present Value of Transport Economic Efficiency Benefits					£30.660m

29.10.2 The scheme is predicted to deliver a TEE of £30.7 million over the appraisal period. Over 98% of TEE accrues due to journey time savings. Personal travel accounts for 70% of benefits and freight travel 30%.

Table 29-8: PA table

Category	Road	Bus	Total
Central Government Broad Transport Budget	£7.881m		
Wider Public Finances	-£0.751m	-£0.021m	-£0.771m

29.10.3 The present year cost of £11.27 million is reduced to a 2010 price value of £7.9 million when calculated using the WebTAG Data Book GDP deflator series. Central government is predicted to receive additional indirect taxation through an overall increase in fuel use and hence tax

incomes. £771,000 of additional tax income is predicted, offsetting almost 10% of the construction cost.

Table 29-9: AMCB table

Category	Benefit
Construction delays	-£1,100m
Accidents	-£0.134m
Greenhouse gas emissions	-£0.375m
Commuter travel time benefits	£5.561m
Other user travel time benefits	£6.356m
Business user travel time benefits	£18.743m
Indirect taxation revenues	£0.771m
Present Value of Benefits (PVB)	£29.822m
Present Value of Costs (PVC)	£7.881m
Net Present Value (NPV)	£21.941m
Benefit to Cost Ratio (BCR)	3.78

29.11 Value for Money

29.11.1 The Value for Money (VfM) index is described in section 18.8 of this report.

29.11.2 Given a PVB of almost £30 million against a PVC of £7.9 million, a BCR of 3.78 is predicted. This suggests that the scheme delivers significant benefits over and above its cost and is likely to repay the central government investment over the scheme appraisal period.

29.11.3 The VfM categories are shown in Table 18-4; a BCR of 3.78 gives this scheme high VfM with significant benefits over and above the estimated costs.

29.12 Non-Monetised Benefits

29.12.1 Many of the social impacts measured in the AST cannot be quantitatively assessed so qualitative assessments have instead been performed using the guidance in WebTAG Unit A4.1. Each of the qualitative assessment categories was assessed on a seven-point scale with effects scored as either positive (beneficial) or negative (adverse), with a magnitude of slight, moderate or large. Neutral scores are assessed where the overall effects are balanced and/or negligible.

29.12.2 Journey time variability was not monetised in the economic assessment as no reliable methodology for estimating journey time benefits on single carriageway roads or single junction upgrades is available. Benefits were estimated by calculating day-to-day (DDV) and incident-related variances (IRV):

- A moderate benefit to day-to-day journey time variation has been assessed with 1,147 PCU per week benefitting from congestion relief in the scheme opening year;
- IRV has been assessed as slight negative due to a small increase in accidents predicted by the scheme.
- An overall slight beneficial effect has therefore been assessed.

29.12.3 Benefits to physical activity were measured qualitatively. There is the potential for journey time benefits for pedestrians using the rerouted path network around Guyhirn Roundabout and repositioned crossings. A distance saving of approximately 115 metres represents a journey time saving of 95 seconds assuming a walk speed of 1.2 ms^{-1}. However, given the very small number of users overall benefits are negligible and therefore assessed as neutral.

29.12.4 The scheme has a significant effect in reducing driver frustration by providing quicker and more reliable journeys, so a moderate beneficial score has been assessed for journey quality impacts.

29.12.5 The scheme does not have a significant impact on any security indicators and therefore a neutral score has been assessed.

29.12.6 The scheme removes a low standard crossing from the northern arm of Guyhirn Roundabout and replaces it with a high standard crossing to the south, although journeys between Guyhirn and Ring's End must then make an additional crossing of the A47 Fen Road. The differing impacts sum to a neutral overall assessment of severance and the number of users remains very low.

30 PCF Stage 2 Environmental Baseline and Assessment

30.1 Environmental Baseline Introduction

30.1.1 The purpose of this section is to provide an update to the overview of the existing environment section described in Chapter 4, where the proposed scheme will take place. It is informed by baseline information within Chapter 5 of the PCF Stage 2 Environmental Assessment Report (EAR), document reference A47IMPS2-AMY-GJ-ZZ-DO-J0024, and its associated drawings, and provides a summary of the key environmental receptors and their associated sensitivity. Chapter 5 of the PCF Stage 2 EAR, which is subdivided into the environmental topics, provides details of the methodology used to define the study area and to characterise the environmental baseline and its sensitivity to change.

30.2 Air Quality

30.2.1 This section provides a summary of the air quality and greenhouse gas baseline within the study area and their associated sensitivity to change.

Background concentrations

30.2.2 Refer to sections 4.2.2 and 4.2.3 for information on the baseline conditions.

30.2.3 For the purpose of characterising baseline air quality and adjusting the modelled air quality results, a programme of air quality monitoring was undertaken in the area around Guyhirn Junction between January and May 2017. Diffusion tubes were used to ascertain levels of NO_2 pollution in areas specific to the junction improvements. Sites were chosen according to the LAQM.TG(16) guidance, including background and roadside sites concentrations were found to be under the annual mean NO_2 objective of 40 $\mu g/m^3$.

Human Receptors

30.2.4 An update to the approximate count of human receptors within the study area (described in section 4.2.4) is shown in Table 30-1 and PCF Stage 2 EAR Figure 5.1.2.

Table 30-1: Approximate Counts of Human Receptors within the Study Area

Receptor Type	Quantity
Residential	74
Community	4
Commercial	6

30.2.5 Receptor sensitivity is considered medium to the risk of amenity impacts from construction dust. Receptor sensitivity is considered very high to the risk of emissions of construction vehicle and plant exhaust gas emissions.

Designated Sites

30.2.6 For information concerning baseline conditions regarding the designated sites, please refer to section 4.2.5 and 4.2.6 of this document and the PCF Stage 2 EAR section 5.4 and Figure 5.1.6.

30.2.7 The Nene Washes Ramsar/SAC/SPA/SSSI area is considered to have very high sensitivity because of the very limited potential for substitution.

30.3 Cultural Heritage

Introduction

30.3.1 This section provides a summary of the cultural heritage assets within the study area and their associated sensitivity to change and updates the information contained in section 4.3.

Archaeological Remains

Designated Heritage Assets

30.3.2 There are no World Heritage Sites or Scheduled Monuments within the 600m study area.

Recorded Archaeological Sites

30.3.3 There are 12 recorded archaeological sites within the study area which are shown in Table 30-2 and PCF Stage 2 EAR Figure 5.2.1. and represent remains from the early medieval period through to the modern era. They vary considerably in size and complexity, from early medieval and post-medieval activity related to agriculture and drainage of the fens. These have been assigned a low sensitivity as they are of local interest.

Table 30-2: Recorded archaeological sites within the study area

Figure ref.	Record No.	Description
1.	HER MBC17863	Cropmark remains of undated ditched field system. A group of small enclosures, possibly indicative of settlement, also identified.
2.	Pastscape no. 10652	Undated linear ditches
3.	HER MCB17773	Thick band of subsoil containing 16th to17th century ceramics and 18th to 19th century clay pipes sealing alluvial silt. No artefacts earlier than 15th century suggests site was unoccupied prior to this time.
4.	HER MCB17511	Series of probable former drainage and boundary features of post-medieval to modern date.
5.	Pastscape no. 354967	Bronze Age axe found at Guyhirn.
6.	Pastscape no. 352027	The Pea Kirk Drain was cut by Cornelius Vermuyden in 1631.
7.	Pastscape no. 499828	Site of Guyhirn Station which opened in 1867 and closed to passenger services in 1953.
8.	Pastscape no. 1419679	Site of Second World War spigot mortar base alongside the A141.
9.	N/A	Line of the March and Spalding Railway opened in 1867 and closed in 1964.
10.	HER MCB17919	Former course of Moreton's Leam constructed in the 15th century.
11.	HER 03827	Moreton's Leam, artificial course of the River Nene, constructed between 1478 and 1490. Most of its length was replaced in 17th century by a parallel course.
12.	N/A	Medieval structural remains, St Mary Magdalene

Unrecorded Archaeological Remains

30.3.4 For information on unrecorded archaeological remains please refer to section 4.3.2.

Listed Buildings

30.3.5 For information regarding listed buildings, please refer to section 4.3.3 of this document and Figure 5.2.1 of the PCF Stage 2 EAR.

