A47 Blofield to North Burlingham Dualling

Scheme Number: TR010040

Volume 7
7.6 Scheme Design Report

APFP Regulation 5(2)(q)

Planning Act 2008

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

July 2021

Deadline 1

Infrastructure Planning

Planning Act 2008

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

A47 Blofield to North Burlingham Development Consent Order 202[x]

Scheme Design Report

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Author:	A47 Blofield to North Burlingham Dualling Project Team, Highways England

Version	Date	Status of Version
Rev 0	December 2020	Application submission
Rev 1	July 2021	Deadline 1 submission

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FIGURES

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EXECUTIVE SUMMARY

This Scheme Design Report has been prepared for the A47 Blofield to North Burlingham Scheme, hereafter referred to as 'the Scheme'.

The Blofield to North Burlingham section of the A47 is located approximately nine kilometres to the east of Norwich. This 2.6km of single carriageway forms a part of the main arterial highway route connecting Norwich with Great Yarmouth to the east. Currently, the existing A47 from Blofield to North Burlingham experiences delays and high levels of congestion during peak hours. The situation is predicted to get worse with proposed growth in residential development.

The Scheme is proposed as a solution which will include upgrading the existing single carriageway to a dual carriageway with the provision of a new road built to the south of the existing A47. Two new junctions will be provided at the east and west of the Scheme to provide connection between the strategic road network and the local road network. Some existing at-grade junctions and private access to the existing A47 will be closed providing significant safety improvements over the existing situation.

The design has been developed to meet the Scheme objectives and to take account of Highways England's design principles, the outcomes of consultation and stakeholder engagement, and the environmental, geographical and social constraints in the area in which the Scheme is located.

The route of the new dual carriageway was chosen and announced in the Preferred Route Announcement in August 2017, following a non-statutory public consultation where feedback was gathered on four alternative route options. Following the preferred route announcement, the junction options were selected following a review of alternatives. The selected junction arrangements were an at-grade westbound only left-in left-out arrangement at the western junction with Yarmouth Road near Blofield, and a compact grade separated junction between the A47 and the B1140. The design of the Scheme, including the local road connections and ancillaries, was progressed in line with national highway standards including the Design Manual for Roads and Bridges, the Manual of Contract Documents for Highway Works and the Traffic Signs Manual.

The construction strategy for the Scheme has been planned to minimise disruption to road users, neighbouring landowners and the general public during construction whilst providing a safe, efficient and environmentally sound working environment.

1 INTRODUCTION

1.1 Purpose of this document

1.1.1 This Scheme Design Report has been prepared for the A47 Blofield to North Burlingham Scheme, hereafter referred to as 'the Scheme'.

1.1.2 The aim of this report is to summarise the development of the Scheme design and to demonstrate that the principles of good design have been given due regard during the design development.

1.2 A47 projects description

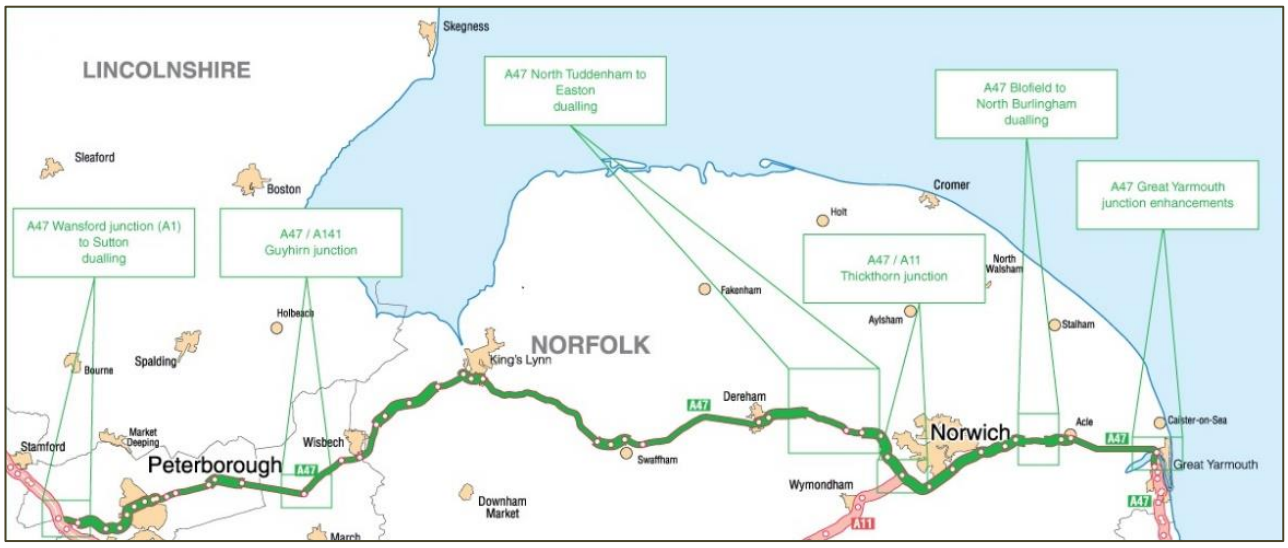
1.2.1 The Scheme is one of six projects to improve journeys on the 115 mile section of the A47 between Peterborough and Great Yarmouth. Together, the proposals will relieve congestion and improve the reliability of journey times for drivers.

1.2.2 The proposals include converting almost eight miles of single carriageway to dual carriageway and making improvements to junctions across the route. The six projects are:

- A47 Wansford to Sutton dualling,
- A47 Guyhirn junction improvement,
- A47 North Tuddenham to Easton dualling,
- A47 Blofield to North Burlingham dualling,
- A47/A11 Thickthorn junction improvement,
- A47 Great Yarmouth junction improvements.

1.2.3 The locations of the six projects are shown in Figure 1-1.

Figure 1-1: A47 projects location plan[1]



[1] Source: AECOM & Amey. This Map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Highways England 100030649 2016.

1.2.4 The Blofield to North Burlingham section of the A47 is located approximately 9km to the east of Norwich. This 2.6km of single carriageway forms a part of the main arterial highway route connecting Norwich with Great Yarmouth to the east.

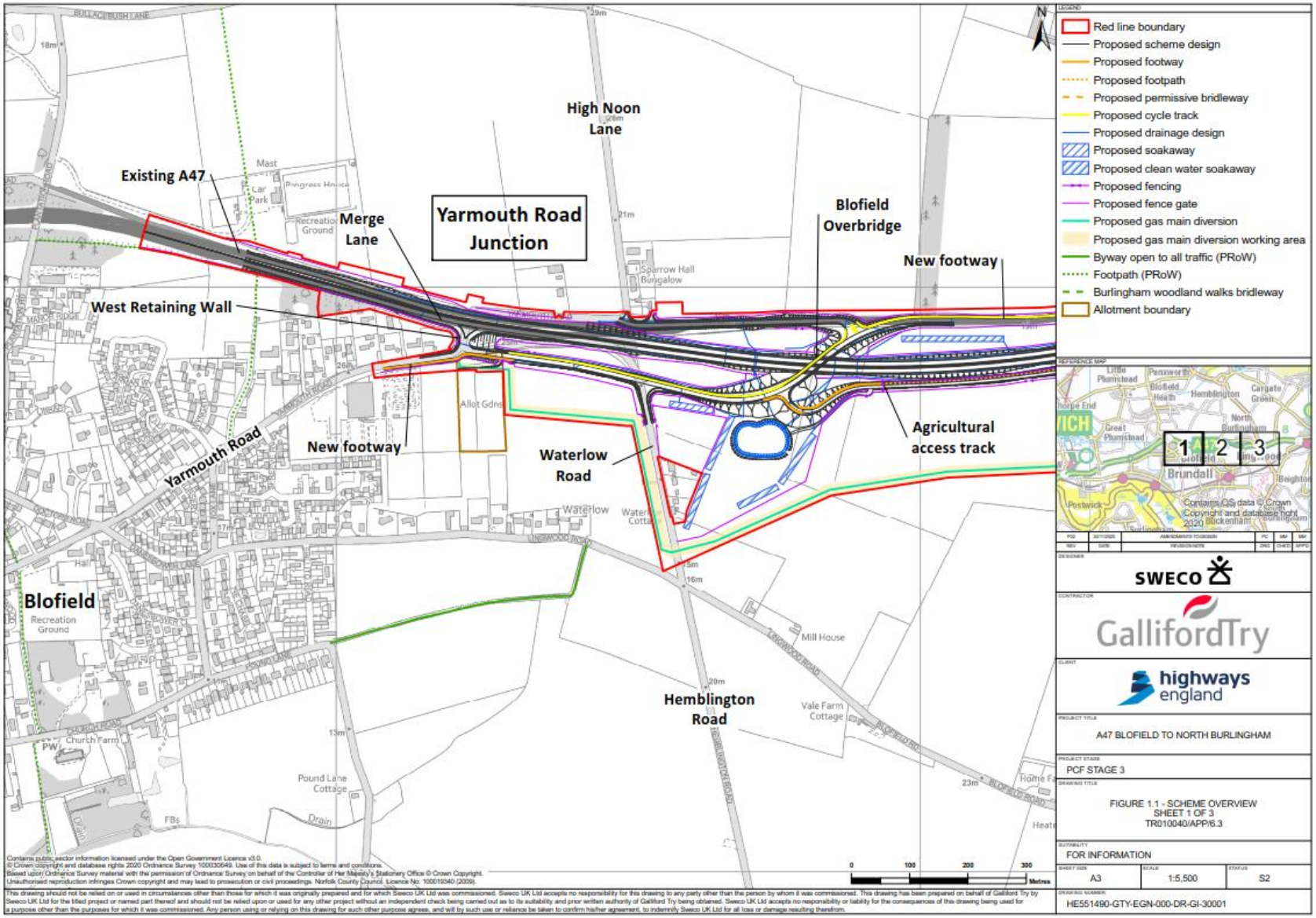
1.2.5 Currently, the existing A47 from Blofield to North Burlingham experiences delays and high levels of congestion during peak hours. The situation is predicted to get worse with proposed growth in residential development.

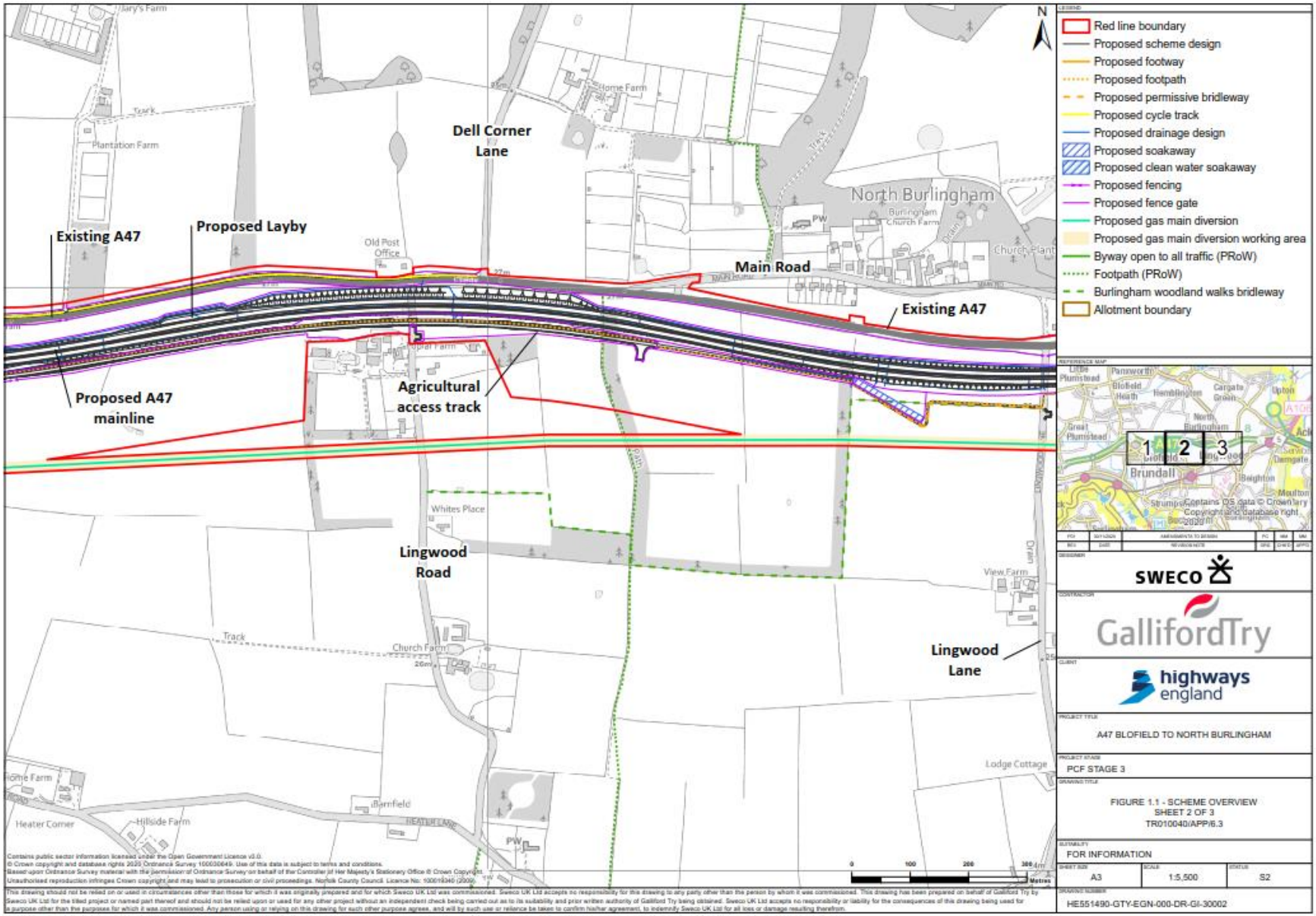
1.2.6 Key elements of the Scheme include:

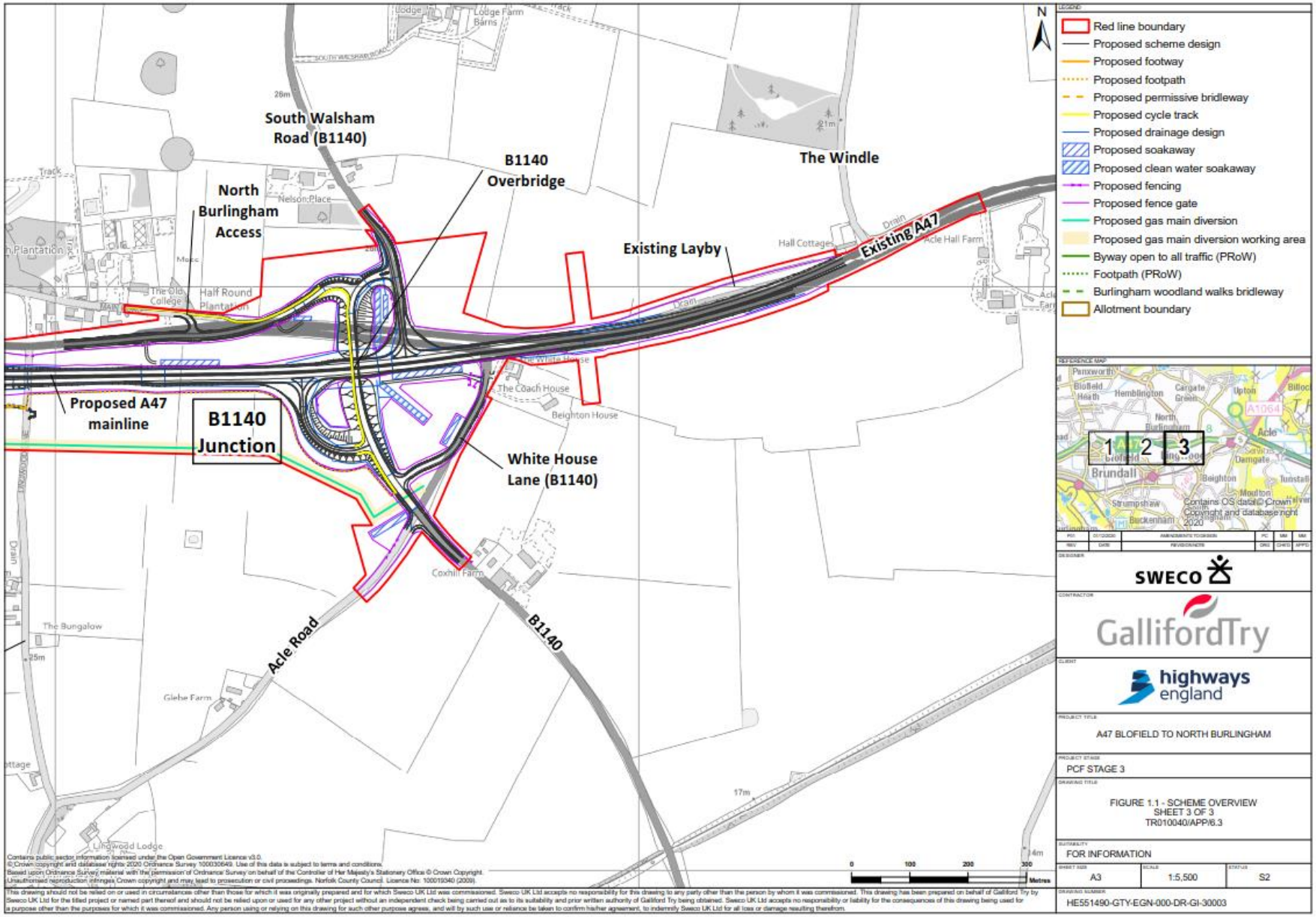
- 2.6km of dual carriageway on the A47
- de-trunking of the existing A47 section between Blofield and North Burlingham
- improvements at Yarmouth Road Junction, including closure of the central reserve, closure of High Noon Lane direct access, merge lane, realignment of Waterlow and local access improvements at the Sparrow Hall properties
- introduction of a compact grade separated junction at B1140 junction, including the B1140 Overbridge
- a new overbridge at Blofield traversing the proposed A47 dual carriageway, connecting Yarmouth Road with the existing A47
- provision of new drainage systems including an infiltration basin and retention of existing drainage systems where possible
- a retaining wall in the western extents
- introduction of lighting at the Yarmouth Road Junction and new lighting layout at the B1140 junction
- closure of an existing lay-by and provision of a new lay-by
- walking and cycling routes connecting Blofield and North Burlingham via the Blofield Overbridge to the west and the B1140 Overbridge to the east
- provision of North Burlingham access
- an agricultural access track
- fencing, safety barriers and signage
- environmental mitigation
- diversions of an intermediate pressure gas main and other utilities

1.2.7 The extent of the Scheme is illustrated in Figure 1-1 (Sheets 1-3) Scheme Overview of the Environmental Statement (ES) **(TR010040/APP/6.3)** which are reproduced in Figure 1-2. A detailed description of the Scheme is provided in ES Chapter 2: The Proposed Scheme **(TR010040/APP/6.1)**.

Figure 1-2: Scheme overview




Dell Corner Lane
Existing A47
Proposed Layby
Proposed A47 mainline
Agricultural access track
Main Road
Existing A47
Lingwood Road
Lingwood Lane
North Burlingham
Red line boundary
Proposed scheme design
Proposed footway
Proposed footpath
Proposed permissive bridleway
Proposed cycle track
Proposed drainage design
Proposed soakaway
Proposed clean water soakaway
Proposed fencing
Proposed fence gate
Proposed gas main diversion
Proposed gas main diversion working area
Byway open to all traffic (PRoW)
Footpath (PRoW)
Burlingham woodland walks bridleway
Allotment boundary
SWECO
GallifordTry
highways england
A47 BLOFIELD TO NORTH BURLINGHAM
PCF STAGE 3
FIGURE 1.1 - SCHEME OVERVIEW
SHEET 2 OF 3
TR010040/APP/6.3
FOR INFORMATION
A3
1:5,500
S2
HE551490-GTY-EGN-000-DR-GI-30002


South Walsham Road (B1140)
B1140 Overbridge
The Windle
North Burlingham Access
Existing Layby
Existing A47
Proposed A47 mainline
B1140 Junction
White House Lane (B1140)
Acle Road
B1140
Red line boundary
Proposed scheme design
Proposed footway
Proposed footpath
Proposed permissive bridleway
Proposed cycle track
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PCF STAGE 3
FIGURE 1.1 - SCHEME OVERVIEW
SHEET 3 OF 3
TR010040/APP/6.3
FOR INFORMATION
A3
1:5,500
S2
HE551490-GTY-EGN-000-DR-GI-30003

1.3 Site address and references

1.3.1 A47 North Burlingham, Norwich, NR13 4TA, NGR TG363098

Table 1-1: Site references

Approximate	Easting	Northing	Latitude	Longitude	Postcode
East end	638587	310147	52.636578	1.524657	NR13 3JS
Midpoint	636135	309952	52.635899	1.488353	NR13 4SU
West end	633662	310103	52.638321	1.452083	NR13 4PL

1.4 Programming of the Scheme

1.4.1 The Scheme has completed preliminary design ahead of the Development Consent Order (DCO) application planned for Winter 2020.

Table 1-2: Milestone dates

Milestone	Date
Preferred route announcement	Autumn 2017
End of Option Selection (PCF Stage 2)	Autumn 2017
End of Preliminary Design (PCF Stage 3)	Winter 2020
End of Statutory Procedures and Powers (PCF Stage 4)	Spring/Summer 2022
End of Construction Preparation (PCF Stage 5)	Autumn 2022
Start of works (Construction, Commissioning and Handover: PCF Stage 6)	Autumn 2022
End of works (Construction, Commissioning and Handover: PCF Stage 6)	Spring 2024

Table 1-3: Indicative construction programme

Indicative construction programme	Date
Proposed start date of works	Autumn 2022
Proposed end date of works	Spring 2024

2 GEOGRAPHICAL AND ENVIRONMENTAL CONTEXT

2.1 Geographical context

2.1.1 The Scheme is located approximately 9km to the east of Norwich and forms part of the main arterial highway route connecting Norwich and Great Yarmouth. It is an offline alignment running parallel and to the south of the existing A47. The layout extents are shown in the General Arrangement Plans **(TR010040/APP/2.6).**

2.1.2 The surrounding area is a generally flat and low-lying landscape. It has limited topographic variation and slopes gently from west to east, becoming flatter as it merges with the Broads.

2.1.3 The area is also characterised by isolated farmsteads and small, nucleated villages with local businesses and retail outlets which are linked by a network of local access roads. Larger populations include Blofield to the west, Acle to the east and North Burlingham located centrally to the Proposed Scheme, adjacent to the eastbound carriageway of the existing A47.

2.1.4 In the immediate vicinity of the existing A47 there are agricultural fields enclosed by hedgerows with mature trees and small areas of woodland. The existing A47 is partially lined by mature trees and hedgerows but is more widely characterised by a context of open arable farmland with limited field boundary vegetation.

2.2 Environmental context

2.2.1 This section highlights the environmental, socio-economic and health receptors that have the potential to be affected by the Scheme, in accordance with the criteria set out in the Design Manual for Roads and Bridges (DMRB).

2.2.2 The study areas for each topic are detailed within the ES **(TR010040/APP/ 6.1)** for the Scheme and summarised in Table 2-1 below.

Table 2-1: Environmental statement study areas

Discipline topic	Study area
Air quality	Construction: 200m from construction activities for dust and vehicle emissions. Operation: the Affected Road Network (ARN)
Cultural heritage	Archaeological potential and history context: 1km from the red line boundary Zone of Visual Influence: approx. 1.3km
Landscape and visual effects	1km from the red line boundary
Biodiversity	Special Area of Conservation (SAC) designated for bats: 30km Statutory sites designated for birds: 10km Designated sites: 2km Phase 1 habitat survey: 100m Great crested newts (GCN) Triturus cristatus: 500m Surveys for breeding birds and wintering birds: 500m Aquatic invertebrates from within wetland sites that could be directly impacted by the Scheme: 50m Surveys for other ecological receptors, including badger Meles meles and reptiles: 50m

Discipline topic	Study area
	Barn owl Tyto alba nests that could be directly impacted or disturbed by the Scheme: 1.5km Bats – flight paths, foraging areas or roosts in trees and buildings: 50m
Geology and soils	1km from red line boundary
Material assets and waste	The assessment has two study areas: 1) All areas within the Scheme redline boundary. 2) Feasible sources and availability of construction materials required to construct the main elements of the Scheme. Suitable landfill infrastructure that could accept arisings and or waste generated by the Scheme.
Noise and vibration	The assessment has three study areas: 1) Construction noise: 300m from the closest construction activity 2) Construction vibration: 30m from closest vibration generating activity 3) Operation assessment
Population and human health	The assessment has two study areas: 1) Land use and accessibility: 500m from the red line boundary 2) Human health: wards affected by the Scheme
Road drainage and the water environment	1km from the red line boundary
Climate	The assessment has two study areas: 1) Effects on climate: The study area considered for the construction phase is the physical infrastructure assets associated with Proposed Scheme and therefore includes the embodied carbon of Proposed Scheme materials and emissions associated with construction activities. 2) Vulnerability of the Scheme to climate change: For the purposes of the climate change vulnerability assessment, the study area is considered to be the physical infrastructure assets associated with the Scheme. The Scheme appraisal period is taken to be 60 years or above in line with the WebTAG GHG Assessment and DMRB LA 114 (Climate).

Air Quality

2.2.3 Sensitive receptors have been identified following the guidance outlined in DMRB LA 105. The assessment includes residential, hospital and school receptors. Receptors are shown in Figure 5.3: Human Health Receptor Locations Sheets 1 to 11, ES Chapter 5: Air Quality **(TR010040/APP/6.1).**

2.2.4 There are currently no declared Air Quality Management Areas (AQMA) within the Broadland District Council administrative area. The closest AQMA is located over 9.5km to the west within Norwich city centre declared by Norwich City Council for exceedances of the annual mean nitrogen dioxide (NO^2) objective.

2.2.5 There were three designated ecological sites identified as being sensitive to nitrogen deposition within 200m of the affected road network. These are the Special Protection Areas (SPA) and Special Area of Conservation (SAC) referenced within the biodiversity section of this report.

Cultural heritage

2.2.6 Cultural heritage includes archaeology, historic buildings / structures and historic landscapes including parks and gardens.

2.2.7 A total of 141 heritage assets have been identified within the study area, in line with DMRB LA 106. These assets are made up of:

- 25 Listed Buildings
- 112 non-designated assets
- Four non-designated historic landscape types in 118 individual parcels

2.2.8 There are no Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields or Conservation Areas within the study area.