Undesignated Historic Buildings and Structures

30.3.6 The CHER includes a railway viaduct and five structures dating to the Second World War within the study area as shown in PCF Stage 2 EAR Figure 5.2.1 and Table 30-3. These are of local historic interest and have a low sensitivity.

Table 30-3: Undesignated historic buildings and structures within the study area

Figure ref.	Record No.	Description
17.	HER CB15220	Spigot mortar emplacement by the B1187, covering former rail bridge.
18.	HER CB15224	Square World War II pillbox, with 2 loops in west face.
19.	HER CB15224	Square World War II pillbox, with 2 loops in west face.
20.	HER CB15217	World War II square pillboxes stride railway line
21.	HER MCB16617	Railway viaduct built to carry the former Great Northern and Great Eastern Junction Railways' March to Spalding line.
22.	HER CB15225	Air raid shelter beside former school.

Historic Landscape Character Areas

30.3.7 Please refer to section 4.3.8 for background information.

30.3.8 There are no landscape scale statutory or non-statutory designated heritage assets (world heritage sites, conservation areas, parks and gardens or registered battlefields) coinciding with the study area.

30.3.9 There are twelve further archaeological and historical structures recorded in the study area. They vary considerably in size and complexity, from early medieval and post-medieval activity related to agriculture and drainage of the fens, to the railway viaduct site of the Industrial era that dominates Guyhirn, to the five historic structures related the Second World War.

30.3.10 The historic landscape is intimately associated with the drainage of the wetlands and as such is of regional historic interest and medium sensitivity.

30.4 Landscape and Visual

Introduction

30.4.1 This section outlines the various landscape and visual receptors within the study area and identifies their sensitivities to change.

Landscape Designations

30.4.2 There are no designated landscapes or registered parks or gardens within the study area.

Landscape Fabric

30.4.3 The study area is set within a broad, flat valley on the floodplain of the River Nene. The land immediately surrounding the existing A47 Guyhirn junction is predominantly high quality agricultural land. These fields shape the linear pattern of the landscape. Woodland is sparse within the area, and tree cover is confined to the roadside verges or as riverside vegetation in the floodplain of the river, screening many views in the area. The River Nene is the main landscape feature of the area distinctively following an almost straight course.

30.4.4 The elements of the landscape are of low sensitivity as they are relatively commonplace and are replaceable in the long term.

Landscape Character

National Character Areas (NCA)

30.4.5 Background information on NCA's is detailed in section 4.4.4 of this report and in the PCF Stage 2 EAR Figure 5.3.3.

Local Landscape Character Area (LCA)

30.4.6 Background information on LCA's is detailed in section 4.4.5 of this document and Figure 5.3.4 of the PCF Stage 2 EAR.

Landcover, Pattern and Texture

30.4.7 Background information is contained in section 4.4.6 and 4.4.7 of this document and section 5.4 of the PCF Stage 2 EAR.

Scale and Appearance

30.4.8 Background information is contained in sections 4.4.8 of this report.

Tranquillity

30.4.9 Background information is contained in section 4.4.9 of this report.

Cultural

30.4.10 Baseline information is contained in sections 4.4.10 and 4.4.11 of this report.

Human Interaction

30.4.11 Land use within the study area is predominately residential and agricultural. The village of Guyhirn contains a number of residential properties predominantly to the east, northeast and south of the junction. The A47 and A141 are used by motorists to access this settlement and towns further afield and commercial properties within the study area. The bridge incorporates footpath access to the east and south via March Road. Nene Way, a long distance footpath follows the top of the flood barrier to the north of the A47 Guyhirn junction before heading west towards Peterborough.

30.4.12 Overall landscape character is of moderate sensitivity as there are historic features of local importance and the elements and features provide a sense of place.

Visual Receptors

30.4.13 Visual receptors are the people who would experience changes in views as a result of the proposed junction improvement, its infrastructure and the traffic on it. Receptors are identified

as residential, cultural, business, recreational, community, road and viewpoints. Figure 5.3.5 of the PCF Stage 2 EAR shows the main visual receptors in the area as described in the following paragraphs.

Residential

30.4.14 There are seven residential receptors, all are of high sensitivity and are identified as follows:

- Group of residential and commercial properties in High Road, from Nene Close to Chapelfield Road
- Properties along High Road from Nene Close to Woodland Garden
- Group of detached residential properties, B1187 Gull Road
- Group of commercial and residential properties, A47 Fen Road
- Residential property Fern Road at Gull Road B1187
- Group of residential properties, A141 March Road and local access March Road
- Properties located south of the roundabout along the A141 at Rings End

Cultural

30.4.15 A number of listed buildings and scheduled monuments are located within the study area as set out in Section 4.3. The visual effects on listed buildings are considered in this section according to their use such as residential, places of worship or recreational. All cultural receptors are of high sensitivity.

Business

30.4.16 Approximately four commercial properties with views of the existing junction lie on A47 Fen Road. These are all of low sensitivity.

30.4.17 A group of three commercial properties on High Road experiences oblique views of the existing A47 looking south. One of these businesses provides accommodation and is of moderate sensitivity. The remaining two are of low sensitivity.

Recreational

30.4.18 There are public rights of way and pedestrian routes along the main roads and along the River Nene that facilitate the movement of non-motorised users through the area. These routes are of high or moderate sensitivity.

Community

30.4.19 There are numerous receptors within 1km of the proposed option. Several are also classified as cultural heritage receptors and these are discussed further in Section 4.3 in relation to setting issues. The community receptor is assigned a moderate sensitivity.

Road

30.4.20 The A47 and A141 converge at the Guyhirn junction with their users being the main visual road user receptors. There are other secondary roads in the area and across the village, but views of the roundabout from these are generally screened by the surrounding buildings, vegetation, and embankments. Road receptors are assigned a moderate sensitivity.

Viewpoint

30.4.21 A range of photographic viewpoints were selected to illustrate important or typical views and are shown in Figures 5.3.6 and 5.3.7 of the PCF Stage 2 EAR. Figures 5.3.8 to 5.3.10 of the PCF Stage 2 EAR show panoramic photographs of the different viewpoints, and the estimated extent of the proposal in the view. As viewpoints are selected to illustrate the views of important receptors, they are assigned a sensitivity of high. Only one viewpoint which illustrates the view of road users is assigned a moderate sensitivity.

30.5 Nature Conservation and Biodiversity

Introduction

30.5.1 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 desktop study and fieldwork undertaken since summer 2016.

Baseline Conditions

30.5.2 For information about baseline conditions regarding designated sites and habitats, please refer to sections 4.5.2 – 4.5.6 and PCF Stage 2 EAR section 5.4.

Protected and Notable Species

30.5.3 Following the Phase 1 Habitat Survey and species specific surveys undertaken since March 2016 (ongoing), the study area is shown to support the following protected and notable species:

- Amphibians - 3 ponds were subject to eDNA survey and all results were negative. The survey results, in combination with a lack of local Great Crested Newt (GCN) records, indicate that GCN are absent from the survey area.
- Birds - observations during the ecological surveys along with records indicate:
    - Extensive bird records with species of various levels of protection. Many of the records are of wetland birds, such as swans, geese and wildfowl, associated with the Nene Washes.
    - Suitable habitat for breeding and wintering birds including reedbeds, grassland, woodland, hedgerows and scrub. Bird nests were frequently observed in woodlands and scrub near to the Guyhirn junction.
    - Wintering bird surveys recorded 56 species, including six Schedule 1 of the Wildlife and Countryside Act 1981 species, six Red listed Birds of Conservation Concern (BoCC) and 16 Amber listed BoCC. Nene Washes SPA/Ramsar notable wintering species recorded during the surveys include lapwing *Vanellus vanellus*, pochard *Aythya farina* and wigeon *Anas penelope*. Wintering birds recorded were mostly those of farmland and woodland, rather than waders and wildfowl associated with wetlands and open water
    - Breeding bird surveys recorded 62 species including three Schedule 1 species (Cetti's warbler Cettia cetti, kingfisher Alcedo atthi and marsh harrier Circus aeruginosus) which must be fully protected from disturbance while nesting. The surveys also recorded ten Red listed and 16 Amber listed BoCC, with notable breeders near to the junction including turtle dove Streptopelia turtur and cuckoo Cuculus canorus. There are no records of barn owl Tyto alba breeding within 1km of the junction and a nest box erected on Ring's End Pumping Station is unoccupied.
- Invertebrates – records of three notable species, including the aquatic beetle Gyrinus paykulli which is nationally scarce. Habitats such as reedbed and semi-improved neutral

grassland have potential to support communities of aquatic and terrestrial invertebrates, including dragonflies and butterflies noted during site surveys. Targeted invertebrate surveys are ongoing between June and August 2017. Due to these surveys being incomplete the findings and recommendations are unknown at the time of writingand will be included in the Ecological Impact Assessment.

- Badger - suitable habitat for badger was identified with two active badger setts with associated pathways and foraging signs recorded during the survey.
- Bats - The results of surveys undertaken to date indicate that habitats close to the junction are used mostly by common pipistrelle Pipistrellus pipistrellus and soprano pipistrelle P. pygmaeus bats for commuting and foraging, with activity concentrated along woodland edges and watercourses including Moreton's Leam and larger field drains. Full results of the activity surveys will be provided with the Stage 3 reporting.
- Otter and Water Vole - Field signs of otter have been located on the eastern Nene riverbank under the A47 road bridge, and under a small bridge over the main field drain entering Ring's End Pumping Station to the east of the junction. No holts have been located to date. Field signs of water vole have been located on the non-tidal section of Moreton's Leam immediately to the south of the Ring's End sluice, where the bankside habitat is suitable, and on the field drain that flows into Ring's End Pumping Station.
- Reptiles - results of the initial survey confirm that grass snake Natrix natrix and common lizard Zootoca vivipara are present in low numbers in the vicinity of the existing junction. Common toad Bufo bufo has also been recorded.

Invasive Species

30.5.4 Background information regarding invasive species is contained in section 4.5.8 of this report.

Receptor sensitivity/Value

30.5.5 Table 30-4 identifies the ecological features within the study area and provides an indication of their value (as explained in detail in section 5.4 of the PCF Stage 2 EAR).

Table 30-4: Ecological Features

Ecological Feature	Resource Valuation
Designated sites	
Nene Washes Ramsar	International
Nene Washes SPA	International
Nene Washes SAC	International
Nene Washes SSSI	National
Ring's End LNR	County
All CWS	County
Habitats	
Priority habitats	County
Running water	County
All other habitats	Local
Protected/ notable species	
Bats	Local
Badger	Local
Reptiles	Local
Breeding bird species	County

Ecological Feature	Resource Valuation
Wintering bird species	County
Water vole	County
Otter	County
Spined loach	National
Invasive species	Negative

30.6 Noise and Vibration

Introduction

30.6.1 This section describes the noise environment, highlights the sensitive receptors and their associated sensitivity.

Noise Sensitive Receptors

30.6.2 Noise Sensitive Receptors (NSRs) are receptors potentially sensitive to noise or vibration. They typically include dwellings, hospitals, community facilities and designated areas. The PCF Stage 2 EAR Figure 5.5.1 illustrates the noise sensitive receptors within the study area defined by a 600m buffer around the proposed option. In total 168 residential receptors and 7 community receptors have been included in the study area as part of this assessment. These include:

- Residential properties – Rivendale, Cobble House, Bank House, Sunrise Cottage, Sunset Cottage, Nene House, The Vicarage and includes those off March Road, High Road, Homelands, Nene Close, Woodland Gardens, The Bungalows and Riverside Close.
- Guyhirn Church of England Primary School;
- St Magdalene's Church; and
- A Public House on High Road next to Nene Close.

Noise Important Areas and Quiet Areas

30.6.3 NIAs are defined by Defra as areas where the top 1% of people affected by noise in England reside. Changes in traffic speed, traffic flows or proportion of HGVs (Heavy Goods Vehicles) on the existing road or new routes may cause a significant change in noise levels. Road schemes should aim to reduce noise levels within NIAs through mitigation measures such as re-aligning the road further from the sensitive receptors; the use of earth bunds and acoustic barriers or using low noise road surface.

30.6.4 Table 30-5 shows the number of dwellings within NIAs within the study area. These are shown on PCF Stage 2 EAR Figure 5.5.1. The responsible authority for NIA 11362 on the A47 is Highways England whereas the responsible authority for NIA 11363 on the A141 March Road is Cambridgeshire County Council. However, none of the NIAs are within the proposed option footprint.

Table 30-5: Count of dwellings within noise important areas

Noise Important Area (Id number and authority)	Location	Primary noise source	Number of dwellings
11362 (Highways England)	Junction between the A47 Fen Road and the B1187 Gull Road	Road traffic noise A47 Fen Road	1
11363 (Cambridgeshire County Council)	A141 March Road	Road traffic noise A141 March Road	8

Representative receptors

30.6.5 A noise model has been developed as part of the PCF Stage 2 assessment and information is reported for representative receptors as listed in Table 30-6.

Table 30-6: Representative Receptors (and façades) for Guyhirn

ID	Address and façade
R1	1 March Road (W)
R2	5 March Road (W)
R3	8 March Road (E)
R4	Bankside Farm, Fen Road (N)
R5	Bank House Farm, High Road (E)
R6	Port Cottage, Gull Road (NE)

30.6.6 Figure 5.5.1 of the PCF Stage 2 EAR shows the location of the representative receptors. More information is provided in section 5.5 of the PCF Stage 2 EAR.

30.7 Road Drainage and Water Environment

Introduction

30.7.1 The purpose of this section is to describe the road drainage and water environment within the study area and to highlight the sensitivity of the receptors. The study area is extremely flat and low-lying with elevations rarely exceeding 1m and dropping below sea level in places.

Surface Water Features/Abstractions

30.7.2 Background information is contained within sections 4.10.3 – 4.10.8 of this report and in the PCF Stage 2 EAR Figures 5.6.1 and 5.6.2.

30.7.3 As a result of the interconnectedness of the surface water environment and the extent to which it influences the high value landscape and nationally important ecology of the area the surface water environment is an important resource in a number of ways. Surface waters within the Lower Nene catchment are also used for irrigation and drinking water. Overall the sensitivity of the surface water environment is very high.

Groundwater Features/Abstractions

30.7.4 Groundwater in the study area belongs largely to secondary shallow superficial aquifers, closest to the existing Guyhirn junction to the north-west and south. These groundwater bodies are of low productivity, sitting within coastal and fluvial alluvium formations. Groundwater in the area is susceptible to pollution from pesticides, fertilisers and saline contamination in coastal areas.