2.2.9 Designated heritage assets identified are shown in Figure 6.1 Cultural Heritage Designated Assets, ES Chapter 6 **(TR010040/APP/6.1)** and include:

- Church of St Andrew (1051522)
- Church of St Peter (1304547)
- Owls Barn and House at Owls Barn (1304603, 1372653)

2.2.10 Non-designated heritage assets are shown Figure 6.2 Cultural Heritage Non-Designated Assets, ES Chapter 6 **(TR010040/APP/6.1)** and include:

- 86 archaeological and built heritage assets identified from the Norfolk Historic Environment Record (NHER)
- 26 assets identified from historic mapping and site visits

Landscape

2.2.11 The study area is within the north east Norfolk and Flegg National Character Area and comprises a generally flat, low-lying landscape. The area is notable for its deep, loamy, free draining and highly fertile soils which support productive arable farming. The rich agricultural land generally comprises small to medium scale fields which are bordered by high hedgerows and prominent hedgerow oaks. The area is also characterised by isolated farmsteads and small, nucleated villages with large medieval churches which are linked by a dense network of lanes.

2.2.12 Woodland cover is generally limited where land is in agricultural use although some areas of land to the south of the A47 have recently been planted to provide community woodland. Mature woodland is found in the grounds of old houses in the north, particularly at North Burlingham, along the tributaries of the Yare and Bure and around settlements.

2.2.13 Hedgerows form the boundaries of fields and lines of mature trees are present along the edges of some fields. Low embankments divide some of the fields and line many of the rural lanes.

2.2.14 In terms of local landscape character, the study area lies within the Broadland District Council Landscape Character Assessment (LCA):

- ‘Blofield Tributary Farmland’
- ‘Freethorpe Plateau Farmland’ (LCA)

2.2.15 From west to east, the following key visual elements are present within the study area:

- St Andrew and St Peter Church spire located on the southern edge of Blofield.
- distinctive shelterbelt of poplar trees running east to west between the existing A47 and Blofield allotments.
- broad open arable fields with extents demarcated by rectilinear hedgerows and occasional lines of mature trees.
- isolated farmsteads scattered throughout the agricultural fields.
- blocks of plantation woodland around Burlingham Green and North Burlingham.
- St Andrew & St Peter's Church to the west of North Burlingham.
- lighting columns associated with the junction of the A47 and B1140 to the south and east of North Burlingham.

Biodiversity

2.2.16 Sensitive receptors have been identified following the guidance outlined in DMRB LA 108. A number of nationally and locally designated sites occur within the study area and are listed in Table 2-2.

Table 2-2: Nationally and locally designated sites identified within the study area

Designated site	Distance from the site
The Broads SAC	2.5km south west (from A47 at Blofield)
Broadland SPA	1.9km south west (from A47 to nearest point)
Broadland Ramsar	2.5km south west (from A47 at Blofield)
Breydon Waters Ramsar	8km south east (from Acle on the A47)
Breydon Waters SPA	8km south east (from Acle on the A47)
Decoy Carr, Acle SSSI	1.85km south of the Scheme
Paston Great Barn SAC	24.6km north of the Scheme
Ancient semi-natural woodland	1.90km north of the Scheme at Walsham Wood
Ancient replanted woodland	2km north west of the Scheme at Pedham Grove
Lingwood Community Woodland	0.07km south (from A47 at Lingwood)
Church and Drive Plantations County Wildlife Site (CWS)	0.14km north (from A47 at North Burlingham)
Woodbastwick Road Roadside Nature Reserve (RNR)	0.29km north (from A47 at Blofield)
Belt Plantation CWS	0.56km north (from A47 at North Burlingham)
Howe's Meadow CWS	0.99km north (from A47 at Blofield)

Designated site	Distance from the site
Acle Road RNR	1-1km north (from Acle on the A47)
Birch Grove and Dawling's Wood CWS	1.39km north east (from A47 at Blofield)
Damgate Wood CWS	1.42km south (from Acle on the A47)
Highnoon Farm Braydeston CWS	1.60km north (from A47 on High Noon Lane)
Land adjacent to Witton Lane CWS	1.65km north (from A47 at Yarmouth)
Walsham Wood CWS	1.90km north (from A47 at Pedham)
Long Lane RNR	2km south west (from Lingwood on the A47)

2.2.17 Six priority habitats listed on Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) are recorded within the study area. These are:

- arable field margin
- eutrophic standing water
- hedgerows
- lowland mixed deciduous woodland
- traditional orchards
- pond habitats

Geology and soils

2.2.18 The majority of the Scheme lies within undeveloped agricultural land, most of which is currently in use by a number of farmers. The route is entirely underlain by freely draining slightly acid loamy soils of low fertility (type 6).

2.2.19 The soils underlying the Scheme are designated as land that can best deliver future crops for food and non-food uses. These are commonly encountered across the Norfolk area. This is a high value receptor that would be affected by the Scheme.

2.2.20 There are no designated geological sites within the study area.

Noise and vibration

2.2.21 Sensitive receptors have been identified following the guidance outlined in DMRB LA 111.

2.2.22 A total of 1,287 dwellings and 16 other sensitive receptors have been identified within the 600m operational study area. Other sensitive receptors include commercial premises, schools and community facilities.

2.2.23 The four noise important areas are located within the operational study area, shown on Figure 11.1: Noise Location Plan, ES Chapter 11 **(TR010040/APP/6.1)**.

Road drainage and the water environment

2.2.24 The main water features within the study area are the catchments of two protected surface water bodies (Witton Run and The Bure). However, the Scheme does not cross these particular water bodies.

2.2.25 The Broads SAC and Broadland SPA are located wholly outside the study area over 2km north and south of the existing A47 carriageway. There is potential for groundwater pathways to link between the Scheme and the Broads SAC and the Witton Run and The Bure Water Framework Directive (WFD) water bodies. The following designated sites are situated approximately 3km to the east of the study area, and down-hydraulic gradient of the Scheme:

- Damsgate Marshes SSSI
- Decoy Carr SSSI

Climate

2.2.26 The UK government has legally binding targets for reducing the carbon emissions by 80% by 2050, relative to a 1990 baseline.

2.2.27 Norfolk County Council reported total emissions for the 2015-16 year to be approximately 99,147tCO2e for Local Authority operations (Norfolk County Council, 2016), and the Council has committed to reducing emissions by 50% by 2020, relative to 2009-10 levels.

2.2.28 Most recent figures released for 2017 indicated total transport emissions for the wider Norfolk County area (including all relevant Districts) to be approximately 1,976,200tCO2 (Department for Business, Energy & Industrial Strategy, 2019b).

2.2.29 In 2017, UK net CO2 emissions were estimated at 373.2 million tonnes (Department for Business, Energy & Industrial Strategy, 2019b). Furthermore, 34% of UK carbon emissions in 2017 originated from the transport sector with emissions of 128.7 mtCO2e.

3 DESIGN PRINCIPLES, OBJECTIVES AND CONSTRAINTS

3.1 Background

3.1.1 Following the Government's Road Investment Strategy (RIS): 2015/16-2019/20, the second Road Investment Strategy (RIS2): 2020 to 2025[2] sets a long-term strategic vision for the network by:

- Specifying the performance standards Highways England must meet
- Listing planned enhancement schemes expected to be built
- Stating the funding made available during the second Road Period (RP2), covering the financial years 2020/21 to 2024/25.

3.1.2 Ensuring this vision is at the centre of the development and delivery of road schemes requires a design led culture to be developed by Highways England and project teams. A starting point for this has been the adoption of a design vision and a set of design principles, by which the success of a scheme is assessed during its design development, implementation and when in use.

3.1.3 There are 10 Highways England principles of good design which should be implemented by a scheme, as identified within Highways England's Strategic Design Panel progress report 3[3]. Good road design:

- makes roads safe and useful
- is inclusive
- makes roads understandable
- fills in context
- is restrained
- is thorough
- is environmentally sustainable
- is innovative
- is long lasting
- is a collaborative process

3.1.4 These principles have been considered and incorporated throughout the option development, option selection and the preliminary design described in this report.

[2] Department for Transport (2020) Road Investment Strategy: for the 2020/21- 2024/25 Road Period [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872252/road-investment-strategy-2-2020-2025.pdf (accessed December 2020)

[3] Highways England () Highways England Strategic Design Panel report [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844039/Strategic_Design_Panel_progress_report_3.pdf (accessed December 2020)

3.2 Scheme objectives

3.2.1 The Scheme's key objectives, derived from the aims of the RIS and the feasibility studies described in the Case for the Scheme **(TR010040/APP/7.1)**, are:

- **Supporting economic growth**: The Scheme aims to reduce congestion related delay, improve journey time reliability and increase the overall capacity of the A47. This will help contribute to sustainable economic growth by supporting employment and residential development opportunities.
- **Making a safer network**: Improving road safety for all road users by designing to modern highway standards appropriate for a major A road.
- **A more free-flowing network**: Increasing the resilience of the junction in coping with incidents such as collisions, breakdowns, maintenance and extreme weather. The improved A47 Blofield to North Burlingham will be more reliable, reducing journey times and providing capacity for future traffic growth.
- **Protected environment**: We will protect the environment by minimising adverse impacts and where possible, improving the environmental effects of transport on those living along the route of the new and existing road. We will do this by reducing the impact on the natural and built environment by the new road and any associated works.
- **An accessible and integrated network**: To ensure the proposals consider local communities and access to the road network, providing a safer route between communities for cyclists, pedestrians, equestrians and vulnerable users where a need is identified.
- **Value for money**: To ensure that the Scheme is affordable and delivers good value for money

3.3 Preferred route development

3.3.1 Four alternative routes were consulted on in 2017:

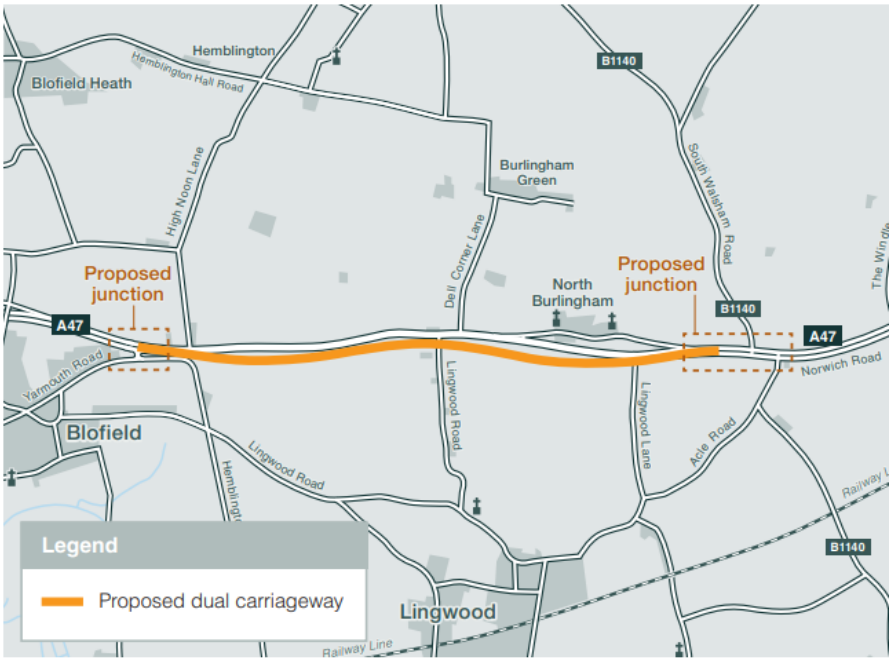
- Option 1 – an on-line upgrade of the existing road to dual carriageway standards.
- Option 2 – a new off-line dual carriageway, to the north of the existing A47 between Blofield and North Burlingham before crossing the A47 and running to the south between North Burlingham and the B1140.
- Option 3 – a new off-line dual carriageway to the south of the existing A47 which would run south of Poplar Farm and the adjacent properties on Lingwood Road.
- Option 4 – a new off-line dual carriageway to the south of the existing A47 which would run between the existing A47 and Poplar Farm and the adjacent properties on Lingwood Road.

3.3.2 From the options assessed and consulted upon as described in the Case for the Scheme **(TR010040/APP/7.1),** a preferred route was selected which meets with

the principles and objectives set out above.

3.3.3 The Preferred Route, 'Option 4 - Building a new dual carriageway to the south of the existing A47', was announced on the project website on the 14 August 2017, see Figure 3-1.

Figure 3-1: The preferred route, Option 4[4]



3.3.4 The key features of the preferred route were set out in the Scheme Assessment Report[5], and can be summarised as follows:

- an approximately parallel offline design to the south of the existing A47 within 70m;
- a junction with Yarmouth Road
- a junction with the B1140;
- an overbridge connecting Yarmouth Road to the existing A47 connecting Blofield and North Burlingham;
- the existing A47 and junctions with it on the north side to remain largely unchanged.

[4] Highways England (2017) Preferred Route Announcement A47 Blofield to North Burlingham. [online] available at: https://highwaysengland.citizenspace.com/he/a47-blofield-to-north-burlingham-dualling/results/25119c-wlea-1-blofield_v2.pdf (last accessed December 2020).
[5] Highways England (2017) Road Investment Strategy East Area 6 A47 Blofield to North Burlingham Scheme Assessment Report (A47 IMPS2-AMY-BB-ZZ-DO-J0006) [online] available at: https://highwaysengland.citizenspace.com/he/a47-blofield-to-north-burlingham-dualling/results/a47blofieldtonorthburlinghama47sarimps2-ame-bb-zz-do-j00061.pdf (last accessed December 2020).