30.7.5 Also within the study area, Geoindex maps indicate there is one water well within the study area located to the north of the existing junction to the west of High Road. It is not known if water is currently being extracted from this well; however, the site walkover did not locate any evidence of the well or any infrastructure leading to nearby properties.

30.7.6 The sensitivity of groundwater is therefore determined to be medium.

Aquatic Ecology

30.7.7 Aquatic ecology is described in section 5.4 of the PCF Stage 2 EAR - Nature Conservation and Biodiversity. The study area is ecologically diverse, with internationally important designated sites in close proximity to the existing Guyhirn junction. It is determined that the sensitivity of aquatic ecology is very high.

Flooding

30.7.8 Baseline information is contained in sections 4.10.13 – 4.10.21 of this report.

30.7.9 Rings End pumping station and its associated infrastructure lie adjacent to the existing roundabout and hold an important role in controlling flood risk within the study. The sensitivity of flood risk in this instance is considered to be very high.

30.8 People and Communities

Introduction

30.8.1 The aim of this section is to identify the key features in the study area in relation to people and communities including vehicle travellers, non-motorised users (pedestrians, equestrians and cyclists) and land use (private property, community land, development land, agricultural land).

Pedestrians, Cyclists and Equestrians

30.8.2 A number of key routes have been identified within the study area, described in Table 30-7 and shown in the PCF Stage 2 EAR Figure 5.7.2. These routes provide an important means of access for local people to community facilities and the wider study area. User numbers for the routes are low and therefore they are of low sensitivity. Route 3 is the most used route and is of medium sensitivity.

Table 30-7: NMU Route Descriptions

Route Name	Description
Route 1	Travelling north-south along eastern bank of Moreton's Leam, before crossing A141 south of existing junction.
Route 2	Follows the western bank of River Nene, crossing A47 to west of existing junction and continuing between High Road and the river.
Route 3	Incorporating a set of stairs and a ramp connecting High Road and A47 to the west of the existing junction and requires users to cross the A47 at one of two locations (either at Gull Road/A47 junction or immediately adjacent to stairs/ramp). NMUs can make use of footways on either side of the A47.
Route 4	Route connects residential properties to the east of the existing roundabout to services west of the junction. Incorporates dropped kerb crossing with central refuge to the north of existing junction and requires NMUs to use linking path through woodland immediately adjacent to eastern edge of the roundabout.

Route Name	Description
Route 5	Footway running from residential properties to the south of the existing junction (on the western side of the A141) to services on the A47 to the west. Does not require users to cross the road.

Land Use

Community land and Facilities

30.8.3 There are a small number of community facilities within the study area, including one primary school, a village hall, a place of worship, shops and services and some recreational facilities as shown in PCF Stage 2 EAR Figure 5.7.2**.** Most of the community facilities are concentrated along High Road and towards the west of the study on the A47 Fen Road which means that NMUs are likely to use a mix of the footways and public rights of way to travel between residential areas and community facilities.

Private Property

30.8.4 There are approximately 188 residential properties within the study area concentrated in Guyhirn village, March Road and High Road. Numerous commercial properties are also located within the study area.

Agricultural & Development Land

30.8.5 Background information on development and agricultural land is contained in sections 4.9.16 – 4.9.19 of this report and in the PCF Stage 2 EAR Figure 5.8.4.

30.8.6 For the assessment of land use, only those plots which will experience a loss of land have been considered in the assessment. These correspond to those shown in Figure 5.7.3 of the PCF Stage 2 EAR. The sensitivity of the plots likely to suffer from land take is outlined in Table 30-8below. It should be noted at this point that plots with the same plot number are owned by the same landowner. Further details are provided in section 5.7 of the EAR.

Table 30-8: Sensitivity of Affected Land Plots

Plot	Land type	Sensitivity
5	This plot is comprised primarily of un-cultivated scrubland immediately adjacent to east of the River Nene. This is classed as Grade 1 agricultural land.	High
5	A small plot of scrubland located to the east of the existing junction.	Low
5	A small plot of scrubland located to the north east of the existing junction.	Low
5	A small linear plot comprised of scrubland which runs parallel to the existing A47 South Brink	Low
16	This plot is comprised of road space (High Road) and associated verges and embankment along the River Nene to the west of the river.	Low
16	A small area of scrubland/woodland which hosts a public footpath.	High
31	This plot is comprised of scrubland located directly under the bridge which spans the River Nene.	Low
33	This plot comprises the river Nene and its bank to the north of the bridge.	High

Plot	Land type	Sensitivity
34	This plot comprises of the River Nene and its bank to the south of the bridge.	High
100	An area of uncultivated scrubland to the south west of the existing Guyhirn junction, adjacent to Moreton's Leam and the River Nene. Contains sporadic woodland and one Public Right of Way. The land is categorised as Grade 1 (excellent) agricultural land.	High
100	A small area of uncultivated scrubland to the south east of the existing Guyhirn Junction adjacent to the residential properties on March Road.	Low
100	This plot is comprised of uncultivated scrubland located to the north east of the existing Guyhirn junction.	Low
100	Small plot of scrubland located to the north of the bridge which spans the River Nene.	Low

Vehicle Travellers

Driver Stress

30.8.7 The high volume of traffic, relative to the size of the road was confirmed during a site visits in June 2016 and February 2017. Congestion around the roundabout is common with the roundabout itself being relatively small, limiting emerging opportunities. Problems on approach roads were observed during the site visit and examples of reverse priority were witnessed at the A47/B1187 junction to the west of the roundabout. Similar levels of difficulty are experienced in emerging from local access March Road to join the A141, particularly when turning right. Each of these factors, particularly in the context of relatively high traffic flow will contribute to driver stress. Driver stress is assessed as high along the A47 and A141.

View from the Road

30.8.8 Refer to section 4.9.21 of this report.

30.9 Geology and Soils

30.9.1 Please refer to section 4.7 of this report for baseline information regarding geology and soils.

30.10 Materials

30.10.1 Please refer to section 4.6 of this report for baseline information on materials.

30.11 Environmental Assessment Introduction

30.11.1 The purpose of this section is to provide a summary of the environmental assessment undertaken during the PCF Stage 2 process. The PCF Stage 2 Environmental Assessment Report (EAR) (document reference A47IMPS2-AMY-GJ-ZZ-DO-J0024) is a standalone document which provides a detailed assessment of the environmental effects of the proposed option for the A47 Guyhirn Junction Improvements scheme. The PCF Stage 2 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) (document reference A47IMPS2-AMY-GJ-ZZ-DO-J0054) have also been produced.

30.12 Preliminary Assessment

30.12.1 Following on from PCF Stage 1, a preliminary environmental assessment of the three sifted scheme options has been undertaken for each environmental topic which has provided a ranking of these three options from the preferred option with the least expected environmental effects, through to the worst option with the most expected environmental effects.

30.12.2 To determine which option performs best from an environmental perspective it is necessary to combine these individual assessments to reach a view on the overall environmentally preferred option. For this report, this has been done by simply comparing the option rankings with the option that is preferred by the majority of the environmental topics being considered to be the overall environmentally preferred option. This is set out in Appendix 2.3 of the PCF Stage 2 EAR, and from this it can be seen that Option 1 was considered the preferred environmental option.

30.13 Assessment methodology

30.13.1 The DMRB Volume 11, Environmental Assessment, was followed as far as possible; where relevant limitations to the environmental assessment are set out in each environmental topic section within Chapter 5 of the PCF Stage 2 EAR.

30.13.2 A six-step assessment was undertaken on Option 1 and details of this are provided in chapter 2 of the PCF Stage 2 EAR. Detailed methodologies for each topic are presented within each topic section of chapter 5 of the PCF Stage 2 EAR.

30.14 Environmental assessment of proposed option

Introduction

30.14.1 Baseline information on all environmental topics is summarised within Chapter 4 of this report. This section provides a summary of the potential impacts on receptors and features of each topic from the Option 1, considered in chapter 5 of the PCF Stage 2 EAR.

Air Quality

30.14.2 The DMRB HA207/07 assessment methodology and associated advice notes have been used to assess air quality impacts at sensitive human and ecological receptors at the Guyhirn roundabout where 'affected' roads have been identified. Predictions have been made for opening year 2021 and assessment year 2036. Although uncertainties are associated with the methodology, the results are intended to indicate the likely impacts of Option 1 and the need for further detailed assessment.

30.14.3 The results of the assessment undertaken in section 5.1 of the PCF Stage 2 EAR show no exceedances of the NO2, NOX and PM10 long term or short term objectives are predicted in the baseline year. All concentrations of NO2, NOx and PM10 are predicted to be lower in the opening and assessment years than baseline year 2017. They are all under half the annual average objectives in the opening and assessment years and no exceedances of the short-term objectives are predicted.

30.14.4 Concentrations are predicted to be lower in 2036 than 2021 because of anticipated improvements in background air quality and vehicle efficiency over time. With the scheme in place in 2021 and 2036, negligible to moderate effects on NO2 and PM10 concentrations are predicted at all receptors with most of these being beneficial. As a result, further detailed assessment of Option 1 and specific mitigation are not considered necessary.

30.14.5 In the baseline year, rates of nutrient nitrogen deposition to the Nene Washes are outside the critical load range at which significant damage could occur. They are predicted to be lower in

the opening and assessment years than baseline year 2017. Without the scheme in place in 2021 and 2036, the assessment has shown rates of nutrient nitrogen deposition to the Nene Washes will remain well below the threshold range at which significant damage could occur at all transect points 50m and beyond Fen Road and March Road. The scheme is predicted to reduce the rate of nitrogen deposition further which will benefit to the health of the Nene Washes in the long-term.

30.14.6 Construction activities are predicted to have a high risk of generating large quantities of dust in an area with high sensitivity for both human and ecological receptors. With construction dust management, mitigation and monitoring within the Construction Environmental Management Plan, the overall effect is expected to be not significant.

30.14.7 The overall judgement of the scheme is that impacts are not significant with respect to local air quality with Option 1.

Cultural Heritage

30.14.8 Option 1 will not impact upon any recorded cultural heritage assets however, there does remain the potential for the scheme to adversely affect currently unknown subsurface archaeological and/or palaeoenvironmental remains.

30.14.9 Archaeological mitigation may 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 further mitigation in line with NPPF paragraph 128 and National Policy Statement for National Networks (NPSNN) paragraph 5.127.

Landscape and Visual

30.14.10 Option 1 would re-align the roundabout and significantly increase the footprint of the junction along with widening of the approach roads. From the assessment undertaken in section 5.3 of the PCF Stage 2 EAR, loss of vegetation would occur along with regrading of the adjacent land, however there would be no significant adverse effects on the fabric and character of the landscape either during construction or in Year 15.

30.14.11 Views to the roundabout would be altered both as a direct result of the construction works and as a result of improving sightlines towards the junction. Residential properties in close proximity to the junction would, as a result of loss of vegetation, be likely to experience a significant adverse visual effect during construction. Although replacement planting belts would generally help to mitigate and soften the adverse effects over time, for some residential properties where there is insufficient space available for sufficiently wide screening belts, there would still be significant adverse effects in Year 15.

30.14.12 Although there would be significant adverse visual effects on some cultural receptors such as the Church of St Mary Magdalene and the Nene Way promoted footpath route as a result of construction activity, there would be no significant effects in Year 15. The Nene Way promoted footpath would experience significant adverse visual effects during construction but generally overall the effects would not be significant in Year 15.

Nature Conservation and Biodiversity

30.14.13 From the assessment undertaken in section 5.4 of the PCF Stage 2 EAR, significant impacts are expected to affect the Guyhirn Reedbed County Wildlife Site (CWS), priority habitats, otter and breeding birds primarily due to loss or disturbance to wetland, scrub and woodland habitat around the junction. With mitigation, these impacts are reduced to neutral or

slight. There is also potential for significant impacts to affect the Nene Washes complex of designated sites during construction of the scheme.

30.14.14 This assessment is currently incomplete and full details of significant impacts, potential mitigation and monitoring requirements will be provided in the PCF Stage 3 reporting.

Noise and Vibration

30.14.15 The assessment undertaken in section 5.5 of the PCF Stage 2 EAR shows that Option 1 has overall neutral effects for most of the noise sensitive receptors within the study area. However, the closest properties to the junction to the east of local access March Road are expected to show moderate adverse effects. The exact measures to reduce the effects of the scheme and the removal of the vegetation will be further assessed at PCF Stage 3 with detailed discussions with the Landscape Architect, Project Engineer and Acoustic Consultant.

30.14.16 The two existing NIAs within the study area (but not within the footprint of the proposed option) show neutral effects. Therefore, the proposed option will not improve the noise environment in those NIAs. Consequently, the proposed option will not meet either the objective in Defra Noise Action Plan or the Highways England KPI for noise of addressing (i.e. contribute to the improvement of) the noise levels within NIAs.

Road Drainage and the Water Environment

30.14.17 Prior to construction, a number of consents/permits will be required;

- An environmental permit will be required from the Environment Agency for all construction activities within 8m of the River Nene;
- A marine licence will be required for any construction activity within the River Nene or to the bridge over the river;
- Written consent will be required from Waldersey Internal Drainage Board (IDB) for all construction work within 9m of any of its drainage infrastructure.

30.14.18 During construction, significant impacts are determined for surface water and aquatic ecology. The surface water environment will likely experience adverse impacts due to the creation of haul roads, movement of construction vehicles and the embankment work required, all of which will be within close proximity to the River Nene. Any deterioration in surface water quality during construction will result in adverse impacts for aquatic ecology.

30.14.19 During operation, it is determined that Option 1 will have limited impacts on road drainage and the water environment. No significant effects are determined for surface water, groundwater, aquatic ecology or flood risk.

30.14.20 Option 1 requires no new crossing over the River Nene and no other surface watercourse will be lost or severed by the scheme. During operation, it is likely that the study area will experience a slight increase in surface water runoff due to the increased impermeable area of the larger roundabout and widened approach lanes. Contamination from routine runoff is unlikely and there is a low risk of accidental spillage (see section 5.6 of the PCF Stage 2 EAR).

30.14.21 Option 1 predominantly runs online and subsequently, large scale excavations in areas which have not been previously excavated are limited. Groundwater for the area is limited and no direct discharges into the groundwater environment will take place. The risk of groundwater contamination from runoff has further been assessed as low.

30.14.22 As Option 1 will largely remain online, impacts upon flood risk are determined to be limited. The larger roundabout and approach lanes may increase the risk of surface water flooding yet this will be mitigated in the long term. The surge chamber to be impacted by the option will additionally be relocated and it is assumed that this infrastructure will be designed to

host baseline flows. It has been determined in accordance with NPFF that the site is suitable for the proposed development and that a full Flood Risk Assessment will not be required; there is no evidence of historic flooding at the site and flood levels from the River Nene do not affect the roundabout.

People and Communities

30.14.23 The assessment undertaken in section 5.7 of the PCF Stage 2 EAR shows that overall Option 1 will result in minimal land use impact. Land take will only occur in areas of carriageway, verge or footway, resulting in an impact of slight significance for the affected plot.