3.4 Programme constraints

3.4.1 The Scheme is to be developed and constructed within the RIS2 period 2020-2025.

3.4.2 The Scheme is not dependent on the completion or commencement of any other projects, transport related or otherwise.

3.4.3 Construction activities which are seasonally constrained due to environmental considerations are set out within the Environmental Management Plan **(TR010040/APP/7.7)**. Constraints include common seasonal restrictions, such as for the protection of breeding birds, but do not impose any unusual or exceptional constraints on the Scheme programme.

3.5 Budget constraints

3.5.1 The funding for the Scheme is set out in the Funding Statement **(TR010040/APP/4.2)**.

3.5.2 The Scheme has a most-likely estimate of £89.5 million, including allowances for risk and inflation at the date of application. This estimate includes all costs to deliver the Scheme from Options stages through to the opening for traffic.

3.5.3 The Scheme was included as part of the Road Investment Strategy (RIS) published by the Government on 1 December 2014. Highways England is responsible for delivering elements of the RIS including the Scheme, as set out in the Highways England Delivery Plan 2015 - 2020 which was published in March 2015 and subsequent delivery plans.

3.5.4 Highways England have contracted Galliford Try to deliver the Scheme under its Delivery Integration Partnership. Galliford Try are contracted to deliver the Scheme from the application for the DCO through to the opening to traffic and handover. Galliford Try are to complete all works within a Statement of Funds Available, which is matched to the most-likely estimate of £89.5 million.

4 DEVELOPMENT OF THE PREFERRED ROUTE DESIGN

4.1 Main elements of the Scheme

4.1.1 The key elements of the Scheme are noted in 1.2.6 above and are described in detail in ES Chapter 2: The Proposed Scheme **(TR010040/APP/6.1)**. This section explains the rationale behind the features and how they have been developed from the design described in the Scheme Assessment Report published alongside the non-statutory consultation in 2017.

4.2 Value engineering of the preferred route announcement

4.2.1 As described in the Scheme Assessment Report, a value engineering exercise was undertaken prior to the design for the application described in this report and other volumes with the aim of bringing the Scheme estimates in-line with the available funding.

4.2.2 This review considered the whole Scheme and, based on the maturity of the design and the available information at the time, made the decision that the B1140 junction should be an at-grade junction to remove the structure and associated earthworks. This value engineered design formed the basis of the design which was reviewed and amended prior to the statutory consultation and this application. These conclusions were tested with further assessment and a revised junction arrangement for the B1140 proposed as described in section 4.6 of this report.

4.3 Dual carriageway design

4.3.1 The parameters of the dual carriageway design were set by the selection of Option 4 as the preferred route. The options assessment is outlined in the Case for the Scheme **(TR010040/APP/7.1)**. The key features of the preferred route are summarised in paragraph 3.3.3 above.

4.3.2 The main highway alignment was developed in 2018 from the preferred route announcement alignment to minimise islanded land area between the proposed A47 and the existing A47 and to accommodate the junction strategy which is described below.

4.3.3 The main highway alignment was further developed in 2019 and 2020 to account for an updated drainage design, as described in the drainage strategy ES Appendix 13.2 **(TR010040/APP/6.2)** and to be compliant with the latest highway standards within the Design Manual for Roads and Bridges as of the date of publication.

4.3.4 Two local road junctions with the existing A47, at Lingwood Lane and Lingwood Road, will not be reinstated with the proposed A47 on road safety grounds. This is to prevent slow moving vehicles exiting from and entering onto the dual carriageway without safe means to increase and decrease speed. These roads will be stopped up south of the proposed A47 and a turning head provided.

4.3.5 The Windle junction will not be changed as part of the Scheme. The existing lay-by to the west is to be closed, due to its proximity with the new B1140 junction. Closing the lay-by may improve the safety of The Windle junction by reducing

weaving manoeuvres in the vicinity of this junction.

4.3.6 The highway design is shown in detail in the General Arrangement Plans **(TR010040/APP/2.6)**, and further described in ES Chapter 2 The Proposed Scheme **(TR010040/APP/6.1).**

4.4 De-trunking design

4.4.1 Where a road or route is no longer to be part of the strategic road network, also referred to as the trunk road network, it will be de-trunked and works may be completed to separate it from the trunk road network or to tie it in to the local road network. These works are described as “de-trunking” works. Once a road has been de-trunked, it will be maintained by the local highway authority instead of Highways England.

4.4.2 In line with the preferred route, the work to the current route of the existing A47 has been designed to retain as much of the existing highway as possible to minimise disruption, retain access where possible and to provide value for money.

4.4.3 At the western end the existing access from the existing A47 to the private access at High Noon Lane will be closed on road safety grounds to prevent slow moving vehicles exiting from and entering onto the dual carriageway without safe means to increase and decrease speed. Alternative suitable access will be provided by the new Blofield Overbridge and the connection to the existing A47.

4.4.4 The existing junction between the private access (which connects to High Noon Lane) and the existing A47 will be revised and moved to the south to create a formalised junction between High Noon Lane and the de-trunked A47. The priority of the junction will remain the same.

4.4.5 The existing A47 will remain in place between High Noon Lane and the existing eastern junction of Main Street, North Burlingham with the existing A47.

4.4.6 The eastern junction of Main Street, North Burlingham, to the A47 will be amended to become a two-way junction to enable persons making shorter journeys from North Burlingham to travel east.

4.4.7 The eastern end of the existing A47 is to be re-aligned to tie into the new junction arrangement with the B1140.

4.4.8 The B1140 to the north and south of the existing A47 has been amended to tie into the new junction arrangement. This includes a change in the priority of the junction with Acle Road/Coxhill Road, and the stopping up of the existing access from White House Lane to the A47. This stopped up section of White House Lane will be retained for residential access but realigned to join the B1140 to the north-west of its current position to provide a safer junction arrangement due to the proximity to the White House Lane junction and the slip road to the A47 westbound.

4.4.9 The cross-section of the de-trunked roads has been designed to remain as existing where possible or to be compliant with the DMRB. There will be a minimum of 5.5m width of carriageway in line with Norfolk County Council highway standards as the adopting authority.

4.5 Yarmouth Road Junction design development

4.5.1 The junction between the A47 and Yarmouth Road was designed in outline prior to the preferred route announcement subject to the following provisions:

- Closing the gap in the central reserve to prevent right-turn movements for road safety reasons
- Retaining access from Yarmouth Road to the A47 westbound
- Closing the existing private access from the A47 toward High Noon Lane

4.5.2 Access to the A47 eastbound from the west of Blofield and Brundall would either be by the Brundall Roundabout junction or by the slip roads to and from Plantation Road leading to the local road network.

4.5.3 Access to the A47 eastbound from the east of Blofield would be by the de-trunked A47 and the B1140 Junction.

4.5.4 It was noted that the strategic traffic model for the Scheme predicted a low usage of a junction with Yarmouth Road in a do-minimum (no Scheme) scenario due to its proximity to the Plantation Road and Brundall Roundabout junctions which also serve Blofield.

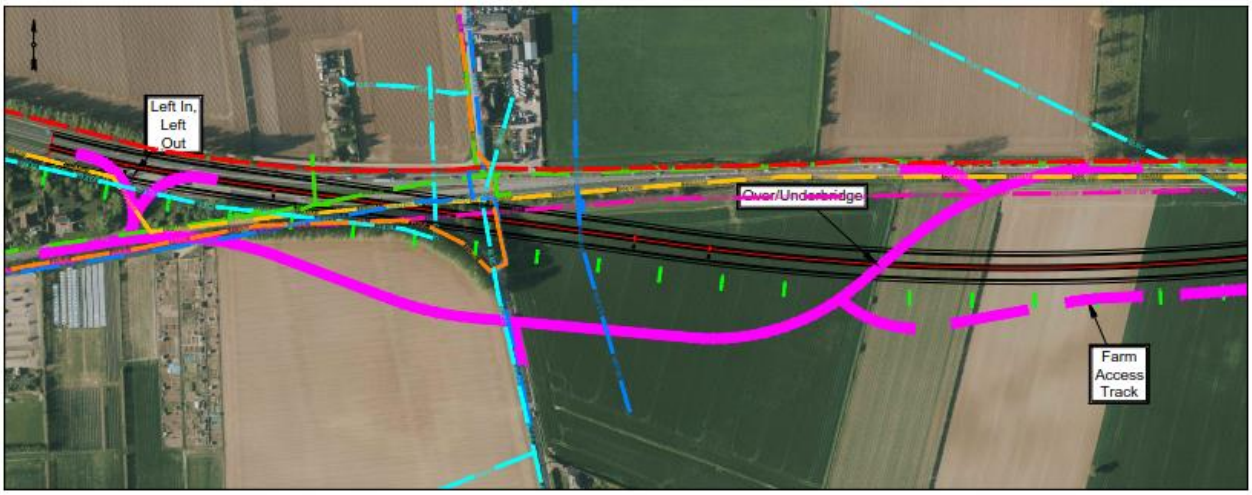
4.5.5 At the commencement of the preliminary design prior to the statutory consultation in 2018, the junction strategy was reviewed with five options identified. Common features of all options considered were:

- An agricultural access track to enable field access
- The closure of private access to High Noon Lane from the A47

4.5.6 Five figures are shown below to show the indicative layouts of the junction arrangement alternatives. The indicative junction and side road layouts are represented by a thick pink line, with the new A47 dual carriageway shown in black outline against a satellite imagery background. Existing utilities are shown in various colours.

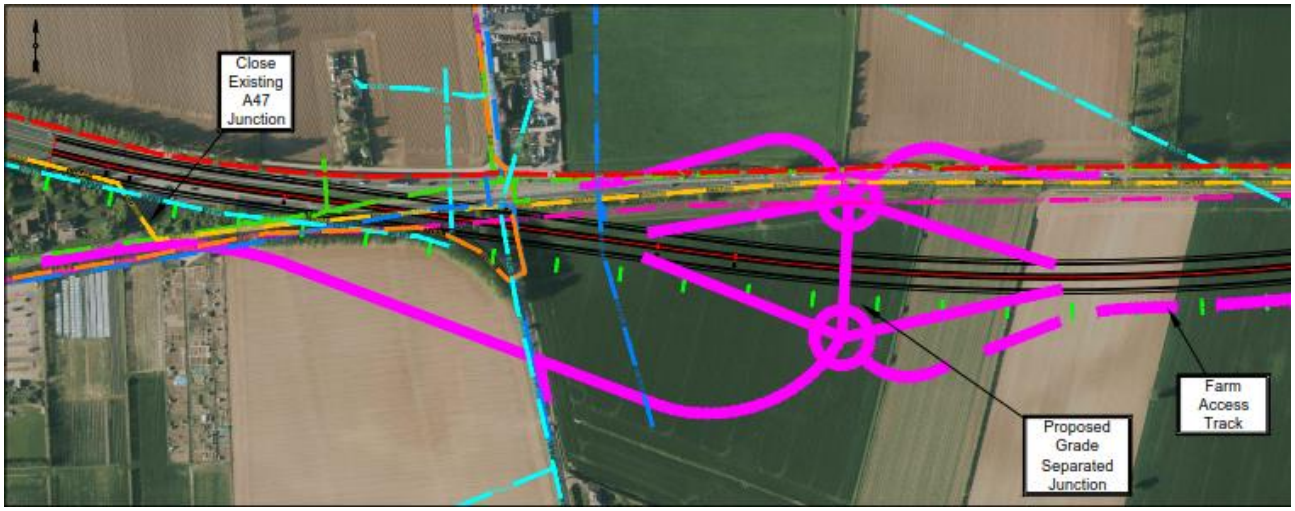
4.5.7 Junction Option A (Figure 4-1) proposed an amendment of the existing junction with Yarmouth Road to a left in, left out arrangement. In order to connect to Yarmouth Road north of the re-aligned A47, an overbridge or underbridge will be provided. This option is as described in the Scheme Assessment Report.

Figure 4-1: Yarmouth Road Junction left in, left out arrangement, Option A



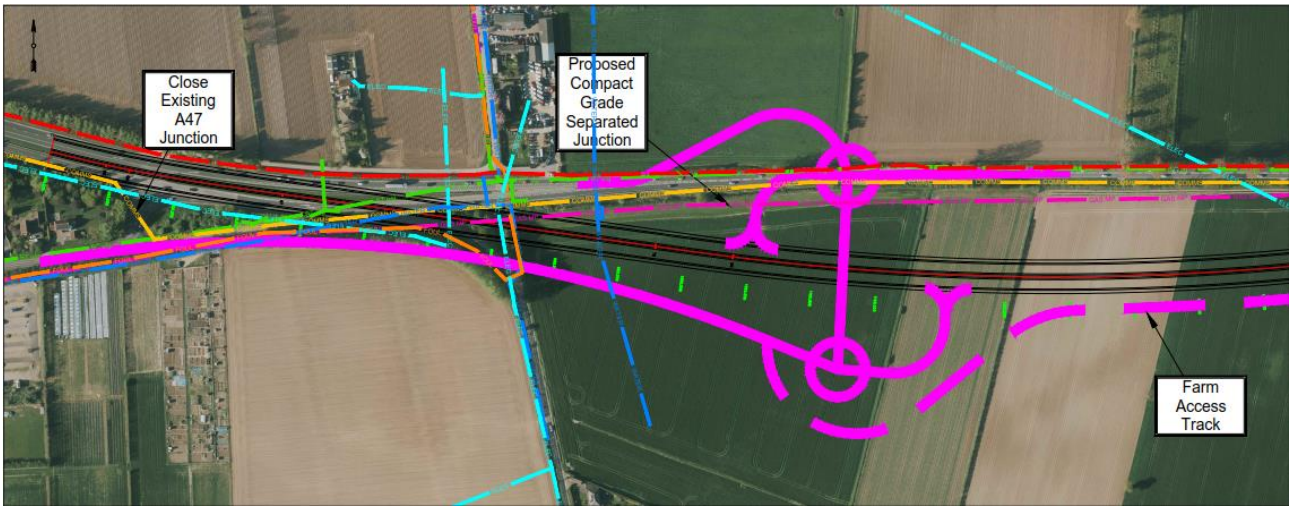
4.5.8 Junction Option B (Figure 4-2) proposed a grade separated junction with an off-line connector road to Yarmouth Road. Connectivity to the existing A47 would be maintained.