30.14.24 Journey lengths for pedestrians and cyclists will be reduced, either in terms of distance or time, for two of the five key routes assessed, with the significance of this impact assessed as slight beneficial for both. This reduction in journey time or journey length will encourage users and reduce community severance. Impacts on all other routes will be neutral.

30.14.25 The most used route incorporates a set of stairs and a ramp to connect High Road and A47 to the west of the existing junction and requires users to cross the A47 at one of two locations (either at B1187 Gull Road/A47 junction or immediately adjacent to stairs/ramp). The introduction of a signalised crossing to the south of the junction has the potential to reduce journey time, improve the consistency of crossing times and encourage local residents to make journeys. During construction however, there will be significant adverse impacts for three of the identified NMU routes due to the presence of construction traffic and traffic management resulting in increased noise and a reduction in air quality.

30.14.26 Traffic data suggests that driver stress is likely to remain unchanged for the year 2036, although some aspects of the driver experience, such as journey time reliability and the formalisation of interactions with NMUs, will be improved.

30.14.27 Views from the road are unlikely to change significantly as the road level will remain broadly the same. Vegetation removal is unlikely to be of a sufficient magnitude to allow drivers to experience the surrounding landscape to an extent notably different to baseline conditions.

Geology and Soils

30.14.28 Option 1 would have slight impacts on made ground, superficial geology and soils. These impacts would be reduced though the production of Materials Management Plan (MMP) and Soils Resource Plan (SRP).

30.14.29 There are moderate risks to construction workers and to surface waters from some contamination sources (S1, S2, S8, S9, S14, and S15), and these can be mitigated through techniques such as appropriate working practices, use of PPE, delineation of areas of contamination etc. See section 5.8 of the PCF Stage 2 EAR for more details.

30.14.30 There is a moderate risk from ground gas (asphyxiant and explosive) in buildings and underground structures. It should be delineated through gas monitoring undertaken in line with CIRIA C665 Assessing risks posed by hazardous ground gases to buildings, BS8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, and NHBC guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. Then risks may be further defined and mitigation measures built into the design.

Materials and Waste Management

30.14.31 Following the implementation of mitigation measures, there will remain some residual impacts with regards to the usage of raw materials and wastage. These are as follows:

- Although wastage will be reduced by following best practice, ensuring good upkeep and condition of plant and machinery, and reducing the usage of plant and machinery, there will remain some inevitable wastage attributed to plant and machinery.
- There will be risk of wastage through spillage of materials attributed to plant and machinery.
- Although every effort would be made to ensure materials are sourced locally, logistical constraints will cause inevitable wastage through transport of materials.
- It cannot be realistically expected that all materials will be suited to reuse or recycling options, and will therefore be considered waste.
- It is expected that, significant materials will be required in future repair efforts, although these are only expected to be slightly higher than those currently and following best practice during construction is likely to considerably reduce this quantity through less frequent need for repairs; reducing the impact of such material usage to negligible levels.
- If energy efficient solutions are found and implemented with regards to new lighting fixtures, along with sustainable energy sources where possible, this will considerably reduce the wastage produced by lighting (light pollution, energy loss) to negligible levels.

Summary of mitigation measures and monitoring requirements

Construction

30.14.32 Mitigation during construction should be clearly stated and recorded within a Construction Environmental Management Plan. At this stage, no specific mitigation has been agreed and general best practice is assumed. This includes general pollution prevention measures such as those contained within Pollution Prevention Guidance (PPGs) or the new Guidance for Pollution Prevention (GPPs). Such measures may include dampening down haul roads, trial trenching and watching briefs, protective fencing for vegetation, stocking and covering of top soil.

30.14.33 The siting of intrusive features such as site buildings, storage compounds, spoil heaps, access tracks and parking areas should take account of sensitive visual receptors such as housing and public footpaths. Existing vegetation should be carefully protected and site hoardings may be used to screen low level activity. Fuel, oil and chemicals stored on site can impact greatly on the water environment, therefore these should not be stored within 10m of any watercourse or surface drainage system to minimise pollution risk. All contractors COSHH materials must be secured when not in use and positioned in such a way that liquid will not flow into any nearby gully systems.

30.14.34 Preconstruction surveys, mammal fencing, timing of works to avoid sensitive periods and habitat re-instatement may mitigate some impacts however in terms of nature conservation and biodiversity, mitigation and compensation will be assessed in detail at PCF Stage 3 when the detailed design and construction methodology is known.

30.14.35 In relation to noise the hours of works may be controlled especially for potentially disruptive operations, preferring works during the day, to those works in the evening and evening works to those works at night.

30.14.36 Control of noise and vibration at source includes ensuring that plant and equipment are the quietest available for the required purpose, the use of enclosures and regular and effective maintenance of plant and machinery. Control of the spread of noise includes maximising the distance between noise sources and noise sensitive receptors and the use of screening.

30.14.37 The Scheme is expected to employ traditional cut and fill methods during construction. In order to maximise the reuse of existing materials on site, consideration could be given to recycling road planings and using them as aggregates in the sub-base layers. This will be subject to agreement and appropriate registration with the Environment Agency prior to work

commencing. Recycled aggregates can be sourced for road construction to reduce costs and improve sustainability of the scheme.

Operation

30.14.38 In terms of the landscape and visual impacts mitigation measures should come from the design of the road, including main line, side roads and junctions. These include:

- To get the best fit with the contours
- To retain and make the best use of existing vegetation
- To optimise protection for nearby houses through use of cuttings, existing features or range
- To avoid loss or damage to landscape fabric (hedges, water features or fields systems).
- Landscape mitigation measures become necessary when the design of the road is not enough to mitigate its impact on the surrounding landscape. These include:
- On and offsite planting
- Mounding and earth shaping
- Careful consideration of the form and finish of structures
- The alignment and appearance of roadside ditches and fences.
- The appearance of other features such as street signs and gantries.

30.14.39 In relation to noise, as there are receptors within 600m of the carriageway, low noise surface (TSCS) is included as part of the design. However, as the average speed for the entire road links in the area is 63km/h, the performance of low noise surfaces will be limited. The noise model has included a surface correction of an additional -0.5dB with low noise surface compared to HRA (rather than the typical 3dB at higher speeds).

30.14.40 Noise barriers are not feasible where direct access to the sensitive receptor from the road is required. This is the case for most of the properties at either side of the A141 March Road and at either side of the A47 Fen Road.

30.14.41 However, noise barriers could be included at the area of 1 and 5 March Road where the belt of vegetation exists as discussed above. Nevertheless, noise barriers have not been included in the noise model at this stage since it is not yet known whether they will be compatible with the visibility and safety requirements close to the roundabout.

30.14.42 Due to the proximity of designated sites to the junction (Figure 5.4.1 of the PCF Stage 2 EAR), appropriate avoidance measures, mitigation and compensation will be assessed in detail at PCF Stage 3 when the detailed design and construction methodology is known.

Conclusions

30.14.43 According to the assessment undertaken, significant impacts will be experienced in relation to visual, noise and vibration and nature conservation as shown in Table 30-9. Further detailed assessment will be undertaken during the PCF Stage 3 to identify specific mitigation and monitoring requirements where these may be required.

Table 30-9: Option 1 Summary

Environmental topic	Significant impact	Non-significant impact
Air quality		x
Cultural heritage		x
Landscape and visual	X	
Nature conservation and ecology	X	
Noise and vibration	X	
Road drainage and the water environment	X (during construction)	x
People and communities	X (NMU routes during construction)	x
Geology and soils		x
Materials and waste	x	

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 70, 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 Guyhirn and the surrounding area.

31.1.2 Sections 24.2.5 to 24.2.9 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 analysis, the consultation comments were filtered to identify where comments were specific to the use of "suggestion" in their response. This was undertaken by filtering comments which had been coded as follows:

31.1.4 "General" theme comments also coded as:

- "Suggestion"
- "Alternative suggestion - consider future improvements to A47 / A141"
- "Alternative suggestion - design / route"
- "Alternative suggestion - traffic lights"
- "Alternative suggestion – dualling of A47"
- "Alternative suggestion – filter lanes"

31.1.5 "Option 1" theme comments also coded as:

- "Alternative suggestion"
- "Alternative suggestion – address A47/B1187 (Gull road)"
- "Alternative suggestion – Dual A47 Guyhirn / Wisbech"
- "Alternative suggestion – traffic lights"
- "Suggestion"
- "Suggestions"

31.1.6 "Provision for non-motorised transport (NMU)" theme comments also coded as:

- "NMU – suggestion"

31.2 Filtered "suggestion" comments

31.2.1 The "suggestion" comments identified by the filtering as explained in 31.1.3 are presented in the tables in Appendix 29.

31.3 Review of comments

31.3.1 Specific public suggestions have been individually responded to in turn and can be found in Appendix 29.

31.3.2 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.

31.3.3 As is stated in the tables in Appendix 29 many 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."

31.3.4 It is also apparent that many of the responses refer to the desire to dual the A47 and / or by-pass this junction which is an aspiration held by many in the area. This is clearly outside of the scope of this scheme as it is specifically addressing the issues identified by the studies that contributed to the improvements being included in the RIS.

31.3.5 The suggestion of installing traffic lights is also raised by a few respondents. As discussed in section 27.3, this was an option (Option 4) that was proposed in PCF Stage 1, but discounted during sifting in that stage and again at the PRD meeting in June 2016 due to the interaction with the nearby B1187 Gull Road junction, that is outside the scheme extents.

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 summary of completed stakeholder engagement during PCF Stage 2 that included Highways England is detailed below and is in addition to that described in Chapter 19 (PCF Stage 1).

32.1.2 A meeting was held with Technical Officers from CCC and FDC on 25 July 2017 to discuss the Preferred Route Announcement and bring them up to date with developments relating to the design.

32.1.3 No further meetings were held with the national or local environmental statutory bodies (Natural England, Historic England, Environment Agency, local IDB) during PCF Stage 2 at the request of Highways England. Informal engagement has occurred with a few of these bodies, namely the EA and IDB, to further inform design details and the assessments.

32.1.4 Further engagement with the environmental bodies is required early in PCF Stage 3 and must be prioritised by Highways England to inform the critical screening opinion.

32.1.5 No further meetings have been held with PINS, the A47 Alliance or Members of Parliament during PCF Stage 2.

32.2 Assessment of Planning Requirements, National and Local Policy

32.2.1 In order to secure planning approval, all significant highways schemes are subject to statutory processes in order to demonstrate that they have followed due process and guidance set out in relevant Acts of Parliament.

32.2.2 The key Acts of Parliament to consider for this scheme are:

- Highways Act 1980
- Planning Act 2008

32.2.3 A determination is required to establish which Act is relevant to this scheme. This is dependent on a number of factors including:

- The type of scheme
- The area of land required for the scheme
- The environmental impact of the scheme

32.2.4 Consultation with Highways England legal representatives and the DCO Statutory Processes Manager was undertaken during PCF Stage 1, where the options were discussed in detail and information was shared between all parties to enable an assessment of the scheme.

32.2.5 This was continued into PCF Stage 2 and focused only on Option 1 following the non-statutory public consultations (PIE).

32.2.6 The legal opinion regarding Option 1 is as follows:

32.2.7 At the time of writing, it is considered that Option 1 is an improvement scheme and will require a DCO due to the expectation that the options will have the potential to create a significant environmental impact. If this is the case an Environmental Impact Assessment will be required.

32.2.8 Option 1 is a scheme which ordinarily could be constructed under Highways England's general power of improvement. This is because there is no new route for traffic, and there is minimal change to the alignment of the road. If the Scheme were to be built using the powers of

improvement, Highways England would need to acquire the land by agreement, and prepare an appropriate side roads order. However, improvement schemes with likely significant environmental effects cannot be built without consideration of these effects, resulting in the need for a DCO.

32.2.9 As detailed in Chapter 27, an approach has been adopted during PCF Stage 2 to inform the process of determining the requirement for DCO. This included additional environmental surveys to investigate the likely impact of the scheme on the close by designated sites and completion of intrusive surveys earlier in the PCF process than normal to enable this information to be fed into the development of the design to a more detailed level, enabling a detailed construction methodology to be produced. The additional environmental information together with the construction information will be used to aid screening by Highways England early in PCF Stage 3 to determine the need for DCO.

32.2.10 From the above, in order to develop an outline process and programme for the scheme, at the time of writing, an assumption has been made that this scheme will be subject to the Planning Act 2008. Furthermore, it has also been assumed that the scheme will be considered a Nationally Significant Infrastructure Project (NSIP) and will be subject to a Development Consent Order (DCO) process as the environmental screening remains inconclusive.

32.2.11 This determination will remain under review as the scheme progresses through later PCF stages as more information becomes available.

32.2.12 A DCO defined programme is discussed in further detail in Chapter 33 (to be updated by HE/ PCF Stage 3 supplier).

National Policy Statement for National Networks (NPSNN)

32.2.13 As detailed above and earlier in this document, during PCF Stages 0, 1 and 2, it was assumed that improvements to Guyhirn junction would meet the criteria for a NSIP and would be subject to the DCO process, primarily due to the potential for likely significant environmental effects of the Scheme. 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.

32.2.14 Specific sections of the NPSNN and how these relate to the Scheme have been addressed in the PCF Stage 2 Product DCO Application – Planning Statement & National Policy Statement Accordance, document reference A47IMPS2-AMY-GJ-ZZ-DO-J0052.

32.2.15 This confirms the assumption that the Scheme should be considered a NSIP and therefore follow a DCO planning route determined by the Planning Act 2008 at this time.

Roads Investment Strategy (RIS)

32.2.16 The RIS described in Chapter 2 of this report is still applicable to this Scheme.

32.2.17 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)

32.2.18 The SBP described in Chapter 2 is still current and relevant to this Scheme and has not been updated.

32.2.19 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)

32.2.20 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.

1.1.6 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.

32.2.21 The KPI's remain but the PI's within each KPI have been updated which will need further consideration during future PCF Stages.

32.2.22 A supplementary Annex was published by Highways England in October 2017 which provides further update on scheme delivery and performance against KPI's.

32.2.23 The A47 Guyhirn Junction 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 by Highways England in future PCF stages.

32.2.24 Specifically, the update to the Delivery Plan describes the reason for delay as 'the route based review seeks to optimise the delivery programme of 7 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 2 schemes around Peterborough enable a joint traffic management strategy to be developed for improved delivery efficiency.'

Greater Cambridge Greater Peterborough Local Enterprise Partnership (GCGP LEP) Strategic Economic Plan 2014

32.2.25 The GCGP LEP Strategic Economic Plan originally published in 2014 is still current but has been updated to include 3 'Growth Deals' (latest in July 2016).

32.2.26 The A47 improvements are present in all 3 of the 'Growth Deal' updates and are recognised as key to unlocking housing and employment developments.

32.2.27 It also recognises the combined authority (see section 2.3.13 and 32.3.31), the Mayor of which is a member of the LEP and it states that 'GCGP will have senior representation within the Mayor's cabinet'.

32.2.28 GCGP are currently developing 'investment pipelines' to support the new combined authority, but no further details are available at the time of writing.