Figure 4-2: Yarmouth Road Junction arrangement, Option B



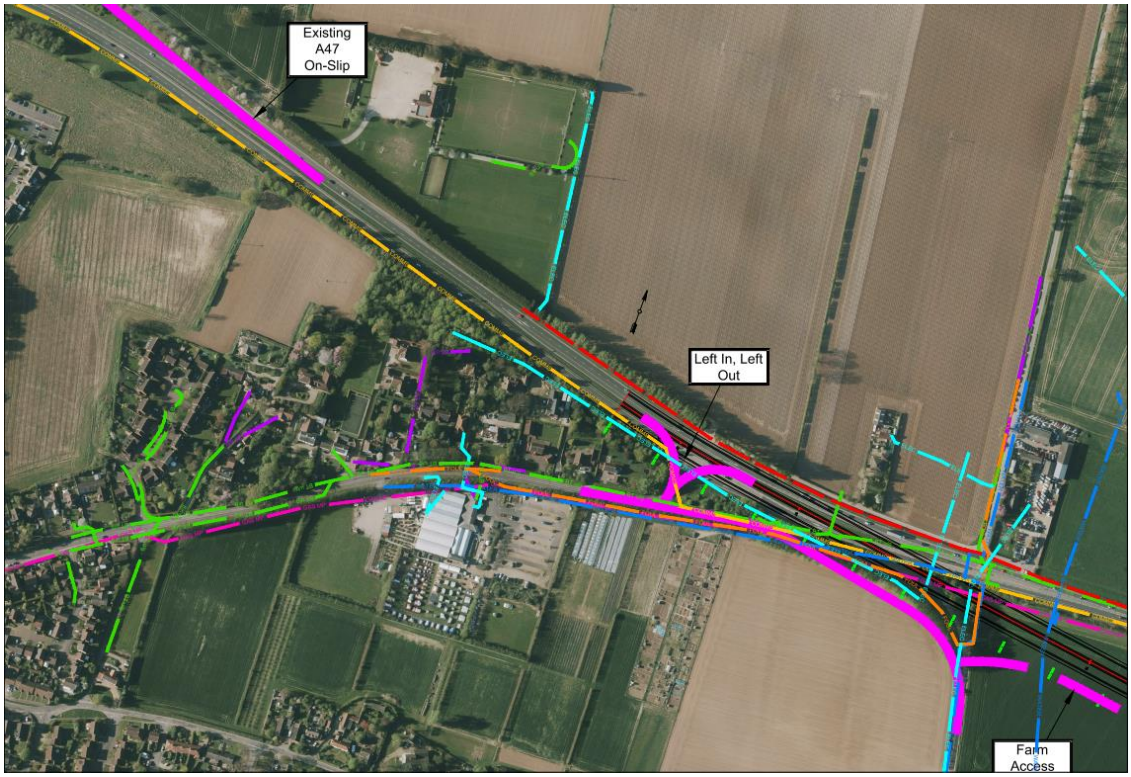
4.5.9 Junction Option C (Figure 4-3) proposed a compact grade separated junction, with left in, left out connections onto the proposed A47. The existing A47 would be re-aligned to connect into a northern roundabout, with Yarmouth Road realigned to connection into a southern roundabout

Figure 4-3: Yarmouth Road Junction arrangement, Option C



4.5.10 Junction Option D (Figure 4-4) proposed upgrading the existing eastbound slip-road north of Blofield from Plantation Road. The existing left-in, left-out junction which connects Yarmouth Road to the existing A47 would also be upgraded to improve safety. No structure to connect Yarmouth Road to the existing A47 would be provided.

Figure 4-4: Yarmouth Road Junction arrangement, Option D



4.5.11 Junction Option E (Figure 4-5) would maintain the existing Yarmouth Road Junction arrangement and provide new off-line connectivity from Yarmouth Road to Waterlow to take account of the new alignment of the proposed A47.

Figure 4-5: Yarmouth Road Junction arrangement, Option E

4.5.12 Following consideration, Option A was adopted for the Yarmouth Road Junction.

4.5.13 Options B and C were discounted due to the additional cost of the grade separated options against an at-grade option as well as the low use of the existing junction arrangement in forecast future years in a do-minimum scenario within the strategic traffic model.

4.5.14 Option D was discounted due to the severance impacts for east-west travel between local communities. The provision of a structure connecting Yarmouth Road to the existing A47 was recognised as a key mitigation to this and provides a significant benefit relative to the existing situation.

4.5.15 Option E was discounted on safety grounds and due to the severance impacts for east-west travel between local communities. Despite retaining the existing junction arrangement, the increased volume of traffic generated by the Scheme and forecast due to underlying future growth would worsen the existing severance as well as the road safety risk of severe accidents due to traffic crossing the carriageway to turn right. As with Option D, the provision of a structure connecting Yarmouth Road to the existing A47 was recognised as a key mitigation to this and provides a significant benefit relative to the existing situation.

4.5.16 The proposed configuration of the Yarmouth Road Junction provides the following features:

- Closes the gap in the central reserve to prevent right-turn movements for road safety reasons
- Retains access from Yarmouth Road to the A47 westbound
- Closes the existing private access from the A47 toward High Noon Lane
- Mitigates existing east-west community severance

- Retains a westbound left in, left out junction.

4.5.17 The improvements to be made to the junction include:

- Improved diverge lane to make leaving the A47 safer for road users
- Additional merge taper and auxiliary lane to make joining the A47 safer for road users
- Elimination of a flat area of carriageway removing a drainage issue
- Safer access to fields and private properties via the retained A47 and the agricultural access track.

4.6 B1140 Junction design development

4.6.1 The junction with the B1140 is to replace the existing at-grade junction between the A47 and the B1140 (South Walsham Road, and White House Lane). In the development of the options this junction was indicatively designed with a full sized grade-separated junction (similar to Option C below) to enable indicative design for option assessment, traffic forecasting, environmental appraisal and assessment and costing.

4.6.2 As discussed above, following a value engineering exercise in 2017, the B1140 Junction was noted as contributing to a cost exceeding the scheme budget. This exercise resulted in a proposed at-grade roundabout for the junction. This option and four others were reviewed to inform the decision on the junction strategy.

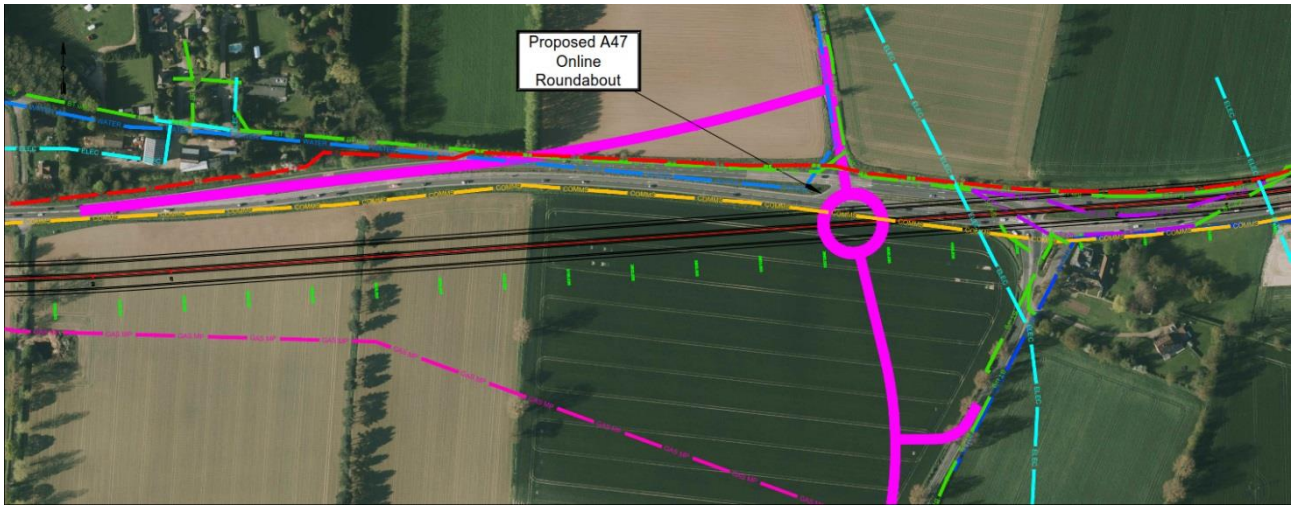
4.6.3 It was noted that there are significant north-south movements over this junction, particularly of Heavy Goods Vehicles (HGVs) transporting sugar beet from farms around Norfolk to the British Sugar PLC processing plant in Cantley, approximately 6 miles south of the Scheme. This peaks in the autumn/winter period.

4.6.4 The existing at-grade junction is a point of road safety concern which would worsen with traffic growth. As a result, all options which were considered would prevent right turn movements which require crossing lanes of the proposed dual carriageway.

4.6.5 Five figures are shown below to show the indicative layouts of the junction arrangement alternatives. The indicative junction and side road layouts are represented by a thick pink line, with the new A47 dual carriageway shown in black outline against a satellite imagery background. Existing utilities are shown in various colours.

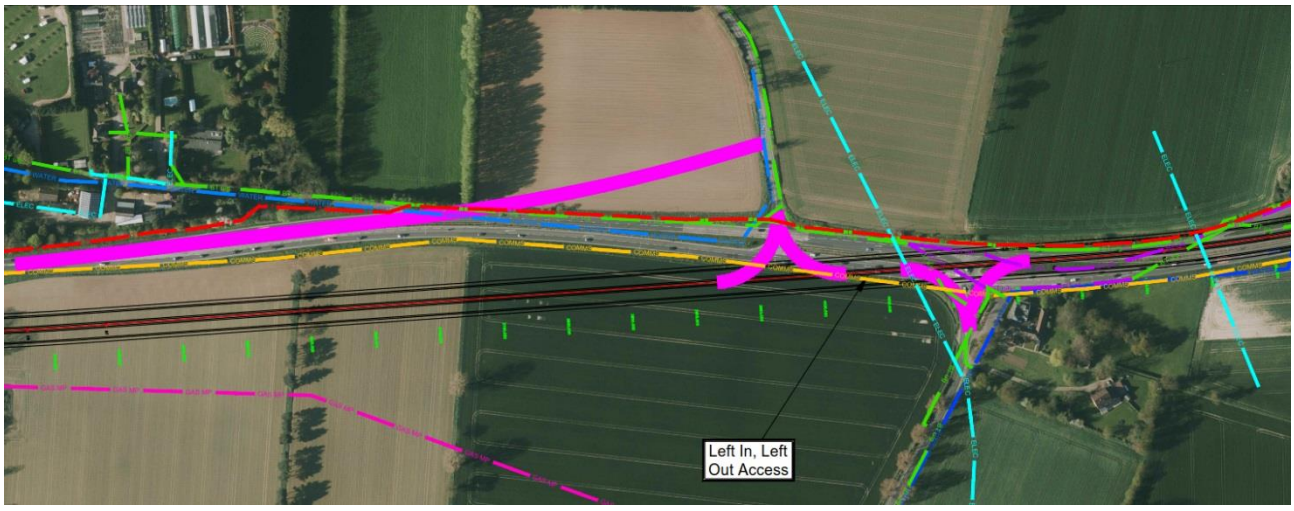
4.6.6 Junction Option A (Figure 4-6) consists of an online roundabout with connectivity provided to the existing A47 via a major/minor priority T-Junction on South Walsham Road (the B1140). Both a two lane and a three lane circulatory were considered for this option. B1140 White House Lane would be realigned to the west with a major / minor priority junction added to provide local residential access.