Cambridgeshire Local Transport Plan (LTP) Long Term Transport Strategy (LTTS)

32.2.29 The Cambridgeshire LTP LTTS from 2014 has not been updated and is still current at the time of writing.

Fenland District Council (FDC)

32.2.30 Both the FDC Local Plan (2014) and the Infrastructure Delivery Plan (2013) described in sections 2.3.6 – 2.3.12 are still current and have not been updated at the time of writing.

Cambridgeshire and Peterborough Combined Authority

32.2.31 The Combined Authority proposal described in section 2.3.13 of this report was submitted to Government and approved in March 2017. A new Mayor was elected in May 2017 that is the contact for Central Government.

32.2.32 Policies are currently in development but at the time of writing, there are no specific areas that have been published in regards to transport or the A47 Guyhirn Junction specifically.

32.3 Assessment of options against planning factors

32.3.1 At the time of writing, Option 1 does not have a negative impact on any of the plans described in Chapter 2 or this chapter and complies with the policies described in the same.

32.3.2 During PCF Stage 2, there were no known developments that influenced the determination of the Preferred Route or affected Option 1.

33 Appraisal Summary Table (AST)

33.1.1 The completed PCF Stage 2 AST can be found in Appendix 34.

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, document reference A47 IMPS2-AMY-GJ-ZZ-DO-J-0063.

34 Programme

34.1 Key milestones

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 for Option 1, see Table 33-1 below.

Table 33-1: Summary of key milestones

PCF Stage	Delivery Item	Estimated project delivery date	Estimated project duration
PCF Stage 0	Strategy, Shaping and Prioritisation	Complete	Complete
PCF Stage 1	Option Identification	Complete	Complete
PCF Stage 2	Option Selection	Jan 2017 to Dec 2017	Complete
PCF Stage 3	Preliminary Design	TBC	TBC
PCF Stage 4	Statutory Procedures and Powers	TBC	TBC
PCF Stage 5	Construction Preparation	TBC	TBC
PCF Stage 6	Construction, Commissioning and Handover	TBC	TBC
PCF Stage 7	Close Out	TBC	TBC

35 Validation of Preferred Route and Conclusions

35.1.1 This study has confirmed the transport problem as being Guyhirn junction is predicted to be over capacity by 2021 on the A47 approaches. By 2036 this problem will be further exacerbated by the potential future developments in the area which are noted within the Fenland District Council Local Plan. The potential increase in traffic flow will potentially lead to increased congestion.

35.1.2 In seeking to resolve the transport problem a number of potential options have been developed that have been considered in this report.

35.1.3 The options have been evaluated and assessed and sifted down to a single preferred option - Option 1, which resolves the transport problem by increasing the junction capacity at Guyhirn and should allow for a safer, swifter movement of traffic through the junction.

35.1.4 The work completed after the PRD meeting, namely the traffic modelling including construction delay modelling and economic, environment and summary of all appraisals during the stage (as detailed in the AST), did not show any issues that contradicted the decision to progress Option 1 as the Preferred Route. In fact, the results from these assessments confirmed the suitability for Option 1 as being selected as the Preferred Route.

35.1.5 Option 1 has a number of positive aspects that confirmed the decision at the PRD meeting as being selected as the Preferred Route, namely;

- Meets RIS Commitment
- Solves the transport problem
- Likely High value for money
- Opportunities associated with DCO screening (programme savings)
- Opportunity to improve NMU facilities to that of existing
- Potential for further cost savings (drainage, surge chamber, reduction in geotechnical solution) identified by buildability contractor
- Positive feedback from the public at the PIE's

35.1.6 Indications from the economics information available at this time are positive with a high BCR (3.78).

35.2 Recommended PRA Route

35.2.1 The preferred route was announced by Highways England on 14 August 2017. The PRA leaflet states:

35.2.2 'Having reviewed the feedback following the consultation, and completed a number of other assessments, we are proceeding with the option (Option 1) presented at consultation.' This will be developed further before further consultation engagement.

35.2.3 'This preferred route will provide improvements for road users, reduces congestion and provides good value for money. The proposed option will look to improve pedestrian crossings'

PCF Stage 3

35.2.4 As detailed previously, the PCF Stage 3 Consultant have been engaged early and are progressing a number of areas. Items of note that are being investigated further include;

- The design taken forward to PCF Stage 3 has been developed in more detail in order to determine the planning route required (DCO) which in turn could offer programme savings.
- Completion of environmental screening to enable completion of an Environmental Impact Assessment and an Environmental Statement (if required) giving greater understanding of the impacts on the sensitive designated sites in the area.
- Affordability and Value Management – the current Highways England budget for the Scheme is in the range of £11M - £17M (2014 Feasibility Study). The current Options Estimate for Option 1 is within this range. However, further value management interventions are recommended as the Scheme progresses to ensure the Scheme remains affordable.
- Greater understanding of the impacts on the existing surge chamber and culvert in the area, in particular the requirement to move the surge chamber.
- Further engagement with statutory stakeholders in particular those concerned with the sensitive environmental areas nearby, to ensure minimal impacts and necessary permits/licenses are in place for any works and to inform the screening opinion that is critical for determining the planning route for the Scheme.
- More detailed investigations and recommendations regarding NMU provisions at the junction, including a NMU audit and a RSA as appropriate.
- Buildability of the option and understanding the arrangements in regards to Traffic Management required during construction to minimise disruption.
- Development of a detailed construction methodology to aid design development and to inform the critical environmental screening.
- Further investigations in regards to the interactions with the nearby B1187 Gull Road junction.
- Full structural assessment of the A47 Fen Road River Nene bridge to determine suitability for the proposed solution.

36 List of Appendices

Appendix 1 – Technical Note – Assessment of Guyhirn Bridge

Appendix 2 – Flood Plain Map – A47 Guyhirn Junction

Appendix 3 – Environmental Study Area

Appendix 4 – Environmental Constraints

Appendix 5 – Route 6 Diversions

Appendix 6 – Route 7 Diversions

Appendix 7 – EAST Based Criteria

Appendix 8 – EAST Sifting A47 Guyhirn

Appendix 9 – A47 Guyhirn ORM Presentation

Appendix 10 – A47 Guyhirn Option 1

Appendix 11 – A47 Guyhirn Option 2

Appendix 12 – A47 Guyhirn Option 8

Appendix 13 – A47 Guyhirn Bridge Preliminary Assessments

Appendix 14 – Option 1 Guyhirn Bridge Structure Information

Appendix 15 – Option 1 Guyhirn Bridge Structure Piers & Abutments Information

Appendix 16 - Option 2 Guyhirn Bridge Structure Information

Appendix 17 - Option 2 Guyhirn Bridge Structure Piers & Abutments Information

Appendix 18 – Option 8 New Guyhirn Bridge Information

Appendix 19 – A47 Guyhirn Existing Utilities

Appendix 20 – Guyhirn AST Option 2 Stage 1

Appendix 21 – Revised Option 2 Layout

Appendix 22 – Schedule of items, revised VM BoQ

Appendix 23 – Final Option 1 Layout (as a result of VM Exercise)

Appendix 24 – Final Option 1 Cross Sections

Appendix 25 – Option 1 Carriageway Modifications

Appendix 26 – A47 Guyhirn Public Consultation Brochure

Appendix 27 – A47 Guyhirn Non-Technical Summary

Appendix 28 – A47 Guyhirn Public Consultation Leaflet

Appendix 29 - A47 Guyhirn PIE Responses

Appendix 30 – A47 Guyhirn PRD Presentation

Appendix 31 – A47 Guyhirn PRD Minutes

Appendix 32 – A47 Exceptions & Limitations at PRD

Appendix 33 – Option 4 Consideration

Appendix 34 – A47 Guyhirn AST Stage 2