Figure 4-6: B1140 Junction arrangement, Option A



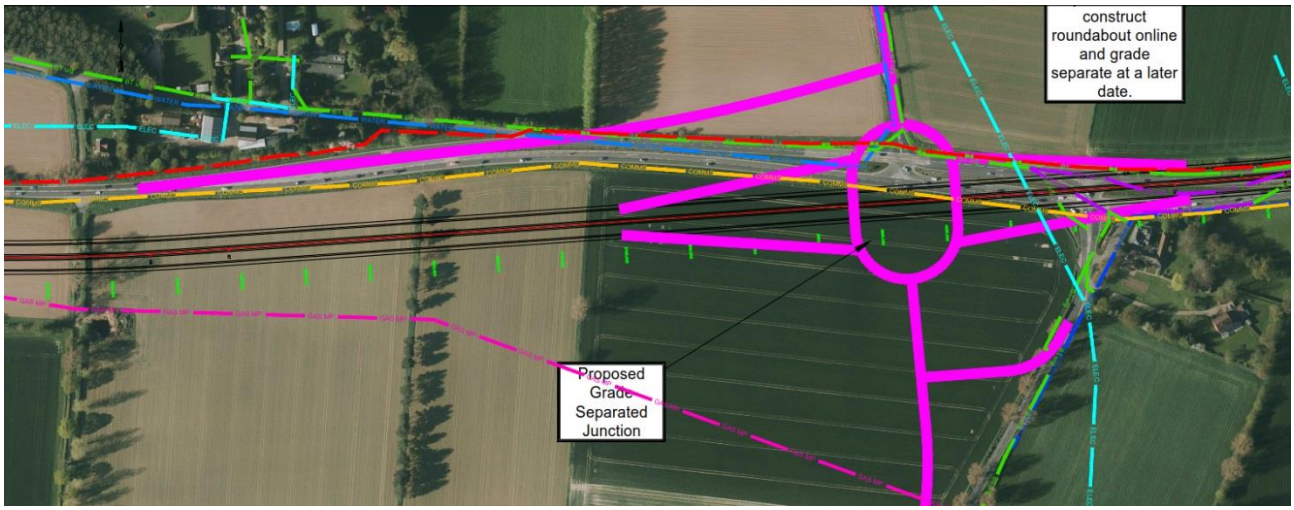
4.6.7 Junction Option B (Figure 4-7) involves an offline connection from the existing A47 to South Walsham Road. Left in, left out junctions are proposed both north and south of the realigned A47 to the existing South Walsham Road and Acle Road. This junction option would not allow north-south movement and would require a significant diversion of traffic utilising the local road network to access the A47 either at the proposed Yarmouth Road Junction and the Plantation Road Junction, or the existing Acle Junction.

Figure 4-7: B1140 Junction arrangement, Option B



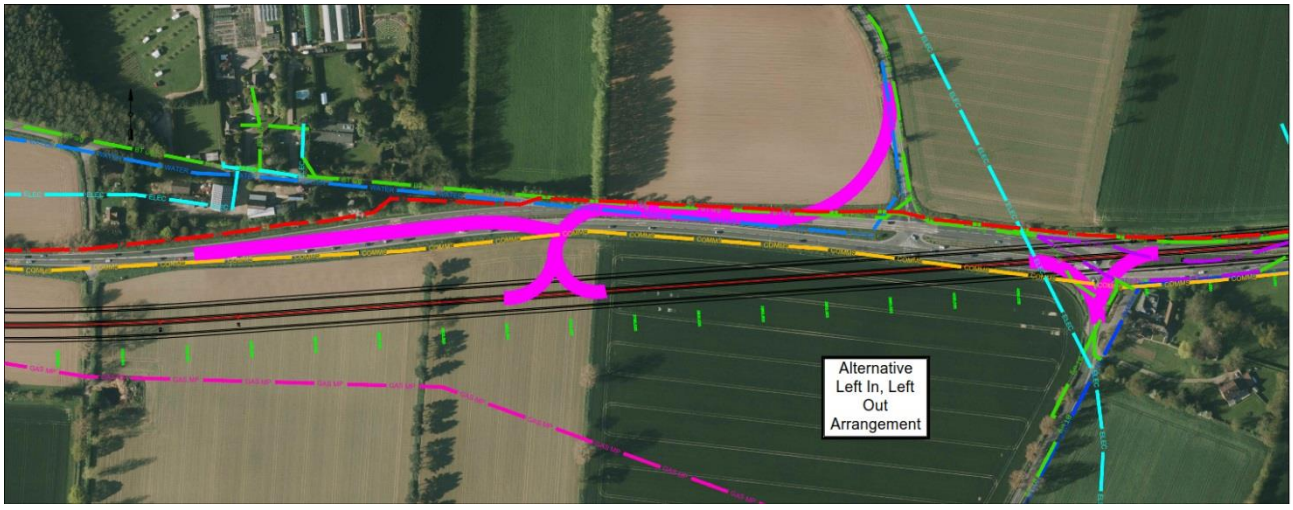
4.6.8 Junction Option C (Figure 4-8) proposed a grade separated junction, which would be constructed at a later point after an at-grade roundabout is provided as part of the proposed Scheme. The existing A47 would be linked to South Walsham Road via a major/minor priority junction. A new link would be provided south to connect to the B1140 (Acle Road) with a new major/minor priority junction to provide residential access to the remaining northern section of the existing Acle Road.

Figure 4-8: B1140 Junction arrangement, Option C



4.6.9 Junction Option D (Figure 4-9) realigns the existing A47 to provide a new left in, left out junction, with additional realignment to tie into South Walsham Road (the B1140). The existing southern junction at the B1140 would be altered to only allow left in / left out movements.

Figure 4-9: B1140 junction arrangement, Option D



4.6.10 Junction Option E (Figure 4-10) provides a compact grade-separated junction. The existing A47 will be realigned north to tie into South Walsham Road (the B1140). Acle Road (the B1140) would also be realigned to tie into the alignment with a major / minor priority junction.

Figure 4-10: B1140 Junction arrangement, Option E

4.6.11 As part of the junction strategy review a detailed traffic modelling analysis was undertaken. Option A, which represents the value-engineered option of an at-grade roundabout, was checked in an Arcady model. The roundabout capacity with a two lane circulatory was found to be insufficient to accommodate the forecast traffic flow. A three lane circulatory was trialled and found to have sufficient capacity.

4.6.12 An operational safety review of the proposed roundabout, and a review against the recommendations within the DMRB was then undertaken. Based on the traffic modelling the mainline A47 traffic would flow through the junction, however this would rely on efficient use of the introduction of a third lane on both the approach and the exit. Operational experience suggests that drivers would be unfamiliar with such an arrangement and lane transgressions would be a common occurrence as well as inefficient use of the feature. The local road traffic wishing to enter the roundabout from the north and south would need to cross three lanes of traffic which at peak times is likely to be difficult and incur driver stress increasing the likelihood of accidents. Following consideration, this arrangement was deemed unsuitable and therefore removed from consideration.

4.6.13 Option C, which would make use of an at-grade roundabout which would then be upgraded to a grade-separated arrangement at a later date was dismissed. The at-grade roundabout would have similar difficulties to Option A, and the reliance on additional future funding would create difficulties in funding, governance and planning. This option was removed from consideration.

4.6.14 Options B and D are two alternatives for an at-grade left in, left out arrangement. These arrangements would not allow for right turns due to safety concerns from the high-speed free flowing traffic on the proposed mainline A47. As such, although both options would offer low cost options they create a significant

severance issue for traffic which would use the existing junction to travel north-south. The alternative route for traffic looking to travel north-south would be to go through the population centres of Blofield, Brundall or Acle, or to make use of the Windle junction. All of the alternatives would put the traffic onto less suitable roads and considering the high percentage of HGVs using this route at certain times of year this is considered to be unsuitable. These options were removed from consideration on this basis.

4.6.15 Based on the traffic flows and existing constraints, it was decided to proceed with a Compact Grade Separated Junction (CGSJ) arrangement as per Option E. This arrangement was chosen as it provides the grade separation for north-south traffic while still providing connectivity to the local road network from the proposed A47. This option is the lowest cost viable option which provides sufficient capacity whilst addressing the potential safety and severance impacts of other options.

4.6.16 Since the selection of the CGSJ arrangement for the B1140, further development has taken place. The junction location has been moved to the west to enable it to be constructed offline and enable the existing junction to remain open during construction. The eastbound slip road will make use of the existing B1140 South Walsham Road to reduce new construction, meaning the two arms of the junction have been mirrored, with the westbound slip road to the west of the structure.

4.6.17 To improve the operational efficiency and safety of the junction, additional auxiliary lanes to both the eastbound and westbound merges from the B1140 to the A47 have been added. The re-alignment of the existing A47 has been brought south-east to be as close as possible to the proposed A47 alignment to reduce the permanent land acquisition.

4.7 Retaining wall requirement

4.7.1 The proposed retaining wall (the West Retaining Wall, refer to Figure 1-2) is located along the highway boundary adjacent to the westbound merge lane at the Yarmouth Road Junction with the proposed A47. The need for the retaining wall in this location is due to the improvement of the left in, left out junction with Yarmouth Road to include a merge taper and auxiliary lane. The widening of the carriageway in this location coincides with a location where the existing road is on an embankment. The retaining wall is required to avoid encroachment on the residential properties neighbouring the highway at this location.

4.8 Lighting

4.8.1 Lighting is proposed for the Scheme as shown on General Arrangement Plans **(TR010040/APP/2.6)**. The lighting is to be provided at the Yarmouth Road Junction and the B1140 Junction with its impacts assessed in the ES **(TR010040/APP/6.1)**. The lighting is currently proposed as road safety mitigation at the Yarmouth Road Junction. At the B1140 junction the lighting is proposed to be equivalent to the existing provision.

4.9 Lay-by replacement

4.9.1 The existing eastbound lay-by is currently located at the eastern end of the Scheme extents, between the B1140 Junction and the A47 / The Windle Junction.

4.9.2 The additional merging length required for the proposed B1140 junction eastbound merge taper terminates at approximately the point of the start of the exit to the existing lay-by. If the lay-by were to remain in operation there would be no separating length to allow for weaving traffic movements. There is no operational arrangement which would allow the safe use of the lay-by and the proposed B1140 Junction without creating conflicting vehicle movements, meaning that the existing lay-by must be closed to traffic and sited elsewhere within the Scheme extents.

4.9.3 The form of the existing lay-by does not meet current standards on safety, security and visibility for traffic merging with the mainline A47. As such it will be replaced with a lay-by designed to current. The new lay-by will be located between the proposed Blofield overbridge and Lingwood Lane.

4.9.4 The existing lay-by will be closed to traffic and decommissioned. To enable this statutory undertakers' plant currently within the lay-by may be relocated to be within the verge of the proposed A47.

4.10 Provision of the North Burlingham access

4.10.1 The access to Main Road in North Burlingham is proposed to change as part of the realignment of the existing A47 to tie into the proposed B1140 Junction. To reduce the journey time for residents travelling to North Burlingham from the west it is proposed to amend the access to be two-way rather than one-way (currently eastbound exit only). This will be enabled by the reduction in the existing A47 to a single carriageway road instead of a dual carriageway.

4.11 Fencing, safety barriers and signage

4.11.1 Fencing has been allowed for at the Highway boundary for safety and security. With the exception of where alternatives have been agreed with neighbouring landowners or noise barrier has been specified for environmental mitigation, timber post and rail fence (in accordance with Manual of Contract Documents for Highway Works standard details) has been provided.

4.11.2 In accordance with DMRB standards, appropriate safety barriers (Road Restraint Systems) have been included where required by the outcome of a risk assessment.

4.11.3 A signage strategy has been completed for the Scheme to inform the overall design. The strategy has been designed to be compliant with national guidance including the DMRB and Traffic Signs Manual.

4.12 Access road and agricultural access

4.12.1 For road safety reasons private means of access are to be avoided on new dual carriageways. The existing A47 is the means of access to multiple plots of agricultural land to the south of the proposed and existing A47. To mitigate the

loss of these accesses a dedicated un-paved agricultural access track will be constructed, which will run parallel to the proposed road and to the south. This access track will run from an access road south of Blofield Overbridge to a point approximately midway between Lingwood Road and Lingwood Lane.

4.12.2 The access road will also provide safe maintenance access to highway drainage assets to the south of the Scheme to protect both the road users and the maintainers.

4.12.3 A footpath will be provided adjacent to the agricultural track as described below in section 4.13. The agricultural access will not provide a through route for vehicles to prevent rat-running.

4.13 Footway and cycleway provision

4.13.1 Document GG 142 of the DMRB sets out the walking, cycling and horse-riding assessment and review (WCHAR) process for highway schemes on motorways and all-purpose trunk roads. The level of detail required for the assessment is dependent upon the size of the scheme, large or small, which in turn defines the study area.

4.13.2 The A47 Blofield to North Burlingham Scheme fits within the definition of a large scheme as given in Table 2.2.1N of GG 142, vis “New motorway or all-purpose trunk road construction or major modification of an existing trunk road or motorway junction”. The assessment guidance relevant to this definition has been followed and applied to the Scheme.

4.13.1 The walking and cycling provision for the Scheme has been assessed and designed based on non-motorised user surveys in 2018, feedback from the public consultations of 2017 and 2018, and from feedback received between those consultations and the date of the application.

4.13.2 The design, mitigation and enhancement measures that will be provided as part of the Proposed Scheme are described below and shown in Figure 12.2 (**TR010040/APP/6.3**).

4.13.3 Where the existing A47 is unaffected by the dualling, it is proposed to be de-trunked and serve as a local access road for residents. This will include a new combined footway/cycleway provided adjacent to the eastbound carriageway connecting Yarmouth Road at Blofield to the existing footway, which commences at the Dell Corner Lane junction via the Blofield Overbridge. A new section of footway is also proposed on Yarmouth Road to connect to the existing footway and allow pedestrians to walk along Yarmouth Road to the allotment gardens. These new sections of infrastructure will provide improved connectivity between Blofield and North Burlingham for WCH.

4.13.4 The Proposed Scheme provides a new length of footway and Public Right of Way (PRoW) footpath, to the south of the new A47 mainline, connecting from the Blofield Overbridge to the B1140 junction. This route connects with multiple existing north / south permissive routes and footpath Burlingham FP3.

4.13.5 This new PRoW consists of an unbound footpath running east to west, starting on the footway of the Access Road which provides a link to the Blofield Overbridge:

- adjacent to the proposed agricultural access track passing Lingwood Road to FP3
- adjacent to the agricultural access track and then the maintenance track from FP3 to permissive Burlingham Woodland Walks
- adjacent to the existing Burlingham Trails Network (bridleway) to Lingwood Lane with a short diversion of approximately 50m round the proposed soakaway
- a new footpath from Lingwood Lane to the B1140

4.13.6 A new combined footway/cycleway would be incorporated into the A47/B1140 grade separated interchange allowing the safe crossing of the new A47 for pedestrians and cyclists between South Walsham Road and the B1140. The new provision would also include a footway/cycleway link into North Burlingham via the existing A47 to be downgraded and Main Road.

5 STRUCTURES DESIGN

5.1 Structures options report summary

5.1.1 Within the Scheme there are two new major structures required:

- (S01) Blofield Overbridge, a new skew crossing at the western end of the Scheme which carries a link road over the proposed A47 dual 2 lane carriageway (D2AP). The link will connect Yarmouth Road and the town of Blofield to the west with the old A47 and the village of North Burlingham to the east.
- (S03) B1140 Overbridge, a new square crossing at the eastern end of the Scheme which forms part of a compact grade-separated junction and provides a north-south connection between South Walsham Road (B1140) and White House Lane (B1140).

5.1.2 Both structures are proposed 2 spans with precast prestressed beam composite decks, with Blofield Overbridge and B1140 Overbridge as fully integral. This will ensure the structures are cost-effective and are straightforward to maintain. The new structures will be built off-line alongside the old A47 with few construction constraints in terms of buried services or existing structures.

5.1.3 Recent ground investigation has been utilised to carry out preliminary foundation design. Spread foundations have not been considered in the options due to the excessive bearing pressures and differential settlements expected therefore, both bridges at the abutments and piers are piled.

5.1.4 Due to their quick construction time, cost and flexibility reinforced soil wingwalls are proposed for both structures. Ground improvement in the form of stone columns are required beneath the reinforced soil wingwalls at Blofield Overbridge.

Other structures

5.1.5 There is a proposed retaining wall at the western end of the Scheme at the junction between Yarmouth Road and the new alignment of the A47. It is located adjacent to the south western onslip side of the junction. The retaining wall varies in height to approximately 3.5m.

5.1.6 Three options are currently proposed:

- Precast reinforced concrete units supported on a mass concrete foundation
- Eco-crib recycled mixed polymer retaining wall system
- A sheet piled solution

5.1.7 All 3 options have adopted rapid and / or off site construction techniques to minimise construction time, enhance safety and reduce cost. The contractor will be allowed to choose the best value system prior to construction based on its construction strategy.

6 DRAINAGE DESIGN

6.1.1 The drainage design for the Scheme is explained in outline in this section. For further information and assessment of the impacts of the design, refer to the Drainage Strategy Report, ES Appendix 13.2 (**TR010040/APP/6.2**)

6.2 Existing drainage

6.2.1 Where possible, existing drainage will remain in place at the tie-ins with the existing A47. Filter drains and soakaways may be relocated in some sections on the approaches to junctions at the eastern and western extents of the Scheme, to maintain the operation of the drainage on the existing A47.

6.2.2 Where existing direct discharges to streams are not taking any increased road run-off from the Scheme, these outfalls will remain in place.

6.3 Infiltration rates

6.3.1 An infiltration basin and frequent soakaways have been included in the design, which emulates the existing drainage regime at these locations on the existing A47. These infiltration facilities will receive surface water discharges from the new road and will maintain existing greenfield discharge rates.

6.3.2 Treatment in the form of filter drains and infiltration basin / soakaways and separate spillage containment will also form part of the drainage system.

6.3.3 The inclusion of deep soakaways has been considered necessary on the Scheme due to:

- attaining volumes of storage required within the space available
- test results demonstrating inadequate infiltration at shallower depths
- avoid the creation of flow paths to properties downstream

6.4 Flood improvements

6.4.1 It is expected that road run-off from approximately 400m of existing A47 carriageway may have to be brought into the new section of the drainage system due to the Scheme. These discharges would be attenuated utilising the new infiltration systems. This would reduce the likelihood of flooding downstream.

6.5 Structure drainage

6.5.1 Deck drainage will be provided on the bridges.

6.5.2 Back of wall drainage is proposed for the retaining wall and will drain to an existing ditch at this location.

6.6 Carriageway drainage

6.6.1 The new carriageway will drain to filter drains and discharge to an infiltration basin located to the south of the new Blofield Overbridge and to frequent soakaways across the Scheme, providing treatment of the surface water run-off and maintaining greenfield discharge rates.

6.6.2 Additional spillage containment at the discharge points will be provided where

required.

6.6.3 Proposed drainage systems include:

- Kerbed sections of the mainline, which will be drained utilising gullies or a combined kerb and gulley system, discharging to the filter drains or carrier drains in the verges.
- Filter drains, which will be provided at the toe of any cuttings along the mainline. The filter drains will collect run-off from the slopes or carriageway.
- Central reserve drainage, which will be provided where the road is in super-elevation.
- Toe drains, where required, draining embankments greater than 1.5m in height, will drain via ditches to soakaways or along existing surface water pathways.

6.6.4 Side road links to the new carriageway will drain to soakaways. Where the existing A47 is de-trunked and will link into the proposed new alignment at the B1140 junction, the existing drainage will remain in place where possible with some realignment. This existing drainage system will be maintained through the junction, collected and diverted back into the existing drainage at the western tie-in.

6.6.5 Natural overland drainage and existing ditches / streams between the existing A47 and the proposed new mainline will be intercepted by new ditches and conveyed along the natural drainage paths as far as possible. This will involve pipe crossings of the proposed new mainline.

6.6.6 A new footway is proposed for the existing A47. The footway will result in realignment of existing drainage on the existing A47 and new gullies and / or combined kerb drainage units which will tie-in to the new drainage networks and to existing drainage where possible. Some drainage on the existing A47 will be unaffected where the road falls away from the footway. At these locations it is proposed to provide a fall in the footway towards the road. This new footway will extend into the de-trunked A47 to allow for safe crossing north of the Blofield Overbridge. Additional gullies and or combined kerb drainage units will be provided to facilitate this extended footway.

6.6.7 On the B1140, which provides access to the White House (Coach house), an existing ditch will be culverted to allow access to a field west of the existing road.

7 UTILITY DIVERSIONS

7.1 Number of diversions

7.1.1 The construction of the Scheme requires the diversion, relocation or protection of existing utility assets. For further information refer to the works descriptions in Schedule 1 of the Draft DCO (**TR010040/APP/3.1**) and the Works Plans (**TR010040/APP/2.3**).

7.1.2 Utilities requiring diversion are:

- Anglian Water (Foul Water), 1 location
- Anglian Water (Potable Water), 8 locations
- BT Openreach, 7 locations
- Cadent, 1 location
- UKPN, 8 locations
- Virgin Media, 3 locations
- Vodafone, 2 locations

8 ENVIRONMENTAL DESIGN

8.1 Introduction

8.1.1 The Scheme has been developed taking account of multiple stages of environmental assessment and appraisal throughout its progression. The Environment Statement **(TR010040/APP/6.1)** in Volume 6 sets out the full assessment of the Scheme as well as the need for design, mitigation and enhancement measures where there are identified effects. This has been fully incorporated into the design submitted as part of this application.

8.2 Mitigation design

8.2.1 The environmental mitigation identified for the Scheme has been summarised in each of the chapters of the Environment Statement **(TR010040/APP/6.1)**. The relevant chapter section relating to mitigation is presented in Table 8-1 below along with a high level summary of the proposed design mitigation:

Table 8-1: Environmental mitigation references from the Environment Statement (TR010040/APP/6.1)

Environment Statement reference	High level mitigation summary
Chapter 5 – Air Quality (section 5.9)	No mitigation required. Construction length under 2 years and standard best practice measures of dust management control measures during construction detailed and secured through the Environmental Management Plan (EMP **(TR010040/APP/7.7)**)
Chapter 6 – Cultural Heritage (section 6.9)	Proposed planting is sensitive to the setting and location of heritage assets. Reduction in scheme extents, removing effects on several heritage assets. Milestones and guideposts impacted by works will be protected, conserved and restored..
Chapter 7 – Landscape and Visual Effects (section 7.9)	Primary landscape, planting and visual mitigation measures embedded in the Proposed Scheme design are shown in the Environmental Masterplan (**TR04004/APP/6.8**).
Chapter 8 – Biodiversity (section 8.9)	Where planting is proposed as mitigation, refer to the Environmental Masterplan (**TR04004/APP/6.8**). Mitigation includes: • Replacement woodland planting with a net gain of 1.98ha alongside the Scheme. • Habitat creation (bird / bat boxes, specialist planting, habitat piles, etc) • Bat hops with the use of extra heavy standard trees at least 4.25m high at identified bat crossing points. • Translocation of 2 important hedgerows. • Wetland planting around drainage pond and creation of a new wildlife pond. • Timing of vegetation clearance to outside of the breeding season which runs from March to August (inclusive). • Vegetation clearance will be undertaken under supervision.

Environment Statement reference	High level mitigation summary
	• Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Volume 1: Chapter 13). This would be implemented as part of the Register of Environmental Actions and Commitments (REAC) and overall Environmental Management Plan (EMP).
Chapter 9 - Geology and Soils (section 9.9)	A Soil Management Plan and a Material Management Plan will be created and implemented prior to construction. Construction compound and working areas will have a clear boundary for the construction area to prevent access onto adjacent land. Where excess soils are generated they will be saved and reused outside the Scheme where possible. Where necessary for protection from construction activities, agricultural soils will be stripped, stored and replaced to their baseline condition, as far as possible.
Chapter 10 – Material Assets and Waste (section 10.9)	The Scheme is designed to avoid and minimise the environmental impacts of material assets and waste (as far as reasonably practicable) through the process of the assessment of alternatives and 'embedded mitigation'.
Chapter 11 – Noise and Vibration (section 11.9)	The A47 dual carriageway shall be surfaced with a low-noise road surface. 4 permanent noise barriers will be provided as below. **Permanent noise barrier locations:** North Blofield – Reflective barrier, 3m tall, approximate length 265m. Poplar Farm, Lingwood Road – Absorptive barrier, 3m tall, approximate length 400m. The White House, Acle Road – Reflective barrier, 3m tall, approximate length 170m. 1 and 2 Hall Cottages, The Windle – Reflective barrier, 2m tall, approximate length 130m. Refer to Figure 11.2 (**TR010040/APP/6.3**).
Chapter 12 – Population and Human Health (section 12.9)	2 new grade separated crossings of the propose A47 at the Blofield overbridge and the B1140 overbridge. Provision of approximately 2.8km of new footpath and 3km of new shared footway / cycleway in the area. Including a new PRoW. The design, mitigation and enhancement measures that will be provided as part of the Scheme are shown in Figure 12.2 (**TR010040/APP/6.3**).
Chapter 13 – Road Drainage and Water Environment (section 13.9)	Mitigation for the Road Drainage and Water Environment has been incorporated in the Scheme's drainage design. Refer to Section 6 of this report for a summary of the scheme drainage design.
Chapter 14 – Climate (section 14.9)	No additional mitigation to previous chapters.
Chapter 15 – Cumulative Effects (Table 15-6)	No additional mitigation identified due to cumulative effects.

9 CONSTRUCTION

9.1 Introduction

9.1.1 The approach to construction described below is indicative but it is representative of the likely approach to be adopted. Further provisions in relation to construction of the Scheme are provided in the Environmental Management Plan (EMP) **(TR010040/APP/7.7)**.

9.2 Land required for the Scheme

9.2.1 The powers to compulsorily acquire the land required permanently and to use land temporarily to deliver the Scheme are being sought by Highways England through the DCO.

9.2.2 Temporary and permanent land requirements have been identified through a combination of the design-development, environmental assessment, buildability advice from Galliford Try (Highways England's appointed contractor) and through engagement with landowners that would be affected by the Scheme. The Land Plans identify the required land **(TR010040/APP/2.2)**.

9.2.3 Land requirements include:

- 15.68ha of existing land owned by Highways England
- 47.4ha of permanent land take for operation of the Scheme
- 40.16ha of temporary land take for construction (including 12ha for new rights)

9.3 Construction programme

9.3.1 The indicative construction programme for the Scheme has been informed by Galliford Try as Highways England's appointed contractor, although some aspects are likely to be refined during the detailed design stage.

9.3.2 The impacts of construction activities are considered in each chapter of the ES **(TR010040/APP/6.1)**. Standard best practice construction techniques that will be adopted are set out in the EMP **(TR010040/APP/7.7)**.

9.3.3 Construction is anticipated to take approximately 22 months. This would be carried out in phases, so not all sections of the Scheme would be under construction for the full period.

9.3.4 The proposed phases of construction are set out in Table 9-1 (Construction phasing programme). Enabling and site preparation work would be largely carried out during Phase 0, with the main works carried out during Phases 1 to 7 before final compound removal in Phase 8.

Table 9-1: Construction phasing programme

Phase	Traffic management stage	Approximate programme	Key construction activities
0	Site preparation and utility diversions	Six months (month 1 to 6)	Utility diversionary works completed including BT Openreach, Cadent Gas, Vodafone, Anglian Water, UKPN, Virgin media and Vodafone. Compound and welfare areas constructed for main works. Hardstanding areas will be constructed topsoil stripped and subbase installed. Areas for car parking will be surfaced as required. Clearance of vegetation undertaken as required to enable the works.
1	Offline construction, including overbridges and retaining wall	Twelve months (month 6 to 17)	Construction of carriageway offline from existing A47. Activities including topsoil strip, cut / fill earthworks, drainage installation, carriageway construction including capping, subbase and the bitumen bound layers. Construction of offline structures including new overbridges and retaining walls. Sheet piling, bored piling and concrete works will be undertaken.
2	Construct the realigned Waterlow	Four months (month 9 to 12)	Realigned Waterlow involves topsoil strip, cut / fill earthworks, drainage installation, carriageway construction including capping, sub-base and the bitumen bound layers.
3	Traffic using realigned Waterlow and construct further section of new carriageway	Six months (month 12 to 17)	Main works will involve completion of carriageway pavement and road restraint systems. Landscaping will commence. Road lighting installed where required.
4	Construct cross-overs either end of existing east bound dual carriageway. Small sections of contraflow used to enable new west bound carriageway to tie-in to existing A47. Traffic to remain on existing single carriageway.	Two months (month 16 to 17)	Cross-overs will be constructed by removing existing central reservation and road restraint at either end of the Proposed Scheme. Central reservation will have carriageway construction inlaid.
5	Weekend and overnight closures (as required) to finalise tie-in to new westbound dual carriageway	One month (month 17)	Tie-ins will require existing carriageway to be cold milled and new overlays installed that join the new carriageway to the existing carriageway at either end of the Proposed Scheme.
6	Traffic using new westbound carriageway as single carriageway. Construct connecting roads over now disused A47, remainder of approach ramps and east bound carriageway tie-ins completed.	Five months (month 17 to 21)	Completion of east bound carriageways. Construction of new approach ramps to new overbridge structures. Activities include topsoil strip, cut/fill earthworks, drainage installation, carriageway construction including capping and subbase and the bitumen bound layers. Road restraint installed. Road lighting installed where required. Landscaping works will continue.

Phase	Traffic management stage	Approximate programme	Key construction activities
7	Final tie-ins and finishing works. Overnight closures used as required to tie-in new eastbound carriageway.	Two months (month 20 to 21)	Final tie-ins will require existing carriageway to be cold milled and new overlays installed that join the new carriageway to the existing carriageway at either end of the Proposed Scheme. On completion of final surfacing works traffic use new carriageways, temporary cross-overs will be removed, permanent road markings will be installed, and road restraint systems will be completed at the temporary cross-over locations.
8	Compound removal	Two months (month 21 to 22)	Compound and site welfare will be removed. Hardstanding areas will be removed and the site re-topsoiled. Area will be re-landscaped as required.

9.4 Construction compounds and site accesses

9.4.1 Construction compound locations have been identified in balance of practical locations near key areas of work and avoidance of environmental impact (such as retention of trees and hedgerows, fitting withing context of the landscape).

9.4.2 The main construction compound is proposed to the east of Lingwood Lane with an available area for a storage yard and car park on the western side.

9.4.3 Three satellite compounds are proposed. Two satellite compounds will service the construction of the proposed B1140 Junction, an additional compound to serve the west end of the Scheme. The compounds would include temporary site offices, parking, and welfare facilities. Table 9-2 indicates indicative areas, access arrangements of use of each of the compound locations.

Table 9-2: Proposed compound details

Compound number	Approximate area (m^2)	Purpose / justification	Access arrangements
Main 1	20,250	Main project offices and welfare facilities. Also catering for traffic management and vehicle recovery operations. As a traffic management compound, it is required to be in operation on a '24/7' basis to service the traffic management and recovery requirements of the Scheme.	Off existing Lingwood Lane.
Main 2	9,000	Storage yard for plant, equipment and materials.	Off existing Lingwood Lane.
Sat 1	10,000	Satellite compound to serve junction construction, South side (welfare facilities, small offices, plant, equipment and materials storage)	Accessed via Main Compound 1
Sat 2	4,800	Satellite compound to serve junction construction, North side (welfare facilities, small offices, plant, equipment and materials storage)	Off South Walsham Road

Compound number	Approximate area (m^2)	Purpose / justification	Access arrangements
Sat 3	9,000	Satellite compound to serve West end of Scheme (welfare facilities, small offices, plant, equipment and materials storage)	Off Waterlow / A47
N/A	1,000	Minor satellite compounds to serve construction of permanent works at outlying locations (welfare facilities, small offices, plant, equipment and materials storage)	

9.5 Material storage and stockpiles

9.5.1 Topsoil (and potentially subsoil) will need to be removed from the proposed mainline alignment and then temporarily stockpiled it until needed for re-use.

9.5.2 Stockpiling will also be required for imported general fill and aggregates for use in the permanent works.

9.5.3 The stockpiles would generally be located at the perimeter of working areas, approximately 2m to 3m in height (in accordance with British Standard BS3882: 2015), so that they would also screen the works from the public.

9.5.4 Soils removed from areas identified as being of designated archaeological importance would be subject to specific procedures, defined in the EMP **(TR010040/APP/7.7)**.

9.6 Construction traffic

9.6.1 The haul routes would be located under the footprint of the Scheme for the on-site vehicle movements, as well as the use of the wider existing road network.

9.6.2 Construction traffic arriving from off site would consist of vehicles delivering the products required for the construction of the Scheme, including concrete, bitumen, aggregates and pipes.

9.6.3 Some deliveries would arrive as abnormal loads, such as large construction plant. In most cases these construction traffic movements, as well as site worker journeys, would be directly to and from the main compound area next to the proposed B1140 Junction. Table 9-3 provides a summary of the likely heavy goods vehicle (HGV) movements.

Table 9-3: HGV daily totals during construction

Phase	Max number of lorry trips per day	Indicative locations	Approximate programme
0	75	Compounds	Six months (month 1 to 6)
1	150	Site wide	Twelve months (month 6 to 17)
2	25	Compounds and Waterlow	Four months (month 9 to 12)
3			Six months (month 12 to 17)
4	50	Compounds and cross-over locations	Two months (month 16 to 17)
5	50	Compounds and carriageway tie-in locations	One month (month 17)

Phase	Max number of lorry trips per day	Indicative locations	Approximate programme
6	150	Compounds and embankments north of existing A47	Five months (month 17 to 21)
7	100	Compounds and final tie-in locations	Two months (month 20 to 21)
8	75	Compounds	Two months (month 21 to 22)

9.6.4 It is assumed that 75% of all deliveries would go to the main construction compound at Lingwood Lane, 20% to the satellite compounds and 5% to the laydown areas.

9.6.5 The Outline Traffic Management Plan **(TR010040/APP/7.8)** defines the measures used to reduce the impacts from construction traffic, including measures to reduce worker vehicle movements and to reduce HGV movements, particularly at peak periods. This will be implemented by the contractor.

9.6.6 The construction traffic will be managed to limit noise and dust (as well as mud and the cleanliness of the local roads), in line with industry best practice. This will include the use of wheel washing and similar controls as set out in the EMP **(TR010040/APP/7.7)**. Specific management plans will be produced prior to the start of construction.

9.7 Existing A47 during construction

9.7.1 The Scheme is an offline alignment, allowing traffic to continue to use the existing A47 as works progress on the main dualling section.

9.7.2 Appropriate traffic management measures would be put in place to ensure that traffic flows on the existing A47 and other local roads are maintained, whilst allowing safe working at the interface between the existing road network and the Scheme.

9.8 Construction methods

9.8.1 The construction of the Scheme would use typical construction techniques associated with major infrastructure projects.

9.8.2 Indicative timescales for daytime, night-time and weekend working for each phase (refer to Table 9-1 for details), are presented in Table 9-4.

Table 9-4: Indicative working times by phase

Phase	Indicative working hours	Indicative locations	Approximate programme
0	Predominantly daytime works. Overnight works to construct works accesses.	Compounds	Six months (month 1 to 6)
1	Predominantly daytime works. Overnight works to construct works accesses.	Site wide	Twelve months (month 6 to 17)
2	Predominantly daytime works. Overnight and weekend works required to complete tie-ins.	Compounds and Waterlow	Four months (month 9 to 12)
3	Predominantly daytime works. Overnight works if required.		Six months (month 12 to 17)

Phase	Indicative working hours	Indicative locations	Approximate programme
4	Predominantly daytime works. Overnight works required to construct A47 cross-overs.	Compounds and cross-over locations	Two months (month 16 to 17)
5	Daytime, overnight and weekend works required to complete A47 tie-ins.	Compounds and carriageway tie-in locations	One month (month 17)
6	Predominantly daytime works. Overnight and weekend works required to complete A47 tie-ins.	Compounds and embankments north of existing A47	Five months (month 17 to 21)
7	Predominantly daytime works. Overnight works required to complete vehicle restraint systems and removal of cross-overs.	Compounds and final tie-in locations	Two months (month 20 to 21)
8	Predominantly daytime works. Overnight works if required.	Compounds	Two months (month 21 to 22)

9.8.3 Piling would likely be required to construct the support for the retaining wall and overbridges, and possibly elsewhere for the retained cuttings. Major bridge structures would be likely to be built using combinations of 'cast-in-situ' elements and imported 'off-site' pre-cast elements craned into place.

9.8.4 Earthworks, including cuttings and embankments, would be required to create the route alignment. The cuttings and embankments would be constructed using a 'cut-and-fill' approach, using the alignment to move materials along the route corridor. The formation of the road surface would use standard techniques, including construction of capping, sub-base and pavement layers.

9.9 Plant and equipment

9.9.1 Construction of the Scheme would require a large quantity of plant and equipment. The volume of earth to be moved would require large excavators, dump trucks, bulldozers, compactors, graders, bowsers and stabilising plant.

9.9.2 Plant numbers and usage will be determined by the chosen construction method. Preliminary plant lists have been used for the purposes of assessment to consider construction impacts as set out in ES Chapter 11 Noise and Vibration **(TR010040/APP/6.1)**.

9.10 Utilities

9.10.1 Construction of the Scheme will require the diversion, relocation or protection of existing utility assets as set out in section 7.0 of this report and as per the corridors shown in the Works Plans **(TR010040/APP/2.3)**.

9.11 Demolition

9.11.1 The Scheme does not require the demolition of existing buildings or major structures.

9.12 Excavated materials

9.12.1 Construction of the Scheme would require excavation in places to form cuttings for the highway, ground improvement, foundations, soakaways, other drainage and miscellaneous features. Where material is recoverable, this material would then be used to form embankments or for other fill requirements. This is considered in greater detail in ES Chapter 10 Material Assets and Waste **(TR010040/APP/6.1).**

9.13 Environmental Management Plan

9.13.1 An EMP **(TR010040/APP/7.7)** has been prepared to include construction, operational and maintenance good practice and mitigation measures. These have been identified in part by the assessments presented in the ES **(TR010040/APP/6.1)**. The EMP includes the Register of Environmental Actions and Commitments (REAC).

9.13.2 In line with DMRB LA 120 (Environmental Management Plan), the EMP establishes a suitable mechanism to link assessment assumptions, DCO Requirements and obligations. The EMP is secured by Requirement 2 to the Draft DCO **(TR010040/APP/3.1)** and is a live document which will be revised as more information becomes available throughout the lifetime of the Scheme.

9.14 Operation and long-term management

9.14.1 Once the proposed A47 mainline is opened, it would form part of the A47 trunk road and the wider strategic road network.

9.14.2 The new A47 mainline would be managed by Highways England on a day to day basis using the monitoring and control systems in accordance with the relevant design standards.

9.14.3 The Scheme has been designed with maintenance and safe operation in mind, with liaison having taken place with Highways England's Operations Directorate (the day-to-day maintainers), at multiple points in the Scheme development and the feedback incorporated into the submitted proposals. Maintenance is defined as actions needed to inspect, repair, adjust, alter, remove, replace or reconstruct all aspects that relate to the Scheme.

9.14.4 Long-term maintenance and repairs to the highways and associated assets (including drainage) would be undertaken as required to maintain the appropriate standards for the relevant highway authority.

9.14.5 Three maintenance lay-bys are included which are near to both junctions and the two major structures to facilitate off-network maintenance access.

9.14.6 The two overbridges (the Blofield Overbridge and the B1140 Overbridge), have been designed as fully integral structures without bearings. This reduces the maintenance requirement of both structures. Inspections would be required of the bridge piers, including the pier within the central reserve. Lane closures would be required to safely facilitate the inspections.

9.14.7 It is currently anticipated that the de-trunked A47 and new side roads would become the responsibility of Norfolk County Council as identified on the De-trunking Plans **(TR010040/APP/2.10)** and the Classification of Roads Plans (**TR010040/APP/2.12**).

9.15 Decommissioning

9.15.1 It is considered highly unlikely that the Scheme would be demolished before the end of its design life of 60 years as the road would have become an integral part of the strategic road network.

9.15.2 In the event of the Scheme needing to be demolished, this would conform to the statutory process at that time, including EIA if required.